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MONTEREY, CALIFORNIA

MBA PROFESSIONAL REPORT

ACTDs: Management Plans as Predictors of Transition

By: **Matthew Phelps, and**
Jeffrey S. Wideman
December 2007

Advisors: **Nicholas Dew,**
William Gates

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13. ABSTRACT (maximum 200 words)

This thesis evaluated the Department of Defense's Advanced Concept Technology Demonstration (ACTD) process and the challenges encountered in transitioning an ACTD to an acquisition program. The methodology included case analysis of thirty-eight ACTD program business plans. Nineteen of the programs transitioned while the other nineteen were terminated either prior to the Military Unit Assessment (MUA) or after. The scope included a review of: 1) ACTD origins and processes as of October 2007, 2) past ACTD programs, 3) the established documentation criteria associated with ACTD selection and evaluation, 4) business plans for the thirty-eight ACTD case programs selected for analysis, 5) potential process improvements that would aid in ACTD transition to acquisition success. This thesis identified several statistically significant variables in the existing ACTD transition process. These variables predict transition, or not - they therefore suggest several criteria that should be maintained in the ACTD process. Perhaps equally as important, we identified several variables that are not significant predictors of transition. Based on our results, we suggest several enhancements that could be incorporated into future ACTD processes that may improve the insertion of technology to the war fighter.

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ACTDS: MANAGEMENT PLANS AS PREDICTORS OF TRANSITION

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Submitted in partial fulfillment of the requirements for the degree of

MASTER OF BUSINESS ADMINISTRATION

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December 2007

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ACTDS: MANAGEMENT PLANS AS PREDICTORS OF TRANSITION

ABSTRACT

This thesis evaluated the Department of Defense's Advanced Concept Technology Demonstration (ACTD) process and the challenges encountered in transitioning an ACTD to an acquisition program. The methodology included case analysis of thirty-eight ACTD program business plans. Nineteen of the programs transitioned while the other nineteen were terminated either prior to the Military Unit Assessment (MUA) or after. The scope included a review of: 1) ACTD origins and processes as of October 2007, 2) past ACTD programs, 3) the established documentation criteria associated with ACTD selection and evaluation, 4) business plans for the thirty-eight ACTD case programs selected for analysis, 5) potential process improvements that would aid in ACTD transition to acquisition success. This thesis identified several statistically significant variables in the existing ACTD transition process. These variables predict transition, or not - they therefore suggest several criteria that should be maintained in the ACTD process. Perhaps equally as important, we identified several variables that are not significant predictors of transition. Based on our results, we suggest several enhancements that could be incorporated into future ACTD processes that may improve the insertion of technology to the war fighter.

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I. INTRODUCTION

During the 1980s and 1990s, the Department of Defense (DoD) was facing a dilemma with regard to its technology management. One key issue was the time between project conception and utilization. One solution would find its beginnings in the recommendations of the Packard Commission of 1986 [President's Blue Ribbon Commission on Defense Management, Jun 1986] and the Defense Science Board reports of 1987, 1990 and 1991 [Reports of the Defense Science Board, 1987, 1990, 1991]. The Packard Commission identified a concept that could be broadly defined as a fieldable sample to bridge the gap between prototypes and operational units. The commission's view was summed up as "Operational tests should be combined with developmental tests of the prototype to uncover operational as well as technical deficiencies before a decision is made to proceed with full-scale development [citation]." In this statement (and similar complementary conjectures) was the catalyst for Advanced Concept Technology Demonstrators (ACTD). To date, 167 programs have been designated as ACTDs.

This project is broadly defined to analyze the ACTD process and associated issues involved within the process. Our focus is on the predictive value of "management plans" for ACTDs. We analyzed the management plans for 19 programs that have successfully navigated the ACTD process towards an attempted acquisition transition and 19 that failed to transition into the acquisition process. We used multivariate regression to examine what factors predict a successful transition, or not. In summary we found the following variables were significant predictors.

1. Budget matches the schedule
2. Technology Maturity
3. Risk Assessment

After laying out our analysis we discuss our findings and suggest managerial recommendations.

A. BACKGROUND

As defined in Department of Defense Directive (DoDD) 5000.1 the primary objective of Defense acquisition is to acquire quality products that satisfy user needs with measurable improvements to mission accomplishment and operational support, in a timely manner, and at a fair and reasonable price. [DoDD 5000.1, January 2001] Department of Defense Instruction (DoDI) 5000.2 identifies technology transition mechanisms designed to ensure the transformation of innovative concepts and superior technology to the user and acquisition customer through: 1) Advanced Technology Demonstration (ATD) programs, 2) ACTD programs, and 3) Experiments. [DoDI 5000.2, January 2001]

The formal acquisition process, as directed by DoDD 5000.1 and DoDI 5000.2, is the primary mechanism for the procurement of new systems and the introduction of new capabilities via new or upgraded systems. Recently, it has been recognized that the ACTD process, as a pre-acquisition event, provides an important mechanism and opportunity for the war fighter to try out and evaluate proposed technology solutions to urgent military needs. [ACTD Introduction, September 2001] Each ACTD is aimed at one or more war fighting objective and is reviewed by the Services, Defense Agencies and the Joint Staff. Key criteria by which ACTD candidates are evaluated consist of: 1) Response to user needs, 2) Exploit of mature technologies, and 3) Potential effectiveness. [ACTD Guidelines - Introduction to ACTDs, May 2001] An ACTD is designed to provide a sound assessment of the military utility of a proposed solution prior to a decision on formal development or acquisition. The purchase of additional capability beyond the residuals provided by the ACTD, where appropriate, is accomplished through a formal acquisition program.

While identified as tools to rapidly transition technology to the war fighter, it is not certain whether ACTDs live up to their expectations. As defined in greater detail later in this thesis, ACTDs are two to four year programs that, if successful, may be transitioned to the war fighter as residual assets, for two or more years, or as a new acquisition program. Utilization of residual assets alone typically lack the logistics chain

associated with standard DoD program, thus limiting useful life. The acquisition transition process however, currently requires funding, via the Program Objectives Memorandum (POM) cycle, along with the appropriate DoD acquisition related documentation to be available/completed before the process can move forward. These combined events impart a two-year acquisition transition window following the successful completion of an ACTD program, which adversely impacts program momentum. Additional momentum impacts include changes in user organizations, sponsor organizations or lead service organizations.

The ACTD process has a significant level of management oversight, however each program is highly tailored and there is a much less formal structure than with the standard acquisition process. The standard process typically involves programs with higher funding levels, which are therefore governed by laws and regulations, which have to be addressed by major defense acquisition programs. For those ACTDs that demonstrate strong military utility, the intent is to transition into the formal acquisition process to acquire the system in sufficient quantity to meet the operational requirement. However, without careful preparation, the transition may result in the loss of some of the benefits of the ACTD. For example, without suitable preparation in areas such as contracting, costly delays - including a break in a production line - could occur. Upfront planning is crucial to ensuring successful transition of an ACTD to the acquisition process. Potential outcomes that could be expected depending on the amount of groundwork performed could include:

1. ACTD does not transition because it is judged to lack military utility.
2. ACTD does not transition because of poor management (or other problems).
3. ACTD transitions, but has problems (due to poor management, etc).
4. ACTD transitions with no problems.

The ACTD process appears to be performing its job well, 43 out of 98 ACTDs have successfully completed the demonstration phase based on DoD statistics. However, ACTD transition to a DoD 5000 series acquisition project remains a hurdle with only 32 out of 98 ACTDs currently being executed as acquisition programs. [Joint War fighting

Science and Technology Plan, February 2002]. Tailoring of this process or defining transition needs to benefit the program and the war fighter is required. This thesis will attempt to define those elements that have helped or hindered ACTD transitions and establish guidelines to assist transitions in the future.

B. PURPOSE

The purpose of this project is to help improve ACTD program management by identifying attributes which predict transition into the acquisition process. These attributes can furthermore be used to identify potential pitfalls in existing ACTD programs.

C. RESEARCH QUESTIONS

The research questions associated with this project consists of:

Primary

1. What are the most important variables that will affect success or failure of an ACTD to transition into the normal acquisition process?

Secondary

1. Were all managers identified by name? What effect does the inclusion or exclusion of managers identified by name have on an ACTD's success?
2. Does the funding profile correspond to the development schedule? What effect does the budget profile matched to a program's development schedule have on an ACTD's success?
3. Was a well-defined military need included in the ACTD's management plan? What effect does the inclusion or exclusion of a thoughtful military need have on an ACTD's success?
4. How mature was the technology (especially, software technology) noted for inclusion in the ACTD program? What degree of commercial/off-the-shelf versus new development was utilized? What effect does the maturity of a program's technology have on an ACTD's success?
5. Was a detailed transition strategy included in the management plan? What effect does the inclusion or exclusion of a detailed transition strategy have on an ACTD's success?

6. Did the program's development fall within the prescribed development timeline of two to four years? What effect does a development schedule contained to two to four years have on an ACTD's success?

7. How in-depth was the program's management plan? What effect does the depth of a management plan have on an ACTD's success?

8. How many parties were involved in management oversight of the program? Do fewer or more parties have an impact on an ACTD's success?

9. How much capital investment was required as laid out in the management plan? Does the degree of capital requirement have an effect on an ACTD's success?

10. How complex is the ACTD's technology? To what degree does the interrelationship between technology efforts determine technology complexity? What effect does technology complexity have on an ACTD's success?

11. How risky is an ACTD effort? To what degree do all programmatic efforts analyzed holistically have on a program's risk? What effect does assessed risk have on an ACTD's success?

D. BENEFITS OF STUDY

This thesis is intended to define attributes that involves the ability of ACTD programs to transition to the acquisition process. Its findings may have value by suggestion how ACTD management may be improved.

E. SCOPE AND METHODOLOGY

The scope of this thesis is to: (1) review of the ACTD process as defined under DoD 5000 documentation, (2) review past ACTD programs, (3) perform an analysis of multiple ACTD program management plans, (4) investigate potential areas affecting ACTD successes, and (5) define potential pitfall identification which would aid in ACTD transition to acquisition programs. This thesis is intended to identify failings in the existing ACTD transition process and conclude with recommended improvements that enable a more stable and rapid introduction of technology to the war fighter through the acquisition process.

The methodology used in this thesis research consists of coding programmatic elements and statistical analysis

F. ORGANIZATION OF STUDY

This thesis is organized into four primary sections, the first of which discusses the acquisition reform revolution. This section will describe the ACTD process that is in place today. The second section will review the transition process and associated risk involved with the ACTD process. The content will consist of the transition plan, contracting strategy, and the transition funding along with the risk involved. These sections will be followed up by an analysis of 38 randomly chosen ACTD programs that were measured against the research questions. These 38 programs were run in a multiple regression and correlation analysis to determine what variables affect the success or failure of an ACTD to transition into the normal acquisition process. We identified several statistically significant variables. The final section concludes with recommendations about how to improve the ACTD process in the future.

II. THE ACTD PROCESS

ACTDs were first introduced in 1995 with twelve authorized demonstrations. These programs started the revolution towards a more rapid acquisition process that is still ongoing today. This process allows the U.S. government to reduce its cycle time and speed its delivery of advanced capabilities to the war fighters (Aldridge, April 12, 2002).

Chapter II will discuss the evolution of the ACTD process; the initiation, developments implemented in the ACTD lifespan, the process and goals associated with the ACTDs, and will close with a brief review of the ACTD programs initiated between FY95 and FY07. This information will help the reader understand and appreciate how ACTD programs are integrated into the acquisition system.

A. ACTD BEGINNINGS

In 1986, Advanced Concept Technology Demonstrations were identified by the Packard Commission as an idea without a name. They presented this idea of improving DoD management and organization in a Presidential report (Packard, 1986). The report dealt with improvements to the defense acquisition system and identified several means to obtain acquisition reform. Their findings were critical elements for the process changes that followed. The commission believed that through the use of demonstration platforms, or prototypes, the government could streamline procurement practices to reduce costs while at the same time gain a realistic assessment of operational suitability (South, 2003).

Secretary of Defense Dick Cheney took this idea from the Presidential report of 1986 and defined a new acquisition strategy in his 1992 annual report to the President and the Congress (Cheney, 1992). The use of demonstration platforms instead of the traditional production programs allowed the military to validate new concepts. This would reduce procurement timelines so Cheney recommended that proven subsystems or technologies be inserted into existing weapons platforms (Cheney, 1992).

During that same time Representative Les Aspin grabbed Cheney's idea and developed a "Rollover-Plus" plan (Aspin, 1992).

> We would not commit to quantity production at the outset of the development. Instead, a prototype would not be brought into full-scale production until the resulting component or system met stringent criteria. Those criteria are a) the technology works, b) it is required by development of the threat, or c) represents a breakthrough that would alter battlefield operations. If the resulting prototype did not meet those criteria, however, we would "rollover" the new technologies and lessons learned from development into a further iteration of engineering, development, and prototyping. (Aspin, 1992).

Secretary Cheney finally gave this concept a name in his 1993 annual report. He came up with guidelines for Advanced Technology Demonstration (ATD) that allowed an ATD to transition into production (Cheney, 1993). His approach on the ATD is that it could not stand alone. It will need exercises and simulations to prove the technology is ready, manufacturing process is available, and operations are understood before the ATD is considered. Each ATD is required to demonstrate to decision makers that the technology is feasible, affordable, and compatible with operational concepts (Cheney, 1993). The intent of the process was to provide realistic demonstrations of the technology development and involve the war fighter in the evaluation process prior to commitment of funds (Cheney, 1993).

In January of 1994, Les Aspin took over as Secretary of Defense. In his first annual report to the President he referred to the ATD as it became known from Secretary Cheney to Advanced Concept Technology Demonstration (ACTD). Secretary Aspin went on to say that ACTD's need to have an integrated effort between operational users and Science and Technology (S&T) community. Where the user provide the operational context, concept of operations, and manages the operational aspects of the demonstration; while the S&T community provides the advanced technology elements (Aspin, 1994). The point of this is to address operational utility and have a cost effective program with minimal risk involved. By refining the operational requirements and concept design will allow the new capability to enter the formal acquisition process with minimal delay and cost (Aspin, 1994).

Aspins ACTD approach emphasized cooperation between the war fighter and the S&T communities. The ACTD concept would provide the traditional role of technical and cost risk reduction, while also providing a way for refining the operational concept. Concurrent with these efforts, Aspin created the position of Deputy Under Secretary of Defense (Advanced Technology) (DUSD(AT)) to effectively manage the ACTDs (South, 2003).

With the base line for ACTDs in place, Secretary of Defense William Perry continued to add to the process. His change allowed the war fighter to modify the ACTD as it evolved through the process of fielding and operational testing (Deutch, 1994). An important aspect for the user of the ACTD is that it has operational capability for continued use. This allows the combat commander flexibility to refine the doctrine and tactics to maximize the technologies capabilities. (Deutch, 1994).

Perry continued to improve the ACTDs and made them official in his 1995 annual report. Most of the earlier ideas for ACTDs were still in place including early involvement by users, refinement of operational concepts, fielding, and quick transition to the field. In his annual report he also introduced the following four criteria for an ACTD to be considered (Perry, 1995).

1. Offers a potential solution to a military problem or introduces a significant new capability. The Joint Requirements Oversight Council (JROC) and the unified commanders must approve and ACTD.
2. Is relatively mature and contributes to solving the problem.
3. Has and executable program and management plan.
4. Is a two to four year program that can be supported for two years in the field?

The 1995 annual report also defined outcomes for ACTDs. If unsuccessful, ACTDs were to be terminated or shelved for future restructuring. Upon the user's recommendation, an ACTD could be directly fielded with minor modifications or enter the formal acquisition process at and advanced milestone (MS B or MS C) (South, 2003). Although he did make it clear that the ACTD process was not a substitute for the formal acquisition process and was not to be used as a vehicle to purchase large, complex weapon systems such as ships and tanks. It was also not intended to support acquisitions

of new systems such as vehicles or munitions. With these restrictions Secretary Perry prevented the ACTD programs from directly fielding expensive defense acquisition programs.

In 1995, the first twelve ACTD programs were selected. Because these programs are not followed with the same oversight as typical acquisition programs they have collected the interest of political officials. In 1997, the Office of the Inspector General (OIG) audited the ACTD process (South, 2003). The major topics the OIG wanted to look at were 1) the criteria used to select current and pending ACTD efforts, 2) the process for determining the program's effectiveness, and 3) the transition of the program into the defense acquisition cycle. They also evaluated 4) the adequacy of the DoD management controls as they applied to the audit objective (Office of the Inspector General, 1997). OIG investigated 9 of the 22 ACTDs approved in FY95 and FY96. They found five were questionable choices based on their interpretation of the ACTD selection criteria (South, 2003).

OIG also found four projects did not have mature technology. All four ACTDs relied significantly on modeling and simulations because supporting programs were not mature. A recommendation of a clear and consistent criteria selection for mature technologies to be established (South, 2003). They also reported that eight of the nine programs assessed did not have a declared urgent military need. OIG recognized that military need may be declared by certain DoD officials but indicated that DUSD(AT) had not defined what constitutes an urgent military need or who may declare the urgent need for the ACTD candidates (South, 2003). OIG recommended that a critical military need be defined.

In 1998, General Accounting Office (GAO) received a request from the House of Representatives to take a closer look at the ACTD process. Specifically they wanted GAO to determine:

1. Whether the selection process included criteria that were adequate to ensure that only mature technologies were selected for ACTD prototypes.
2. Whether guidance on transitioning to the normal acquisition process ensured that prototypes appropriately completed product and concept development and testing before entering production.

3. Whether DoD was procuring more ACTD prototypes than needed to assess the military utility of mature technology (Rodrigues, 1998).

What GAO found was a great need for improvement within the ACTD process. GAO reported back to the House of Representatives that:

1. DoD's process for selecting ACTD candidates did not include adequate criteria for assessing the maturity of the proposed technology resulting in the approval of ACTD projects that included immature technology.
2. Guidance on entering technologies into the normal acquisition process was not sufficient to ensure that prototype completed product and concept development and testing before entering production.
3. DoD's practice of procuring prototypes beyond those needed for the basic ACTD demonstration and before completing product and concept development and testing was unnecessarily risky (Rodrigues, 1998).

With all these findings the GAO stated three recommendations for the Secretary of Defense to take action on in order to clarify the ACTD process:

1. Ensure the use of mature technology with few, if any, exceptions
2. Describe when transition to the development phase of the acquisition cycle is necessary and the types of development activity that may be appropriate.
3. Limit the number of prototypes to be procured to the quantities needed for early user demonstrations of mature technology until the items product and concept development and testing has been completed (Rodrigues, 1998).

One way to approach the maturity level issue would be to establish a criteria based of the DoD 5000.2-R manual that list various Technology Readiness Levels (TRL) which includes a description of what each of the levels mean including examples. In 2002 a gentleman named Jim Sheldon expanded the chart to include component/system levels, equipment necessary to demonstrate capability and potential operation environment. Based on the TRL chart, level 1 through 4 would not be acceptable levels for ACTDs. TRLs 5 and 6 could possibly be acceptable. TRLs 7 through 9 would appear to directly satisfy the intentions of the ACTD maturity level (South, 2003).

Technology Readiness Levels	Description	Level	HW/SW Necessary to Demonstrate Capability	Environment
1) Basic principles observed and reported	Lowest level of technology readiness. Scientific research begins to be translated into applied research and development. Examples might include paper studies of a technology's basic properties	Studies	None	None
2) Technology concept and/or application formulated	Invention begins. Once basic principles are observed, practical applications can be invented. The application is speculative and there is no proof or detailed analysis to support the assumption. Examples are still limited to paper studies.	Studies	None	None
3) Analytical and experimental critical function and/or characteristic proof of concept	Active research and development is initiated. This includes analytical studies and laboratory studies to physically validate analytical predictions of separate elements of the technology. Examples include components that are not yet integrated or representative.	Component	Nonscale components (pieces of subsystem)	Lab
4) Component and/ or breadboard validation in lab environment.	Basic technological components are integrated to establish that the pieces will work together. This is relatively "low fidelity" compared to the eventual system. Examples include integration of "ad hoc" hardware in a laboratory.	Component / subsystem	Low fidelity breadboard (integration of nonscale components not fully functional or form and fit)	Lab
5) Component and/or breadboard validation in relevant environment	Fidelity of breadboard technology increases significantly. The basic technological components are integrated with reasonably realistic supporting elements so that the technology can be tested in a simulated environment. Examples include "high fidelity" laboratory integration of components.	Subsystem	High fidelity breadboard (functionally equivalent but not form and fit)	Lab or may include demonstration in surrogate platform

Technology Readiness Levels	Description	Level	HW/SW Necessary to Demonstrate Capability	Environment
6) System/ subsystem model or prototype demonstration in relevant environment	Representative model or prototype system, which is well beyond the breadboard tested for technology readiness level (TRL) 5, is tested in a relevant environment. Represents a major step up in a technology's demonstrated readiness. Examples include testing a prototype in a high fidelity laboratory environment or in a simulated operational environment.	Sub-system	Prototype (should be very close to form, fit and function)	Lab or limited demonstration
7) System prototype demonstration in an operational environment	Prototype near or at planned operational system. Represents a major step up from TRL 6, requiring the demonstration of an actual system prototype in an operational environment, such as in an aircraft, vehicle or space. Examples include testing the prototype in a test bed aircraft.	Sub-system	Prototype (form, fit and function)	Demonstration in representative environment such as test bed
8) Actual system completed and flight "qualified" through test and demonstration	Technology has been proven to work in its final form and under expected conditions. In almost all cases, this TRL represents the end of true system development. Examples include developmental test and evaluation of the system in its intended weapon system to determine if it meets design specifications.	System	Field qualified hardware	DT&E in actual system application
9) Actual system "flight proven" through successful mission operations	Actual application of the technology in its final form and under mission conditions, such as those encountered in operational test and evaluation. In almost all cases, this is the end of the last "bug fixing" aspects of true system development. Examples include using the system under operational mission conditions.	System	Actual system in final form	OT&E in operational mission conditions

Table 1. Technology Readiness Level (From: Sheldon, August 2002)

Since the beginning ACTDs have been scrutinized heavily which has led to multiple improvements. For example, transition manager were originally defined at the completion of the ACTD program. Currently with the more proactive execution attitude all ACTD programs must have an established transition manager before being considered for execution approval.

The ACTD process evolved in 1994 in response to the recommendations of the Parkard Commission of 1986 and the Defense Science Boards of 1987, 1990, and 1991. As can be seen it has been through many variations and continues to change as the global environment changes. While these changes have affected the process they have not effected its execution (South, 2003). Since its inception, a total of 167 ACTDs have been initiated from fiscal years 1995 through 2007.

B. ACTD PROCESS

Advanced Concept Technology Demonstrations (ACTD) is a complicated program that many customers in the defense industry do not understand. ACTDs are capabilities demonstration and evaluation programs in which the development and employment of technology and innovative operational concepts by the military user are the primary focus (Defense Acquisition University, 2006). The definition still does not explain much.

The ACTD process is a pre-acquisition activity with a significant level of management oversight, but each program is tailored and a much less formal structure than the actual acquisition process (Office of the Deputy Under Secretary of Defense for Advanced Systems & Concepts, August 2004b). This typically causes problems when transitioning from an ACTD to the acquisition process because it is not governed by laws and regulations the same as the normal acquisition process. For this reason some lessons learned from past transition problems are addressed in the most current version of the Department of Defense (DoD) 5000.2 document.

1. Objective

An Advanced Concept Technology Demonstration (ACTD) is a joint effort by the acquisition and operational communities within the DoD. Typically, ACTDs begin by identifying significant military needs, and then matching them with technology programs ready to focus on a military application. The emphasis in ACTDs is a current fix in order to validate joint military needs. These fixes are typically technology based and usually include new operational concepts and new organizational structure. The fixes must be

affordable, interchangeable, sustainable, and capable of being expanded as the technologies and threats change (Office of the Deputy Under Secretary of Defense for Advanced Systems & Concepts, August 2004a). The acquisition approach over time is an important part of the ACTD concept.

The initial requirements and the initial design reflect the performance achievable with current technology, but provisions are included to encourage growth. The basic form of an ACTD generally starts from a collection of mature technologies or technology demonstration programs which are key technologies. The technologies are combined and integrated into a complete military capability. The objective is to provide decision makers an opportunity to fully understand the operational potential offered by a proposed new military capability before making an acquisition or long term decision. This objective is met by developing useful prototypes of the proposed capability and providing those prototypes to the war fighter for evaluation (Office of the Deputy Under Secretary of Defense for Advanced Systems & Concepts, August 2004a). The war fighter first develops operational concepts designed to fully challenge the proposed capability, and then uses the prototypes and associated operational concepts in realistic military exercises to assess the resulting military utility. During the assessment of the ACTD, the user also determines the broad statement of need. This was first introduced in the proposal of the ACTD, and should have a definite set of operational requirements that can support a follow-on acquisition (Office of the Deputy Under Secretary of Defense for Advanced Systems & Concepts, August 2004a). At the completion of an ACTD, the remaining systems used in the evaluation process are left with the user to provide a temporary capability or in some cases to fulfill the total current need.

Each ACTD should provide a serious need for new or increased military capability. This need is usually provided by the operational war fighting community (JCS, CINCs, Service operational organizations). Although some ACTDs focus on a service specific capability, the highest priority in the selection process is placed on joint capabilities. ACTDs have become an important vehicle for addressing joint needs (Office of the Deputy Under Secretary of Defense for Advanced Systems & Concepts, August 2004a).

A primary ground rule for any ACTD is the active participation of a sponsor or user organization, in partnership with a service which will serve as the Technical Management Office. A proposal for an ACTD must identify and develop this user and developer partnership before consideration can be given. The initiation is either by the acquisition community, or by the war fighter community. The interests of the war fighter are very important and the guidelines regarding ACTDs are considered flexible.

The Deputy Under Secretary of Defense (Advanced Technology) (DUSD/ AS&C) has the oversight responsibility for the ACTD program. He is responsible for developing and issuing guidance regarding the ACTD program, for evaluating candidates and approving new ACTDs. He is also going to provide oversight, support and evaluation of ongoing ACTDs (Defense Acquisition University, 2006. This document describes the process for formulating, and evaluating ACTD candidates, and for approving and initiating ACTDs.

The goals of the ACTD processes are to accelerate and facilitate responses to priority military needs with a combination of new and fielded hardware and/or software, confirming that transformational technology is appropriate for military use, develop CONOPS trough resources, and creating an organizational structure that satisfies those needs (South, 2003).

To satisfy the objectives guidelines have been developed which apply to both the proposed capability and to the program for developing and evaluating the capability. These guidelines have been referred to as the ACTD selection criteria, they are intended to provide guidance for formulation of candidates, as well as structure during the ACTD process. The criteria are as follows: (Office of the Deputy Under Secretary of Defense for Advanced Systems & Concepts, August 2004a).

1. The timeframe for completing the evaluation of military utility is 2-4 years.
2. The technology should be sufficiently mature.
3. Provide a potentially effective response to a priority military need.
4. Lead service/agency has been designated.
5. Risks have been identified.

6. Demonstrations or exercises have been identified.

7. Funding is sufficient.

8. Developer is ready to prepare a plan that covers all essential aspects.

There are other factors that should be considered during the ACTD formulation phase. Although these are not selection criteria per se, they do lead to better alignment with the objectives of the ACTD program and may affect the level of support a given candidate receives during the selection process. As indicated earlier, the emphasis in ACTDs is on near-term responses to the need, responses that are affordable, interoperable, sustainable, and capable of being evolved as the technology and threat change (Office of the Deputy Under Secretary of Defense for Advanced Systems & Concepts, August 2004a).

2. Selection Process

The ACTD process is marked by three basic phases: selection of the projects, demonstration of the technologies, and residual use of prototypes or the transition to acquisition programs (United States General Accounting Office, 2002). The selection process begins with the submission of proposed Advanced Capability Technology Demonstration in response to the data call issued by the Deputy Under Secretary of Defense (Advanced Technology) (DUSD(AS&C) in October of each year. When submitting a particular technology/concept as an ACTD, a one to three page description of the proposal should be provided and should include the following information:

Describe the perceived military need, urgency of timing, and potential utility of the candidate system.

Paragraph(s) describing the basic technology/concept.

Paragraph describing the type of demonstration envisioned.

Participants in the ACTD. To what degree will the proposed ACTD support joint/combined operations?

Overall funding required, proposed funding sources and the schedule for the ACTD.

Paragraph describing perceived technical, funding, and schedule risks of the proposal.

Is the ACTD primarily directed towards Dominant Maneuver, Precision Engagement, Full-Dimensional Protection, or Focused Logistics?

Proposed Lead Service/Agency and User-Sponsor.

Briefly describe envisioned residual assets and ACTD transition strategy.

Point(s) of contact for the ACTD submission. Include name, rank, organization, phone number, fax number, and addresses (mail / e-mail). (Office of the Deputy Under Secretary of Defense for Advanced Systems & Concepts, August 2004a).

Once a developer and user team has submitted the information described above, the candidate review process begins. A specific individual within the ODUSD(AS&C) is designated to serve as the point-of-contact (POC) for each ACTD candidate. That person will work with the individual organization to ensure the proposal is complete and coordinate the review process (Office of the Deputy Under Secretary of Defense for Advanced Systems & Concepts, August 2004a). A typical schedule for this process is shown in the Figure 1 below.

The first step in the process is to prepare a briefing package (no longer than 30 minutes) to be presented first to the DUSD(AS&C) due the January after the data call is pronounced. The briefing should define the top level mission need, the ACTD objectives, operational concept, technical approach, time scale, anticipated program cost (with funding sources identified and/or required, including out-year, OSD ACTD funds), the management structure, the primary participants, the anticipated capability and, should address the "ACTD Selection Criteria." (Office of the Deputy Under Secretary of Defense for Advanced Systems & Concepts, August 2004a). Doing this first step correctly is the key to success. If this step is not complete then the whole proposal is at risk. The first impression is what makes or breaks the success of the proposal.

The briefing should be presented by both the user and developer teammates. The user outlines the mission need and operational concept, and the developer presents the technical concept and programmatic approach, highlighting a clear statement of the end product (the interim capability). The USD(AS&C) staff stands ready to assist in the development of this briefing, as well as the scheduling, as necessary (Office of the Deputy Under Secretary of Defense for Advanced Systems & Concepts, August 2004a). With the USD staffs assistance this initial submission should be perfect.

The result of this initial briefing will be one of the following courses of action: (a) acceptance of the ACTD as a formal "candidate" and scheduling for presentation to the full AT/BC principles for discussion and recommendation; (b) critique by DUSD(AS&C) and request for revision and follow-up presentation; or (c) determination that the concept, for whatever reason, is outside the scope of the ACTD process (Office of the Deputy Under Secretary of Defense for Advanced Systems & Concepts, August 2004a).

After the DUSD(AS&C) briefing the proposal goes through a couple initial reviews (Advanced Technology Breakfast Club (AT/BC) initial review from February to March, then a status review with the hill in April) before being submitted to the Breakfast Club (BC) or a detailed review. The BC will meet at the beginning of April and usually finish up by the beginning of June. BC is comprised of the senior Science & Technology (S&T) representatives from the services, Director of Defense Research & Engineering (DDR&E), Command, Control, Communication & Intelligence (C3I), and selected Department of Defense (DoD) agencies, representatives from the Operational Departments of the Services and from the Joint Staff (Defense Acquisition University, 2006). After the BC is done with the proposal it is then submitted to the Joint Staff for another review that takes place from June to August.

The DUSD(AS&C) will consider the recommendations of the AT/BC and the Joint Staff and make the decision to retain the specific ACTD candidate for presentation to the Joint Requirement Oversight Counsel (JROC). The JROC reviews and recommends prioritization of ACTD candidates based on military need. At this point, information on the candidates is provided to the Congressional Authorization and Appropriations Committees to support their committee marks. A final review, termed the

'Final Scrub', is then conducted prior to the start of the fiscal year (Defense Acquisition University, 2006). Of the candidates selected by the Joint Staff and OSD are most deserving of ACTD status. The focus of this review is once again on the selection criteria, with the addition of two other topics; transition strategy and proposed ACTD.

The ACTD list is then coordinated with the Vice Chairman, Joint Chief of Staff (JCS) and the Under Secretary of Defense (Acquisition and Technology) before the final ACTD Implementation Directives (ID) for the approved ACTDs are signed by the DUSD(AS&C) (Aldridge, April 12, 2002).

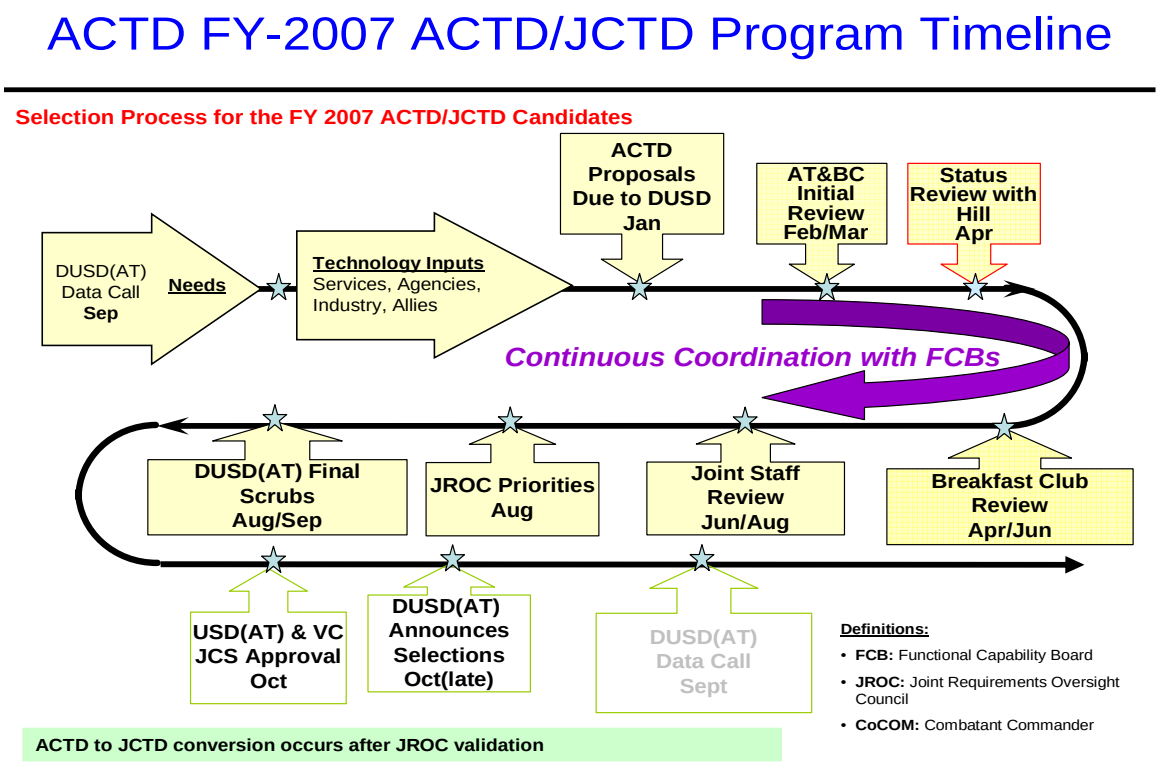

Figure 1. Program Timeline (From: Carson PPT, 2006)

At the same time the briefing is presented to the BC, a draft Implementation Directive should be in work and presented to AS&C staff once the candidate is selected. The final selection of ACTDs will not occur until the Defense Appropriations Bill has been signed. However, soon after that time the final ACTD approvals can be granted.

Approvals are in the form of the DUSD/AS&C signature on the Implementation Directives, so it is imperative the staffing of the Implementation Directives be completed in a timely fashion (Defense Acquisition University, 2006). Even though there is not a set timeline on the ID, it is the highest priority once the selections occur. A late document will risk no final signature and a cancelled ACTD.

The final step of ACTD process is the completion of the ACTD Management Plan (MP). The items that are addressed in the management plan include the following: (Office of the Deputy Under Secretary of Defense for Advanced Systems & Concepts, August 2004a).

1. The objectives that the ACTD must demonstrate.
2. The overall approach.
3. The concept and technical approach of the ACTD
4. The programmatic and organizational approach, which includes the key decision makers.
5. The approval agencies
6. The endorsements of the ACTD participants.
7. Any modifications associated with the ACTD

The process of working out the details of the Management Plan to the satisfaction of all involved will take some time and this process is viewed as a very productive element of the ACTD (Office of the Deputy Under Secretary of Defense for Advanced Systems & Concepts, August 2004a). It is necessary for the Plan to receive full endorsement within 90 days or less after approval of the Implementation Directive.

For this project, the most important section of the management plan is the programmatic and organizational approach, item 4, which include key players and the transition plan.

The initial meeting of the ACTD Oversight Group should be scheduled during the first year of the program to confirm the planned direction of the program and if necessary to resolve any outstanding issues relating to the Management Plan (Office of the Deputy Under Secretary of Defense for Advanced Systems & Concepts, August 2004a). The Management Plan is intended to provide a baseline program definition, as well as, a

practical and flexible learning environment in which operations and technical concepts can be traded off and refined prior to entering the formal acquisition process. Only significant modifications to the Plan need be approved by the ACTD's Oversight Group (Office of the Deputy Under Secretary of Defense for Advanced Systems & Concepts, August 2004a).

3. ACTD vs. Acquisition Funding

ACTD program managers must obtain ACTD and any follow-on acquisition funding through the Planning Program and Budgeting System (PPBS) just like traditional acquisition program managers. While traditional acquisition programs should be fully funded in the Future Years Defense Plan (FYDP), ACTD programs are not required to include funding for post-ACTD activity in the FYDP. At first glance this benefit of not funding additional research and development (R&D) or any production effort may appeal to the Services and OSD in a fiscally constrained environment; however, it is not practical and creates problems as ACTDs transition to acquisition programs (Mol, 1998).

In reality, post-ACTD financial planning must be accomplished during the ACTD since the acquisition Milestone Decision Authority (MDA) will only transition the program from an ACTD to an acquisition program if the follow-on effort is fully funded. This problem is recognized within the acquisition community since it affects not only the ACTD and its follow-on acquisition effort, but also other modernization programs competing for the same scarce funding (Mol, 1998). As mentioned earlier if the initial proposal is not complete on time the ACTD could risk failure due to a lack of funds. This is why that first step in the selection process is so critical to the existence of ACTDs.

OSDs ACTD guidelines offer three strategies to deal with this problem if the funding was not properly planned for. First, the services can appeal directly to OSDs Defense Resources Board (DRB) to include funding for the follow-on acquisition effort. If this brute force method is successful, it means OSD will transfer funding from an approved program to the new ACTD follow-on effort. This method disrupts the PPBS process by placing new funding requirements very late in the process after priority and

funding issues should have previously been resolved within the services (Mol, 1998). This method is not very popular and most likely will not happen unless it comes from very high in the chain-of-command.

The second alternative suggests the acquisition strategy contain a two-year gap between the completed ACTD and the beginning of the formal acquisition process. This gap allows program managers time to obtain funding through the normal two-year POM process. While this suggestion creates efficiency within the PPBS process, it is likely to break the program and cause its cancellation due to the increased contractor shut down and startup costs (Mol, 1998). Historically this has been a major cause of ACTDs to fail. As we will see later there has been a patch to fix this problem by using OSD funds from the RTD&E funds budgeted for this purpose. With that being said it still needs to be planned for in the initial proposal.

The third, and probably most attractive solution offered, is to assume success. If the acquisition strategy includes this course of action, the services must insert an acquisition cost estimate into the PPBS process before the ACTD testing is complete and before the user has had an opportunity to make an operational assessment (Mol, 1998). Unfortunately, not having the test results will build uncertainty into the cost estimate and increase the funding since results obtained in the last year or two of the ACTD are the most important. During this critical time DOD will determine the production configuration, the type of funding required (R&D vs. Production), and the scope of any future effort (Mol, 1998). Consequently, the Services may be reluctant to fund any follow-on effort given the ACTD's unpredictable future.

A specific example would be programming funds in the POM cycle for follow-on production of an ACTD where success is anticipated, such as for Global Hawk, even though flight testing has not yet demonstrated high military utility (Mol, 1998). The Army already has a similar strategy in place to fund emerging technologies, such as Advanced Technology Demonstrations (ATDs) and Advanced War fighting Experiments (AWEs). During the development process of the FY98-03 POM, the Army established a Task Force 21 budget line, with RDT&E funds identified and submitted in the FY98 budget request. The establishment of the RDT&E line, to support Force 21 requirements,

provides the service the flexibility to leverage, exploit and transition new technologies, buy prototype systems, and put them in the hands of the soldiers quickly (Mol, 1998).

In the end, the funding rules are different between the two systems. PPBS reality dictates ACTD programs and it must have a plan and program for follow-on acquisition funding in the FYDP to maintain program stability. ACTD program managers and the service headquarters must incorporate their budgets into the PPBS—just like traditional acquisition programs.

4. Current Funding Process

Programmatic flexibility and speed in adjusting to change are critically important to success with a program as technologically intensive as the ACTD. In the current environment, technology is accelerating at a tremendous rate. Our speed and flexibility to leverage, exploit, and transition mature or emerging technologies into the operational force structure is hampered by resource and budget constraints (e.g., the inability to perform timely programming of funding during the Program Objective Memorandum (POM) process) (Office of the Deputy Under Secretary of Defense for Advanced Systems & Concepts, August 2004b). If the selection process is used correctly it can minimize some of these resource and budgeting issues that become major road blocks for future requirements.

At the time a proposed ACTD is approved, the Deputy Under Secretary of Defense (Advanced Technology) also approves the funding for an ACTD, to include any supplemental funding provided by OSD. The Executing Agent will designate an ACTD Technical Manager (TM) who is responsible for managing the execution of all funds associated with an ACTD (Mol, 1998). It is also the responsibility of the TM to develop a life cycle cost estimate for the system to serve as a basis for planning, programming, and budgeting of the resources by the Lead Service for subsequent acquisition.

Funding for ACTDs can currently be planned, programmed, and budgeted through two sources: 1) The Military Departments or Agencies supplying the underlying technologies provide the funding associated with those technology programs, and 2) OSD can supplement the service or agency funding to cover cost in three areas: a) added costs

incurred when other technology program funds are redirected to support the ACTD; b) costs due to any requirement to provide additional quantities of hardware; and c) cost for technical support for two years of field operations following the ACTD (Office of the Deputy Under Secretary of Defense for Advanced Systems & Concepts, August 2004b). Although OSD provides start up funding for ACTDs, the military services and defense agencies are ultimately responsible for financing the acquisition and support of equipment for the ACTD (United States General Accounting Office, 2002). However, funding to support the follow-on activity (development, full rate production, or purchase of additional quantities of commercial items) is not typically funded in OSD or the Service/Agency until the ACTD demonstrates the military utility of the capability being assessed (Office of the Deputy Under Secretary of Defense for Advanced Systems & Concepts, August 2004b). This lack of prior funding creates a significant challenge that must be addressed as part of the transition effort.

Proper funding of ACTDs is a critical component for successful program execution. Funds for ACTDs are submitted in the RDT&E Presidential Budget Request. A majority of these resources are pulled from the BA-3 Advanced Technology Development funds. Some of the budgeting requirements include funding that must be sufficient to complete the planned assessment of utility. Budget request must be developed and submitted as a part of the proposed ACTD. The budget must identify all costs associated with the design and development of the prototype system, all additional units required in the ACTD, all exercises that must be paid by the project, and test support costs including any modeling simulation and analysis needed to support the utility assessment (Office of the Deputy Under Secretary of Defense for Advanced Systems & Concepts, August 2004a). The budget must also include costs related to planning and preparations for transition into acquisition, as well as the cost to provide technical support for the first two years of fielding the residuals. The lead service is assumed to budget for all support costs beyond that point (Defense Acquisition University, 2006).

Both the Implementation Directive (ID) and Management Plan (MP) require a "break-out" of resources. Historically, OSD has provided 15-20% of the total funding while the services involved provide the rest. It is the goal of AS&C to provide approximately 20% of the total funding and no more than 30% of the actual cash funding for any particular ACTD (not including coalition partners) (Peterson, 2005). In addition, properly spreading the resources is a critical element of the program. AS&C resources should be spread across the life of the project, with no more than half of its funding requested in the first two years. At the discretion of the DUSD (AS&C) these metrics may be waived, but it should be the exception and considered only on a case by case basis (Peterson, 2005). Proposals for OSD funding should be coordinated with ODUSD(AS&C) during the formulation phase. Figure 2 shows the current ACTD funding model in place today and highlights the challenges involved in the process.

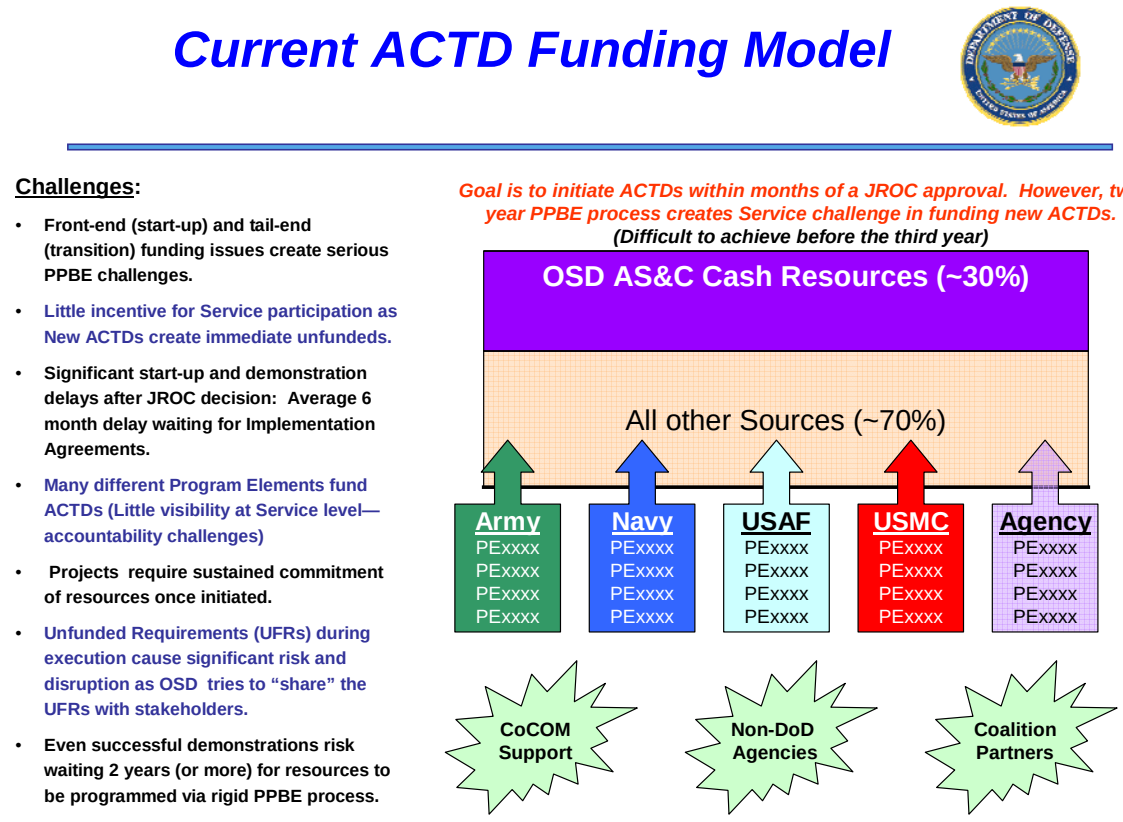

Figure 2. Current Funding (From: Carson PPT, 2006)

5. Conclusion

Although this system has its problems in the end it has been a relatively successful program for the DoD. They claim roughly 71% of the ACTDs transition at least one product to a program of record or directly to the war fighter. DoD would like to see that number climb to over 80% (TechLink, 2005). There has been a considerable amount of effort put into shrinking the time it takes to get a product through the acquisition process. This program was a way to get high priority items in the hands of the war fighter on limited resources. After looking at the process the main problem is the budget because it is not in line with the typical PPBE process.

Figure 3 shows how serious Congress has started to take this program. Prior to 2001 the appropriations were much lower than what was requested. Since then, Congress has issued appropriations above what was requested. This is a good sign for future programs brought into the ACTD process. Improvements will continue to be made as time goes on with the emphasis on transitioning the ACTDs into the acquisition process.

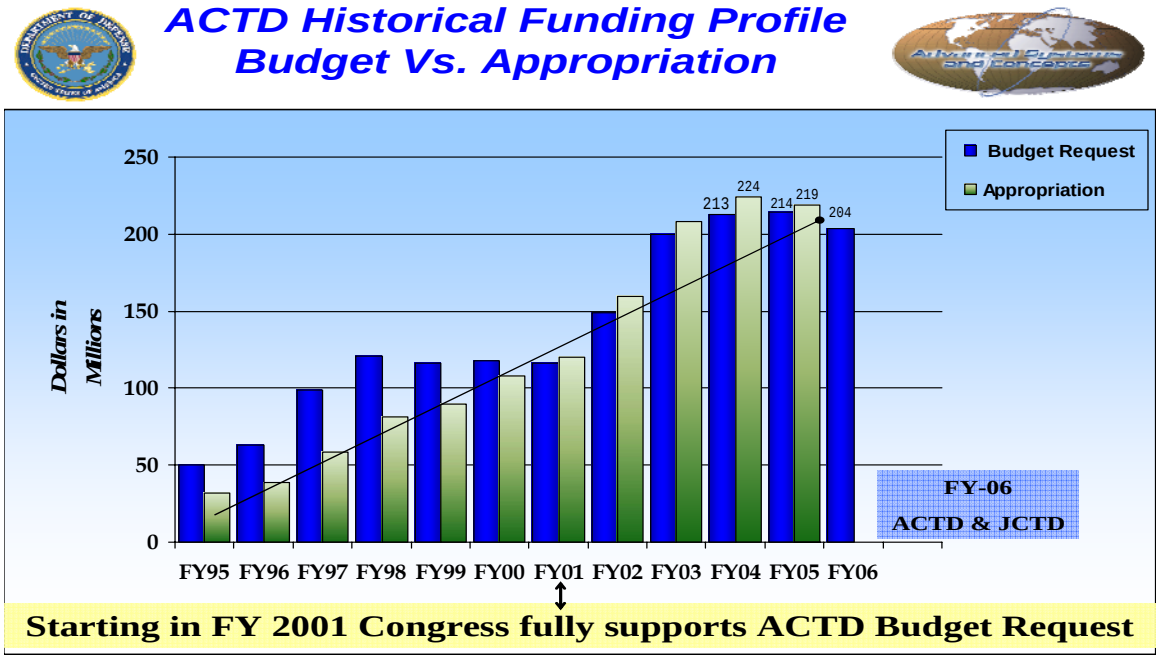

Figure 3. Historical Funding (From: Carson PPT, 2006)

C. REVIEW OF PROGRAMS

ACTDs represent a bold departure from the traditional research and development acquisition cycle that can take 15 years (Kaminski, March 1997) to field a new weapon system. ACTDs typically have a two to four year life span as standalone demonstration activities (South thesis). Since the beginning of the ACTD process there have been 167 programs approved through FY07. Of these, 93 have successfully completed the demonstration phases and 55 are still in process. Of those 167 programs 16 have been terminated due to lack of military utility or immaturity while three have been place on hold. Seventy-four have been placed in the "transitioned on record" category indicating a successful transition. ACTDs initiated to date are presented in Table 2 (Carson, 2007).

FY 95 ACTD	FY96 ACTD	FY97ACTD	FY 98 ACTD
Advanced Joint Planning	Battle Field Awareness and Data Dissemination	Integrated Collection Management	Migration Defense Intelligence Threat Data System
Precision SIGINT Targeting System	Semi-Automated IMINT Processing	Information Operations Planning Tool	Joint Continuous Strike Environment
Synthetic Theater of War	Joint Logistics	Consequence Management	Adaptive Course of Action
Low-Life-Cycle-Cost Medium-Lift Helicopter	Counter Sniper	Joint Advanced Health and Usage Monitoring System	C4I for Coalition Warfare
Kinetic Energy Boost-Phase Intercept	Miniature Air-Launched Decoy	Rapid Terrain Visualization	Space-Based Space Surveillance Operations
Medium-Altitude Endurance UAV (Predator)	Combat Vehicle Survivability	Chemical Add-On to Air Base/Port Biological Detection	Information Assurance: Automated Intrusion Detection Evnironment
High-Altitude Endurance UAV	Navigation Warfare	Military Operations in Urban Terrain	Theater Precision Strike Operations
Cruise Missile Defense Phase I	Tactical High-Energy Laser	Extending the Littoral Battlespace	Unattended Ground Sensors
Precision/Rapid Counter-MRL	Tactical UAV	Counterproliferation II	Precision Targeting Identification
Joint Countermine	Air Base/Port Bilogical Detection		Joint Modular Lighter System
Rapid Force Prjection Initiative	Combat Identification		Line-of-Sight Anti-Tank
	Counterproliferation I		Joint Biological Remote Early Warning System
			Link-16
Total 11	**Total 12**	**Total 9**	**Total 13**

FY99 ACTD	FY00 ACTD	FY01 ACTD	FY02 ACTD
Battle Damage Assessment in the Joint Targeting Toolbox	CINC 21	Active Network Intrusion Defense	Active Denial System
Coherent Analytical Computing Environment	Coalition Aerial Surveillance & Reconnaissance	Adaptive Batlespace Awareness	Advanced Notice
Common spectral MASINT Exploitation	Comm/Nav Outage Forecast System	Advanced Tactical Laser	Agile Transportation
Compact Environmental Anomaly Sensor II	Computerized Operational MASINT Weather	Advanced Technology Ordnance Surveillance	Coalition Information Assurance Common Operational Picture
Force Medical Protection/Dosimeter	Content-Based Info Security	Area Cruise Missile Defense	Contamination Avoidance at Seaports of Debarkation
Human Intelligence Support Tools	Global Monitoring of Space ISR Systems	Coalition Combat ID	Expendable Unmanned Aerial Vehicle
Joint Medical Operations/Telemedicine	Ground-to-Air Passive Survillance	Coalition Theater Logistics	Homeland Security Command and Control
Joint Thheater Logistics	Joint Intelligence, Surveillance & Reconnaissance	Coastal Area Protection System	Hyperspectral Collection and Analysis
Personnel Recovery Mission Software	Multiple Link Antenna System	Hunter Standoff Killer Team	Joint Explosive Ordnance Disposal
Small Unit Logistics	Quick Bolt	Joint Area Clearance	Language and Speech Exploitation Resource
Theater Air & Missile Defense Interoperability	Restoration of Operations	Loitering Electronic Warfare Killer	Micro Air Vehicle
	Tri-Band Antenna Signal Combiner	Network-Centric Collaborative Targeting (formally NCCIS&R)	Pathfinder
		Personnel Recovery Extraction Survivability aided by Smart Sensors	SIGINT Processing
		Tactical Missile System Penetrator	Space-Based MTI
		Theater Integrated Planning System	Thermobarics
Total 11	**Total 12**	**Total 15**	**Total 15**

FY03 ACTD	FY04 ACTD	FY05 ACTD	FY06 ACTD
Adaptive Joint C4ISR Node	Agile Rapid Global Combat Support	Actionable Situational Awareness Pull	Counterintelligence Architecture Modernization Progam-Intell Ops
Counter Bomb/Counter Bomber	Advanced Tactical Targeting Technology	Operations System	Management Planning Tool
Deployable Cargo Screening	Coalition Reception Staging & Onward Movement	Chemical Unmanned Ground Reconnaissance	Awareness
Foliage Pen Syn App Rad	Environment	Epidemic Outbreak Surveillance	Event Management Framework
Gridlock	Future Tactical Truck System	Engagement	Architecture
High Altitude Airship	Joint Precision Airdrop System	Joint Enhanced Explosion Resistant Coating Exploitation	Focused Lethality Munition
Joint Blue Force Situational Awareness	Control	Joint Force Projection	Joint Enable Theater Access-Sea Ports of Debarkation
Midnight Stand	MAGNUM	Theater	Systems
Night Vision Cave & Urban Assault	Joint ISR Interoperability Coalition	Rapid Airborne Reporting & Exploitation	Large Data
Overwatch	Man Portable Threat Warning System	Sea Eagle	Counter Obscured Targets
Tactical IFSAR Mapping	Protected Landing and Take-off	Sea TALON	Node Management and Deployable Depot
Theater Support Vessel	Global Reach	Demonstrator	Capability
Tunnel Target Defeat	Theater Effects Based Operations	TACSAT-2 Roadrunner	Small Unmanned Aerial System
Urban Recon		Gunship standoff Precision Munition	
		Weapons Data Link Network	
Total 14	**Total 13**	**Total 15**	**Total 13**

FY07 ACTD

Airborne Weapons Surveillance System

Coalition Mobility System

Global Observer

IP Routers in Space

Joint Multi-Mission Electro-Optical System

Joint Surface Warfare

Mapping the Human Terrain

Maritime Auto Super Track Enhance Reporting

Smart Threads Integrated Radiation Sensors

Tactical Service Providers

Total 10

Table 2. ACTD Initiated by Fiscal Year (From: DoD Release 95-07)

D. CHAPTER SUMMARY

This chapter began with a review of the ACTD process initiated in 1995. The background information provided the history on how the process got started. With that information we were able to provide detailed procedures on how an ACTD gets selected, funded, and eventually transitioned into the acquisition process.

The most significant items associated with the establishment and methods of a given ACTD program include:

1. ACTDs were initiated to reduce the acquisition cycle time and speed the delivery of advanced capabilities to the war fighter.
2. The process utilized to establish and execute ACTDs has continually evolved since 1995 to increase the potential for success.
3. Technology maturity above readiness level 5, as defined in (Table 1), is critical to the expectation and ACTD will successfully transition into acquisition.
4. Three categories of ACTDs exist: software systems, weapon and sensor systems, and system-of-systems.
5. Exit paths available at the completion of an ACTD consist of: termination, return to technology base for further development, residual utilization, initiate acquisition at MS B with major improvements, initiate acquisition at MS C with minor improvements, initiate acquisition at FOC as COTS or NDI. The last of these is the desired goal of the ACTD process (South, 2003).

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III. ACTD TRANSITION PROCESS VS KNOWN PROBLEMS

A. BACKGROUND

Before we can understand the importance of planning for technology transition, we must first understand what technology transition means. Technology transition is the process by which technology deemed to be of significant use to the operational military community is transitioned from the science and technology environment to a military operational field unit for evaluation and then incorporated into an existing acquisition program or identified as the subject matter for a new acquisition program (Dobbins, 2004).

There are multiple challenges that are involved in the transitioning an ACTD into the normal acquisition process. Some of the issues that continue to surface throughout all the programs are:

1. Contracting strategy this deals with getting the best deal from the contractor without losing momentum during the transition.
2. Interoperability-is the ACTD compatible with other systems?
3. Supportability-can it be supported in a cost effective manor?
4. Test and Evaluation-getting these people involved as early as possible and keeping them involved throughout the transition is very important to the success of the ACTD
5. Affordability-assessing life cycle affordability and application of a Cost as an Independent Variable (CAIV) strategy to continuously look for ways to reduce cost.
6. Funding-finding the right strategy to get the resources for normal acquisition.
7. Requirements-establishing a mission need and goals at the start and ending with system performance that captures the technology maturity and the knowledge gained by the war fighter in a realistic exercise.
8. Acquisition Program Documentation-defining and planning for the documentation required prior to the acquisition decision (Office of the Deputy Under Secretary of Defense for Advanced Systems & Concepts, August 2004).

Being able to address each one of these challenges will increase the probability of ACTDs transitioning into the acquisition model. Even though addressing all of these challenges does not guarantee a successful transition. The options for a failed program are to use it as an interim capability as is, continue development, or terminate the program. Having a solid plan in place way before the transition phase will help in the success (Office of the Deputy Under Secretary of Defense for Advanced Systems & Concepts, August 2004).

Although the formal acquisition process is the primary means for procuring a new military capability the ACTD process is a pre-acquisition action that allows the war fighter to assess its military utility before going into full production. The transition will depend on the Military Unit Assessment (MUA) that an operational user will conduct. They will concentrate on the if the program is a valid requirement, that the maturity is sufficient for the purpose, and the ease of integration into a field usable product (Office of the Deputy Under Secretary of Defense for Advanced Systems & Concepts, August 2004). The ACTD Process is a pre-acquisition activity that is recognized by the acquisition system. Since FY95, there have been 167 ACTD programs. These programs are presented in Table 2. To date, 112 have completed the demonstration phase (due to the nature of ACTDs, those initiated FY06 or later are typically still underway). Of those completed, 16 have been terminated with another 3 placed on hold. There are 74 programs that are reported as transitioned into the acquisition process while 19 are still in the transition phase. Out of all the years (excluding FY06-07), 51.4% have been coded as "transition on record" with an additional 13.2% in the transition phase. This is a combined total of 64.6% of the programs that are eligible (established for 2 or more years) to enter into the transition phase. Although these numbers do not seem impressive the process is making progress. A previous thesis project was done by Matthew South in 2003. He reported that a total of 33% of the programs had entered into the transition phase at the end of FY02. This means that the success rate has doubled in the last 5 years. For a fairly new program it seems to have the potential to continue on this path and reach over 80% success rate.

FY	INITIATED	DEMO COMPLETE	IN DEMO	TERMINATED PRIOR MUA	TERMINATED AFTER MUA	HOLD	TRANSITION ON RECORD	IN TRANSITION
95	11	11		1	1		9	
96	12	12			2		10	
97	9	9					8	1
98	14	14		1	2		11	
99	11	11					11	
00	12	11	1	1	2		8	
01	15	15		1	1		6	7
02	18	15	3	2		1	7	5
03	14	7	7	1		1	2	3
04	13	4	9			1	0	3
05	15	3	12	1			2	0
06	13	0	13				0	0
07	10	0	10				0	0
Total	167	112	55	8	8	3	74	19

Table 3. ACTD Execution History (From: Carson Excel Spreadsheet, 2007)

B. ACTD CLASSES

ACTDs are categorized by three classes or categories. They are listed as Software/workstation/commo, Weapons, sensors, or C4ISR systems, and System of systems. These are generic classes of ACTDs that present significantly different transition challenges.

1. Class I ACTD

Software/workstation/commo (Class I ACTDs) is typically information systems with special purpose software operation on commercial workstations. They frequently are required in small quantities and that requirement can be satisfied without further development or production using the residual ACTD systems or a few additional systems. Class I is typically the easiest class to manage from a transition perspective (Office of the Deputy Under Secretary of Defense for Advanced Systems & Concepts, August 2004b).

2. Class II ACTD

Weapons, sensors, or C4ISR systems (Class II) are weapon or sensor systems similar in concept to systems that are acquired through the formal acquisition process. In

many cases a Class II ACTD will be planned to transition LRIP (post MS C) following the ACTD, but there may be cases where it is appropriate to plan for additional development following the ACTD (Office of the Deputy Under Secretary of Defense for Advanced Systems & Concepts, August 2004b).

3. Class III ACTD

System of systems (Class III) are an individual element within the overall architecture of a Class III ACTD maybe a fielded system, a system already in acquisition, or a system emerging from the technology base. The overall ACTD may involve multiple Program Executive Officers, and perhaps multiple Military Departments. The challenge may therefore be to integrate and coordinate the individual transitions to achieve the capability represented in the ACTD. Although existing ACTDs fit into each of the three classes described above, the only ones which have progressed to the point that a significant amount of transition planning effort has been performed are in Class II (Office of the Deputy Under Secretary of Defense for Advanced Systems & Concepts, August 2004b).

After completion, ACTDs have two possible exit paths - acquisition or non-acquisition. For the non-acquisition path the ACTD can be either terminated due to a lack of military utility, shelved for further development, or fielded to establish a residual operational capacity (South, 2003). Formal acquisition is based on the level of technology maturity demonstrated and MUA success. Based on these elements the acquisition can begin during System Development and Demonstration (SD&D), Production and Deployment (P&D), or additional elements can be procured for Operations and Support (O&S) (South, 2003).

C. TRANSITION STRATEGY

Technology transition into acquisition requires planning beyond that required for initial technology development. Acquisition programs involve a significant level of

oversight, planning and milestone reviews (Dobbins, 2004). Although this statement refers to the normal acquisition process, an ACTD program should not be treated any differently if the program is expected to transition.

It is important that the transition into acquisition occur smoothly and without undue loss of momentum. It is critical that the objective be identified at the approval of the ACTD, and the transition strategy occurs during the early stages of the planning process which should be identified in the management plan (Office of the Deputy Under Secretary of Defense for Advanced Systems & Concepts, August 2004). As in most military transactions a poor plan will result in preventable issues to surface. These types of problems can usually be prevented when a solid, detailed plan is set in place. Starting the transition strategy late in the game will most likely cause the loss of momentum and possibly prevent the program from entering the normal acquisition process.

1. Transition Plan

Although there is no policy or other requirement specifying the contents of an ACTD transition plan, it should address elements specific to the technology being transitioned and how the technology will merge into the acquisition process of an existing program. The transition plan should be an element of the overall ACTD management plan and should reflect the transition strategy. It should address the transition issues and elements relevant to the specific technology being transitioned, including planning for operational user evaluations (Dobbins, 2004). Transition planning is fairly straight forward but not at all easy. At the beginning of the ACTD, estimate whether the program will enter into the formal acquisition process. If entry is necessary the point at which the program will enter needs to be identified (MS B, MS C). After that a whole set of strategies need to be defined including contracting, supportability, interoperability, affordability, and requirements that will support the intended point of entry (Office of the Deputy Under Secretary of Defense for Advanced Systems & Concepts, August 2004). Another important piece of the puzzle is the implementation timelines for each of the above strategies.

a. Transition Integrated Product Team (TIPT)

Part of an effective transition plan and management process is the formation-often by the ACTD demonstration manager-and activation of the transition integrated product team. The TIPT provides the most natural means for bringing the key stakeholders together to review strategies. It also serves as a bridge between the initial ACTD management planning activity and the transition decisions, assists in identifying and resolving transition issues. The receiving acquisition program office and the contractors should be included in the TIPT (Dobbins, 2004).

b. Overarching Integrated Product Team (OIPT)

As the time for completion of the ACTD approaches, an overarching integrated product team (OIPT) should be formed as a successor to the TIPT. The OIPT completes the remainder of the transition reviews (cost, schedule, and performance) in preparation for transition to acquisition. The OIPT ensures that all of the necessary elements and documentation are in place for the ACTD to transition into the acquisition program at the appropriate point in the acquisition life cycle. The OIPT will also prepare for a formal program review by the defense acquisition executive.

It is also advisable (not required) to conduct a major review with the Lead Service organization that will be accepting both the interim capability assets from the ACTD and the objective system. This review should occur at least six months prior to the end of the ACTD and should address the status of preparations for operational support (Office of the Deputy Under Secretary of Defense for Advanced Systems & Concepts, August 2004). Figure 4 shows how the transition strategy should flow throughout the process.

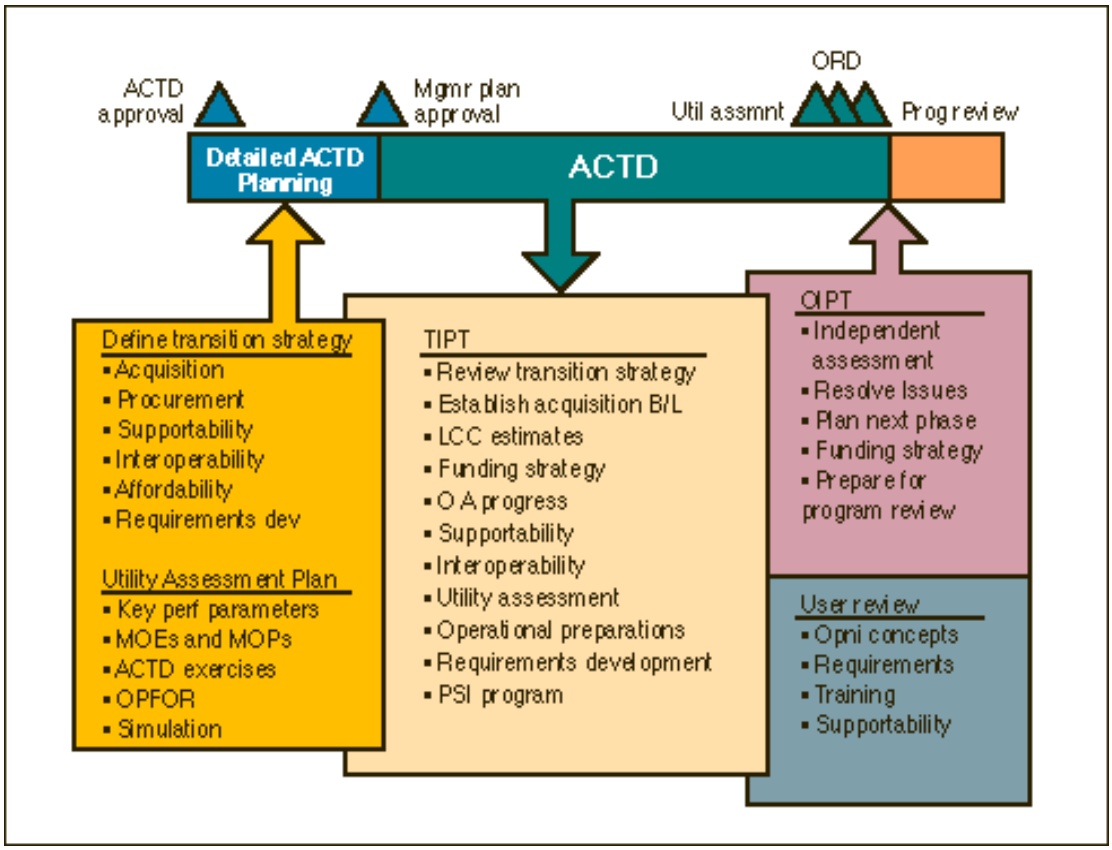

Figure 4. Transition Preparations (From: Carson PPT, 2006)

2. Contracting Strategy

When a technology transitions into acquisition, there will be some form of contracting activity involved. The technology may be inserted into an existing contract whose terms and conditions will apply to the new technology. The program may enter acquisition as a major upgrade to and existing system and may require a separate contracting effort or it could enter acquisition as a major upgrade to an existing system that requires a separate contract. Another option is to have the project enter under a new contract effort (Dobbins, 2004).

The initial contracting strategy should be based on the issues involved with a particular ACTD. It should consider the effort to be performed during the ACTD, as well the post-ACTD objective. A large part of the contracting strategy is deciding where the post-ACTD will enter into the acquisition process. For example, if the post-ACTD

objective is to enter directly into Low Rate Initial Production (LRIP), the contracting strategy should tailor the plan to enter production with the current design but allow for further development after the completion (Office of the Deputy Under Secretary of Defense for Advanced Systems & Concepts, August 2004). This portion should include how DoD will procure additional units of the ACTD if that is the decision at the conclusion of the phase. There are many decisions that need to be made within the contracting strategy. It has become obvious over the years that the early these decisions are made the chances of major problems later are reduced.

The transition can be easier if the OIPT works with the acquisition community to ensure that a proper contracting strategy is in place. The contracting strategy must also make sense for the particular technology along with the existing acquisition process. There are many different contracting strategies, having a liaison with the acquisition manager for the program into which the technology will transition will significantly ease the transition process (Dobbins, 2004). In the end the contracting strategy alternatives, subsequent to the ACTD contract, must be specified in the solicitation. The possibility of continuing with the ACTD contractor into production should be clearly communicated to potential offers. DoD should be forthcoming within certain parameters of uncertainties that exist.

3. Transition Funding

RDT&E funding for ACTDs can currently be planned, programmed, and budgeted through two sources:

1. Military Departments/Agencies
2. OSD can supplement the service/agency to cover cost in three areas:
    a. added costs incurred when the technology programs are reoriented to support the ACTD.
    b. costs due to any requirement to provide additional quantities of hardware.
    c. cost for technical support for two year of field operations following the ACTD.

However, funding to support the follow-on activity (development, LRIP, full rate production, or purchase of additional quantities of commercial items) is not typically funded by OSD or the Service/Agency until the ACTD demonstrates military utility. This lack of prior funding creates a significant challenge that must be addressed as a part of the transition effort (Office of the Deputy Under Secretary of Defense for Advanced Systems & Concepts, August 2004). There are three follow-on funding strategies that are currently recognized:

1. High Military Utility-No Resources programmed. When an ACTD has significant military capability but no resources have been provided to support the program. The lead service and present to the Defense Resource Board (DRB) a funding request. This will interrupt on-going programs funding by taking money away from another program in order to fund the ACTD. This type of funding strategy should only be used in an "urgency of need" situation that requires rapid acquisition (Office of the Deputy Under Secretary of Defense for Advanced Systems & Concepts, August 2004).
2. Military Utility Established-No Resources Programmed. Lead service waits until the end of the ACTD to request funds. Since the POM is a 2 year process the money is not available until 2 years after the completion of the ACTD. This means that the continuity from an ACTD to an acquisition program may be broken, and momentum lost (Office of the Deputy Under Secretary of Defense for Advanced Systems & Concepts, August 2004).
3. Assume Success For Some ACTDs-Program Resources In Anticipation of Follow-On Acquisition. One way to avoid a break in the continuity between an ACTD and the follow-on acquisition program is to establish a budget line with funding, dedicated solely to the acquisition of the ACTD. This is a high risk move because if the ACTD does not prove military utility and is cancelled then the money set aside can not be used on anything else and would be lost. This would be normally done when military utility is expected to be high, and where there are early indications that the expectations will be met. If for some reason the program becomes joint, the lead service can transfer the resources to the Joint Lead Service for execution (Office of the Deputy Under Secretary of Defense for Advanced Systems & Concepts, August 2004). This strategy will prevent a break in continuity altogether.

D. ASSOCIATED RISK

The overarching mantra of the ACTD process is increased rapidity in the delivery of relevant technology to the war fighter. In order to accomplish this, the procedures and regulations that have grown around formal acquisition programs have to be re-examined to determine bottlenecks within the process. One of the prevalent arguments against the formal acquisition process is the formality of the acquisition process (Office of the Deputy Under Secretary of Defense for Advanced Systems & Concepts, 2007). The belief exists that this degree of formality precipitates an unnecessary degree of oversight that bogs the process down. This fact, however, may not be as detrimental as it appears on the surface.

In 1998, the Congressional Budget Office (CBO) issued a report on ACTD programs (Congressional Budget Office, 1998). Within the report, the CBO dug below the surface issue of apparent superfluous oversight and identified one of the subcutaneous (and unforeseen) effects of stripping back control —it introduces further risks into the ACTD process. ACTD programs, by their nature, are conceived with inherent technical risk but lack of proper management introduces a new subset of risk.

1. Questionable Project Selections

One of the harshest criticisms leveled against ACTD programs in the report (Congressional Budget Office, 1998) was in regards to the selection process. The overarching concern with this risk was that an improper selection of an ACTD that was not as technologically viable as another alternative would become more difficult to manage. Because ACTDs fall outside the realm of traditional acquisition processes, the ability to mitigate risk through more structured reviews is degraded within an ACTD program. This inability to grasp and reel in technological difficulties has the potential to translate into significant cost overruns.

2. Ambiguous Criteria in the Selection Process

The risk drawn out by the CBO (Congressional Budget Office, 1998) is not one that berates the selection process of ACTDs per se; instead, it addresses how ACTD program offices interpret two constraints bounding the selection process. The first boundary drawn out is the degree of technical maturity. The main critique of the technological maturity is a precise definition of what it means for a program to be sufficiently mature. GAO notes that their interpretation of maturity within DoD is a system that has demonstrated successes at the subsystem or component level (United States General Accounting Office, 2002). They do not denote what constitutes a successful performance. The lack of fidelity within the definition has led to the adoption of many definitions of technology maturity within ACTD processes. DoD has tried to mitigate this situation by stating that ACTD programs be assessed on their maturity with the same TRLs used by traditional acquisition programs (United States General Accounting Office, 2002). Another weakness noted is the seeming lack of understanding on when to apply the notion of maturity to an ACTD program (Congressional Budget Office, 1998). The issue stems from a propensity for program offices to look toward the ultimate product that an ACTD program provides to the user; however, this lack of focus on present program maturity creates a disparity between determining if a current technology is sufficiently mature and designing a path to an end product. In other words, a lack of understanding on the degree of maturity on a current program precludes a clear roadmap because program offices focus a great deal of effort on the end product.

The second parameter noted by the CBO (Congressional Budget Office, 1998) is a disparity of ACTD development and assurance that they are addressing an urgent requirement. The issue brought to light is that, though the JROC provides initial screening of candidate programs for the ACTD process they are not active participants in the transition process (United States General Accounting Office, 2002). This lack of uncertainty on the joint utility of a program may be one of the factors prohibiting ACTDs from transitioning into the formal acquisition phase. Because the JROC does not have a role in the transition process of ACTDs, these programs often lose upper-level support.

Therefore, the transition process falls back to the services which often do not support the ACTD program because there are other priority programs or the ACTD extends beyond their primary mission.

As identified by the Deputy Under Secretary of Defense for Advanced systems and Concepts (DUSD(AS&C)), which is supposed to be used by ACTD managers and users, the following list of criteria are used to determine approval/implementation of a purposed ACTD program:

Criteria	Indicators of Success
1. The ACTD met a priority military need. (C-1)	a. The proposed solution incorporated intense user involvement to evaluate the ability to meet military needs. b. ACTDs users had realistic and extensive military exercise opportunities to evaluate utility and gain experience with capabilities. c. Users refined their operational requirements, developed CONOPS, and developed a sound understanding of the military utility.
2. The ACTD was adequately mature. (C-2)	a. ACTD was a mature or nearly mature technology based on Technology Readiness Level (TRL) scale (minimum level 5 or above). b. ACTD maturity reduced the time and risks associated with the demonstration. c. ACTD activities focused on integration and demonstration activities not technology development.
3. The ACTD demonstrations / exercises were adequate to provide a military utility assessment. (C-3)	a. Adequate quantities of ACTD were procured to provide a valid assessment of its capabilities. b. ACTD demonstration was sized and structured to provide a clear evaluation of military capability. c. ACTD integrated / executed both developmental and operational T&E swiftly and economically to ensure that requirements were met and the system was operationally satisfactory and useful. d. The user defined the MOEs and MOPs that allowed effectiveness and suitability to be characterized. e. User planned the operational exercises, typically including red and blue forces.
4. The ACTD developer demonstrated the essential ACTD criteria. (C-4)	a. The potential or projected effectiveness was sufficient to warrant consideration as an ACTD. b. The available capability addressed a need for which there was no suitable solution. c. The ability of the technology to be interoperable with other systems on the battlefield was verified. d. The fielded system would maintain a high state of readiness and safety, using trained operators and maintainers, and do so economically and with the smallest possible logistical footprint.
5. The ACTD lead service executed the program appropriately. (C-5)	a. The lead service/agency ensured the necessary planning for transition to formal acquisition was accomplished. b. The lead service/agency ensured transition of the residual assets to the user organization and for all aspects of their support.
6. ACTD sponsorship was executed appropriately. (C-6)	a. The JROC recommendation for lead service/user sponsor was accepted by DUSD(AS&C). b. The user sponsor was a Unified Commander (general rule, not as a requirement). c. Affordability goals were set for acquisition and life-cycle costs that permitted CAIV trade-offs and later design-to-cost (DTC) tradeoffs.
7. The ACTD execution window completed within two to four years. (C-7)	a. The ACTD completed all activities within the expected time (2 – 4 yrs). b. No significant schedule or configuration changes were required to meet objectives.
8. The risks associated with the ACTD were appropriately identified. (C-8)	a. Risks were identified and accepted by the primary stakeholders of the ACTD. b. Programmatic risks (e.g. cost and schedule) and the operational risks related to the acceptability of the operational concepts necessary to realize the full benefit of the proposed capability were minimized. c. System complexity (low to high) was related to risk level (low to high), respectively.

Criteria	Indicators of Success
9. ACTD funding was sufficient to meet program requirements. (C-9)	a. A budget was developed and submitted as a part of the proposed ACTD. b. The proper strategy was chosen for obtaining the resources necessary for acquiring the technology. c. All costs associated with the design and development of the prototype system was identified (this includes all additional units required in the ACTD, all exercises that must be paid for by the project, and test support costs including any modeling simulation and analysis needed to support the utility assessment). d. The ACTD budget included transition costs related to the planning and preparations for acquisition, as well as the cost to provide technical support for the first two years of fielding the residuals.
10. The ACTD executed its transition plans to initiate acquisition. (C-10)	a. The ACTD did not lose momentum in transitioning to the acquisition process (assuming the user made a positive determination of military utility). b. A clear acquisition goal was set for the post ACTD phases. c. Requirements were evolved from mission need and performance goals to formal operational requirements documents; interoperability documents; system performance specifications; and total ownership costs (manning, training and sustainability related to applying the technology) estimates. d. A contracting strategy was established that motivated the contractor to provide a best-value solution (in terms of overall life-cycle cost-effectiveness) and permitted transition into procurement without the loss of momentum.

Table 4. ACTD Criteria and Indicators of Success (From: ACTD Guidelines, August 2004)

3. Too Little Oversight

One of the risks identified by the CBO (Congressional Budget Office, 1998) was a concern that the ACTD may be circumventing the acquisition process and not supplementing it. Restrictions are in place that restricts the number of prototypes bought only to those necessary for operational testing (Mol, 1998); however, ambiguity surrounds what is necessary for operational testing and for how long. The concern is that an ill-defined operational testing environment could involve extensive field trials with an undo number of test vehicles.

In addition to a proper of mix of test vehicles, Congressional concerns also surround the degree of stringency applied to ACTD contracting practices (Congressional Budget Office, 1998). Again, due to their operations outside the traditional acquisition process, ACTDs are open for interpretation in regards to contracting procedures. There appears to be no fast procedures (only guidelines) for the application of contracting criteria when dealing with ACTDs.

4. Future Demands for Defense Spending

The final problem noted by the CBO (Congressional Budget Office, 1998) is that due to their less- formalized nature, ACTDs often do not have the necessary cost projections available if an ACTD transitions into the formal acquisition process. This is a direct outgrowth of the uncertain nature of ACTDs in their initial development. An ACTD lives in a constant state of termination or reversion back to a lab environment, therefore, it is not imperative that long-range financial forecasts are formalized in the early stages of the program.

If an ACTD makes it past the "halfway point" in the ACTD process, the guideline is for the transition integrated product team (IPT) to begin developing costs associated with acquiring the program. Long-term plans, however, regarding ACTDs are inherently uncertain and little certainty can be assigned to cost analysis data generated in the long-term for the program. This uncertainty in costing sets up a scenario where ACTDs are funded with a chunk mentality (Congressional Budget Office, 1998) which may or may not prove sufficient to properly develop the program.

This lack of adherence to formalized fiscal planning processes may be one of the factors jeopardizing the unwillingness to fund an ACTD's transition (United States General Accounting Office, 2002). The main issue is that the lack of authoritative cost projects does not allow for inclusion in the formalized budgeting process. What is often the case is that services must now take funds from their own coffers to support the transition of the program. As was previously mentioned, the lack of support generated for these programs by the services can prevent programs from receiving funding for transition.

E. CHAPTER SUMMARY

This chapter has addressed the transition process of the ACTD programs, including the challenges that each program faces each time they enter into the process. The execution history has identified all the programs to date and where they stand in the process. This helps identify where the successes and weaknesses are located in the

process. We discussed the different ACTD classes along with which class is the most likely to proceed through the programs with the least amount of challenges. Identifying the importance of the transition strategy is a key element. Without the early planning of this strategy the likelihood of a program entering into the normal acquisition process is very limited. How the TIPT and OIPT play key roles through out the process but more importantly in the contracting strategy phase. Funding is probably one of the most important phases of the transition. Without the proper funding in place all the planning is irrelevant. Finally, we reviewed known problems with the ACTD process from project selection, ambiguous criteria, down to the funding issues involved with the process.

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IV. ACTD ANALYSIS

This chapter will describe the approach employed for an overall analysis of those ACTD programs for which data was provided.

The initial section will demonstrate the methods to both summarize and codify the data contained with the ACTD management plans. The data gleaned from the program management plans was not standardized and had to be encapsulated and encoded for effective analysis. To understand this, the approach to analyze the encoded data will be explained.

Once an understanding of the data and encoding techniques are established, a brief overview of the statistical model employed will be discussed.

Finally, given the outputs from the statistical model, possible causal relationships will be examined.

A. DATA SUMMARY

In our analysis we limited our investigation to one quadrant of the two-by-two diagram (upper right) below (Table 5). The quadrant we investigated involved information provided within the management plan (vertical axis) and a hypothesized effect (horizontal axis) from the given data set. Others could look at this by using a different source but the same variable (lower right), using a different source different variable (lower left), or same source different variable (upper left).

The initial challenge when presented with the provided ACTD data was the application of a systematic approach to summarize the data. The data we examined pertaining to the ACTD programs was the program management plans. Though the management plans contained information pertaining to a myriad of aspects of the ACTD programs, they were not uniform in their approach or depth. Therefore, the approach to data summarization was to identify all aspects of the ACTD management plans that were a) available for review and b) might possibly affect the final disposition of the program. Two important limitations to the study should therefore be mentioned here. First, the

data source we used is a limitation in the sense that we were limited to coding what data was available (or missing) across management plans. Second, we used our own hypotheses about which factors might possibly affect transition, and were guided by our advisors knowledge of prior work on technology transition. What emerged from this coding process was a set of coded variables that we believe is reasonable and robust.

In order to ensure uniformity, each management plan was reviewed for those program facets that were identified within the document. Once a comprehensive list of readily available program attributes were delineated from the collection of management plan scrubs, a crosscheck identified those attributes which were common throughout the entirety of the plans.

When the listing of common attributes was finally compiled, it was reviewed for possible significance. The information was subdivided into two categories. One category was information that was available for all programs but was reckoned inconsequential to program outcome. The second category was information that was available for all programs and was reckoned consequential to program success or failure.

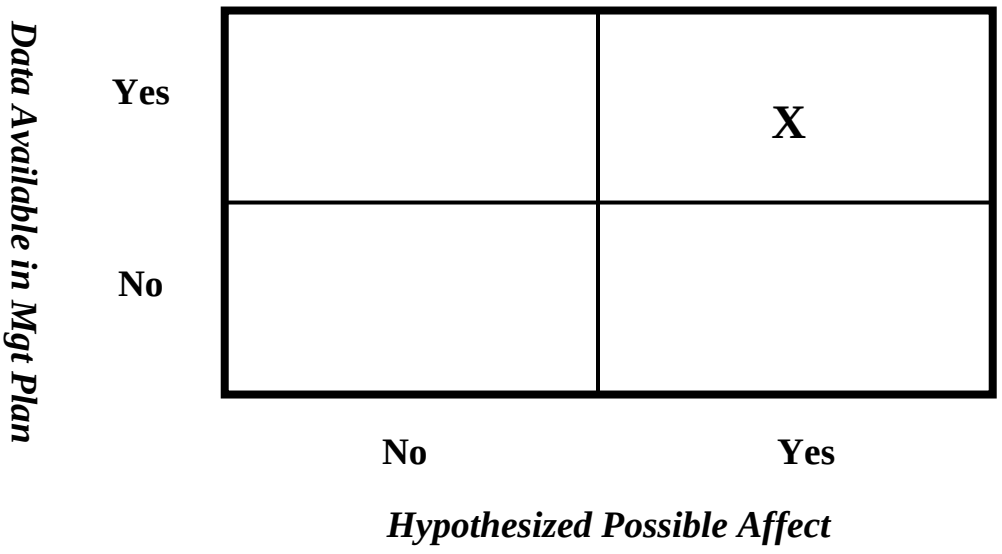

Table 5. 2 x 2 Diagram (From: Wideman/Phelps, 2007)

From the list of substantial data shared by all programs, eleven questions were constructed to identify those areas and ancillary aspects of those areas for analysis. Before the questions could be put to the management plans, however, a system of coding the data needed to be established.

B. CODING

The coding applied to the data (and serving as the basis for analysis) fell into three distinct categories.

The first category was binary. If the question lent itself to a simple yes or no response, this approach to coding was used.

The second category was a scaling system. This approach provided an approach to coding those questions that were more subjective in nature. Not surprisingly this approach constituted a large portion of the questions. Underlying the scaling process was an attempt to create a consistent and objective evaluation of variables. Our intuition is that program management provides a consistently optimistic forecast for program success no matter the underlying difficulties inherent to the program. Scaling the responses allowed the data presented in the management plan to strengthen program management's hopeful outlook against a more objective approach.

The final category was number entry. This approach was utilized in those instances where actual numbers were either provided or could be determined by some rudimentary analysis, and the two aforementioned methods were not appropriate for coding.

We examined the following variables.

1. Transition, or Not

This was the dependent variable in our analysis of the thirty-eight programs. Of the programs studied 19 of them transitioned into the acquisition process while the other

19 did not. A binary method was employed to mark each ACTD as transitioning or not. A "1" was assigned to those programs that transitioned and a "0" to the non-transitioned ACTDs.

We coded the following independent variables.

2. Manager Assignment

Per ACTD Guidelines: Management Plans (Office of the Deputy Under Secretary of Defense for Advanced Systems & Concepts, 2007), by the point that a management plan is produced for a given ACTD, the guidance states that managers of the project must be identified. The extent of management identified is not explicit but implies all anticipated management will be named.

Seven key members of program management (IPT manager, oversight group, executive agent, user sponsor, technical manger, transition manager, and operations manager) were selected for identification. Once the positions were determined, the management plans were reviewed for name identification. If the plan provided a specific point of contact, the corresponding position was assigned a code of “1,” marking it as having met identification criteria. When the plan was reviewed and specific members were identified, the management members were summed to present a total number of those members actually assigned out of 7.

3. Budget Matched to Schedule

In order to determine the correspondence between schedule and forecasted funding data, the two provided schedules were compared for discrepancies. A rudimentary exam of the two schedules often noted minor discrepancies that may have negated this metric; however, further scrutiny identified finesse in budgeting and development scheduling that required investigation. Many of these programs were overlapping the provided funding by extending the program schedule past a noted funding timeline. A closer examination noted that many of these efforts were coming from further auxiliary funding sources or were play in the schedule for further

development. Though the charted timeline provided an initial conflict at first glance, the written narrative delineating the development effort often alleviated such disparities.

Given this information, we coded plans with a binary code (i.e. 0/1) depending on whether there was a reasonable match between the development schedule (both written and charted) against the funding matrices provided in the management plan.

4. Established Military Need

The determination of an established and justified military need necessitated the use of a scaling system. When the management plans were compared across one another it became apparent that a binary coding system was wholly inadequate in measuring this program facet. The elaboration and citations contained within this portion of the management plan lent itself to scaleable grading system.

At the lowest end of the scale was a low rating. The low rating reflected either a complete lack of inclusion of the military need justification or a generic justification that had a few specific connections to the particular ACTD program. Typically a need was posited based on a strategic or tactical deficiency, but little or no effort was applied to demonstrating how the ACTD contributed to fulfilling the claimed need.

The middle rating was a medium rating. A medium rating demonstrated an effort to tie the ACTD program to a particular military need; however, it did not demonstrate conclusively how the particular program would help remedy the situation. Within this rating, a continual tendency of the management plans was to generalize the military need and hypothesize how the ACTD could be molded to meet this need.

We coded plans "high" when the management plans identified specific military failings that facilitated the overarching military need and explicitly addressed how the particular ACTD in development would fulfill this need and showed a clear path on how to achieve this aim.

5. Technology Maturity

One of the most difficult program parameters to gauge was the level of technology maturity of the ACTD. The difficulty arose primarily from the degree (or lack thereof) of data provided within the management plans regarding technology maturity. Traditionally, the maturity of technology is spelled out in a regulated system known as Technology Readiness Levels (TRL) (Advanced Systems & Concepts, 2006). However, the management plans provided were inconsistent in their mention of TRL's pertaining to their programs or did not provide enough technical data to ascertain a rough estimate on where the program may fall on the scale. Another method of scaling was needed.

The foundation of most of the ACTD's relied heavily on the success of software development. The thread of software success ran through all of the management plans and provided a basis for some scaling of technology maturity. In lieu of TRL's, an alternative system for gauging technology maturity, known as ImpACT, was utilized (Advanced Systems & Concepts, 2006). ImpACT deals specifically with software development and the degree of impact of commercial-off-the-shelf (COTS) software on the success of the development effort. ImpACT allowed for an effective scaling methodology to be developed based upon the description of development.

The highest rating was an all COTS/pre-existing rating. Given the lack of detail within the preponderance of management plans, this rating reflected an assignment to software (technology) that they had been developed and tested and demonstrated to be a viable option. It does not reflect the anticipated degree of success of militarizing the COTS but simply shows that the technology is one in existence with some degree of practicality.

The middle rating was partial COTS rating. This rating demonstrated that at least part of the software (technology) development effort was more mature than new development due to the inclusion of COTS. It also took into account that because the effort was partially composed of new development (in addition to COTS) the technology maturity was lessened.

The lowest rating was the new rating. Reflected within this rating is the knowledge that the software (technology) has no aspect that has either been fully developed or tested.

6. Transition Strategy

The transition strategy was also coded using a scaling metric. Like the aforementioned military need criteria, transition strategy's scale had to be constructed, not against an available benchmark, but against the verbiage provided within the management plans themselves.

A low rating reflected either a complete omission of a transition strategy or an acknowledgment that it was the hope of the program office that the program would transition at a later date.

The medium rating was given to those ACTD efforts which had a transition plan in development. In other words, the program management plan had either a detailed plan to develop a transition plan or had a transition plan lacking significant detail.

The highest rating was given to transition plans that had exacting details (e.g., involved parties, sequential processing, timelines, etc.). This rating reflected a transition plan that marked a clear path to incorporate the ACTD beyond the development phase.

7. Timeline Requirement

Per ACTD Guidelines: Formulation, Selection and Initiation (Office of the Deputy Under Secretary of Defense for Advanced Systems & Concepts, August 2004), ACTD programs are intended to have a development and demonstration lifetime of between two and four years. This timeline underscores the primary presupposition for ACTD programs to be rapid development efforts to get critical technologies to combatants.

For the supplied management plans, the development and demonstration schedules were reviewed for number of years. The years were counted and actual numbers were entered. The numbers entered do not reflect ancillary efforts that may

have preceded the ACTD. For consistency, if such efforts were noted on the schedule, we discounted them and did not include them in the overall count. Given our sample size (over 30) and random selection of our sample, it is reasonable to assume that we have randomized for ancillary efforts, and that these should not bias our statistical analysis in any particular way.

8. Plan Depth

Plan depth was coded with actual page counts of the management plans. The assumption here is that increased page counts are indicators of a more developed management plans.

9. Number of Parties Involved

For the number of parties involved, actual counts of the parties were used. There were two considerations made in ascertaining party involvement numbers.

The first consideration is that one mention reflected one count. Many of the involved parties were mentioned under numerous development phases, as well as, numerous integrated product team (IPT) membership. Second we considered how ACTD management is intended for implementation. The program is subdivided into sub-efforts (e.g., IPT). Each sub-effort is managed by an overarching agency appointed by ACTD program management. The purpose of the underlying management is to align and rectify concerns within their functional area.

It might be noted that the number of parties involved is an indicator of the coordination complexity involved in a particular ACTD program. More complex coordination arrangements may be reasoned to be more prone to breakdown, and therefore to failure for a program to transition.

10. Capital Investment Requirement

This metric is summation of budgeted dollars laid out in the management plan.

11. Technology Complexity and Risk Assessment

These last two metrics were coded separately. However, they are intrinsically related and will be discussed together. Technology complexity was not a metric included in the original management plans. It was a subjective measurement we included in our consideration of the overall complexity of the program. Each was coded as high, medium, or low.

First we coded technology complexity.

1. We looked at the scale of proven technologies versus unproven technologies within the program.
2. We then verified whether or not a clear plan of technical integration was present. A clear plan was considered one that addressed an obvious path for integrating the technologies as a whole to accomplish the function of the program.
3. Finally, if the management plan mentioned utilization of COTS but also noted a lack of forecasted integration between COTS programs, we coded it as complex. We assigned a subjective rating of high, medium, or low based upon these three factors taken as a whole.

Second, we coded plan risk.

1. Management plans that identified risk in a program usually identified it as low-to-medium risk. Not all management plans included their own risk assessment and, given the criticality of a risk analysis in a development program, we included a subjective risk analysis. We coded these and included them in our regression analysis.
2. We coded plans based on specific mentions of risk analysis and risk mitigation efforts or procedures that were being put in place. We considered information contained in the management plans on risk mitigation efforts in place or being put in place as part of the management plan for the particular ACTD in question.
3. We then coded the management plans based on our own assessment of their risk level. In part, the risk measure we used reflects our assessment of the nine aforementioned metrics. This metric was utilized to provide an independent and (relatively) objective assessment outside of program management authorship of the overall program risk, given the data provided in the management plan.

C. METHODOLOGY

After we coded the variables we analyzed them using multivariate regression so as to examine their relationship with ACTD transition.

1. Multivariate Regression Analysis-Explanation

Multivariate regression can establish that a set of independent variables explains a proportion of the variance in a dependent variable at a significant level (through a significance test of R^2), and can establish the relative predictive importance of the independent variables (by comparing beta weights). Power terms can be added as independent variables to explore curvilinear effects. Cross-product terms can be added as independent variables to explore interaction effects. One can test the significance of difference of two R^2's to determine if adding an independent variable to the model helps significantly. Using hierarchical regression, one can see how most variance in the dependent can be explained by one or a set of new independent variables, over and above that explained by an earlier set. Of course, the estimates (b coefficients and constant) can be used to construct a prediction equation and generate predicted scores on a variable for further analysis (Garson, 2007).

Dummy variables are a way of adding the values of a nominal or ordinal variable to a regression equation. The standard approach to modeling categorical variables is to include the categorical variables in the regression equation by converting each level of each categorical variable into a variable of its own, usually coded 0 or 1. For instance, the categorical variable "region" may be converted into dummy variables such as "East," "West," "North," or "South." Typically "1" means the attribute of interest is present (ex., South = 1 means the case is from the region South). Of course, once the conversion is made, if we know a case's value on all the levels of a categorical variable except one, that last one is determined. Why not run separate regressions? It is true that one approach to a categorical variable in regression would be to run separate regressions for each category. While this is feasible for a single variable such as gender, running a male and a female regression, it is not the best approach for two reasons. In practical terms, if there are multiple categorical variables each with multiple categories (levels), the number of

needed regressions may become unwieldy. In statistical terms, we will lose power since each regression will have a smaller sample size than if there were one overall regression. That is, we will be more likely to make Type II errors (false negatives, thinking there is no relationship when in reality there is) (Garson, 2007).

Program	Dependent Variable	Total Managers Identified	Budget Matches Schedule	Military Need Established	Technology Maturity	Transition Strategy	2-4 Year Requirement	Parties Involved	Technology Complexity	Risk Assessment	Page Count (Plan Depth)	Capital Investment	Management Plan Risk Assessment
Mountain Top	0	4	0	2	3	1	1	3	2	1	22	70.50	1
MDITDS	0	5	1	3	2	3	1	4	2	3	33	12.35	na
Multi Link	0	3	0	1	2	1	1	3	2	2	3	14.70	na
Boost Phase	0	1	0	1	2	2	1	2	1	2	1	0.00	na
CBIS	0	3	0	2	2	3	1	3	2	2	29	0.00	na
Tac Laser	0	1	0	1	1	1	1	2	3	3	2	0.00	na
JMLS	0	6	1	1	3	2	1	4	1	1	21	25.30	1
Tac UAV	0	2	1	2	3	1	1	3	1	1	1	84.90	na
HLS/HLD	0	3	1	1	3	1	0	3	1	1	20	63.43	na
CIA COP	0	3	1	3	2	3	0	3	2	2	51	29.00	2
Agent Defeat	0	1	0	2	3	2	1	1	1	1	13	12.06	na
TACMS-P	0	4	1	2	3	3	1	3	2	1	31	50.6	1
TASC	0	6	1	2	3	1	1	3	3	2	11	2.85	1
HPM	0	0	0	1	1	1	1	0	3	3	0	0	na
Plato	0	0	0	1	1	1	0	0	3	3	0	0	na
HAA	0	3	0	1	2	1	0	5	2	3	3	145	na
JEERCE	0	2	0	2	2	2	1	3	3	2	8	14.2	na
IFSAR	0	1	0	2	2	3	0	4	3	3	6	62.3	na
LEWK	0	3	0	3	1	3	0	4	3	3	16	27.95	na
Adv Joint Plan	1	5	1	1	3	1	1	3	1	1	20	32.8	1
HAE UAV	1	6	1	2	2	3	0	4	2	2	28	935.8	na
Nav War	1	7	1	3	3	3	1	3	2	1	28	59.1	na
SAIP	1	5	1	3	3	3	1	4	3	2	29	119.8	na
Joint Cont Stk	1	3	1	3	2	2	1	5	2	2	29	15.6	na
C4I for CW	1	3	1	3	2	2	0	4	3	2	8	21	na
CAESAR	1	1	1	1	3	1	1	1	1	1	1	1	na
JICR	1	4	1	3	2	3	0	4	2	2	26	0.061	2
LOSAT	1	3	1	2	3	3	1	3	2	1	30	176.7	1
WDLN	1	3	1	2	2	1	1	3	2	2	8	31.4	n/a
MANPACK	1	1	1	2	2	3	1	4	2	2	18	56.5	2
TSV	1	7	1	3	2	2	1	3	2	1	25	143.8	1
JBFSA	1	6	1	3	2	3	1	3	2	2	81	39.75	2
LASER	1	3	1	3	2	3	0	3	2	2	37	33.8	2
JDSR	1	7	1	3	2	3	0	10	2	1	61	31.6	2
CASPOD	1	4	1	2	2	3	0	3	2	2	32	43	2
TIPS	1	3	1	2	2	1	0	3	1	1	13	16.7	2
JAC	1	7	1	2	2	3	1	4	2	2	27	12.6	2
ABA	1	3	1	3	2	3	0	3	2	2	35	52.9	2

Table 6. Raw Data Coding (From: Wideman/Phelps Analysis, 2007)

D. ANALYSIS

1. Overall Model Results

The full model (Table 7) indicates a coefficient of determination adjusted for degrees of freedom (Adjusted R2) as .40. This would suggest that 40% of the model is explained by the 11 independent variables. When the core model (Table 8) was run with the three statistically significant variables (from the initial full model), the adjusted R2 climbed to .50. This indicates that the model with these three independent variables explains 50% of the variance. The output of the regression model noted several distinct areas with noticeable impact on the resolution of an ACTD program.

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.76467
R Square	0.58472
Adjusted R Square	0.40902
Standard Error	0.38953
Observations	38

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	11	5.55483	0.50498	3.32802	0.00571
Residual	26	3.94517	0.15174		
Total	37	9.5			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	0.99265	0.63874	1.55407	0.13226	-0.32031	2.30560	-0.32031	2.30560
Budget Matches Schedule	0.72701	0.19680	3.69424	0.00103	0.32249	1.13153	0.32249	1.13153
Technology Maturity	-0.38282	0.17502	-2.18728	0.03791	-0.74258	-0.02306	-0.74258	-0.02306
Risk Assessment	-0.29174	0.17528	-1.66446	0.10803	-0.65202	0.06855	-0.65202	0.06855
Capital Investment	0.00041	0.00048	0.85332	0.40127	-0.00057	0.00138	-0.00057	0.00138
Transition Strategy	0.06007	0.11339	0.52980	0.60074	-0.17300	0.29315	-0.17300	0.29315
Military Need Established	0.07130	0.13854	0.51464	0.61115	-0.21347	0.35607	-0.21347	0.35607
Page Count (Plan Depth)	-0.00289	0.00627	-0.46013	0.64925	-0.01578	0.01001	-0.01578	0.01001
2-4 Year Requirement	0.06853	0.15948	0.42974	0.67092	-0.25928	0.39635	-0.25928	0.39635
Technology Complexity	0.05759	0.14643	0.39328	0.69732	-0.24340	0.35858	-0.24340	0.35858
Total Managers Identified	-0.01249	0.05208	-0.23991	0.81228	-0.11954	0.09455	-0.11954	0.09455
Parties Involved	0.01112	0.05353	0.20774	0.83705	-0.09892	0.12116	-0.09892	0.12116

Table 7. Regression model for Significant Variables Only (From: Wideman/Phelps Analysis, 2007)

Several authors have offered guidelines for the interpretation of a correlation coefficient (Statsoft, 2003). As Cohen himself has observed, however, all such criteria are in some ways arbitrary and should not be observed too strictly. This is because the interpretation of a correlation coefficient depends on the context and purposes. A

correlation of 0.9 may be very low if one is verifying a physical law using high-quality instruments, but may be regarded as very high in the social sciences where there may be a greater contribution from complicating factors (Statsoft, 2003).

2. Independent Variables that are Significant Predictors of ACTD Transition

The output of the regression model noted three distinct variables that had an impact on the resolution of an ACTD program.

We examined these in a second regression model – Figure 6. This model has an overall adjusted R2 of 0.50, which means that these 3 variables can be used to generate a simple model that is a strong predictor of ACTD transition results, i.e., here is a simple, parsimonious set of predictors.

These areas are discussed below in an attempt to garner an understanding of the causal relationships that might explain the statistical results we found.

a. Budget Matched to Schedule

The first variable that was statistically significant was "budget data matched to schedule." Those programs that progressed successfully were more likely to have funding available to match program scheduling. Conversely, those programs which failed to successfully progress were more likely to have the opposite relationship.

Given the importance of a program's schedule and the supporting funding means, proper alignment between the two is essential. The data presented in the management plan stage of ACTD programs demonstrated that this consideration was not always rectified satisfactorily.

The correspondence between a properly aligned budget and schedule and the ultimate success or failure of an ACTD program is notable for several possible reasons. The failure to align two program facets so inherently related demonstrates an absence of consideration for one or the other when constructing the profile. This lack of communications could be facilitated through poorly aligned communications methods or

a lack of congruence when developing the management plan. Overall, it portrays a potential instance where these two facets are developed with either minimal consideration or concern for the other.

Given the omnipresent status of an ACTD's budget it is hard to justify that this is as prevalent as the data presents. What this relationship presents (in addition to lack of consideration) is a degree of living beyond current constraints. A program schedule contrary to funding profile projects a sense of a project lacking the proper understanding to align the disjointed facets. The technical schedule is held as a projection to achieve a viable program and an inability to mold it to funding constraints demonstrates a questionable understanding of the program as it currently stands.

b. Technology Maturity

Another area cited with high significance is the degree of technology maturity. The more mature an ACTD's technology was (heavily cited as COTS in this instance) the higher was the probability of success for the program.

The correlation between technology maturity and program success is important in the context of an ACTD's existence. The ACTD program exists to rapidly apply technology to a real-world concern. In other words, it is about the proper application of technology.

ACTDs either utilize existing technologies in a new manner, mix new and existing technologies to augment current capabilities, or develop new technologies. The issue is that simultaneous development is occurring and the more certainty (or proven ingredients) that can be included in the outset, the focus on the solution becomes more salient. While the utilization of technology addresses the technical aspect of a real-world military issue, there is also the tactical concern of how to employ said technology. The more proven a system's underlying technology is allows for more rapid evolution to a war fighter's demands while concurrently not promising more than can be provided.

c. Risk Assessment

The final area with a reasonably high significance is the risk assessment. Those programs coded as lower risk were more likely to succeed. In many ways, this corresponds to the abovementioned conclusion drawn from technology maturity.

One additional consideration here (in addition to technology maturity) is the certainty that an overall risk assessment can be inferred from. When management plans consistently they demonstrate a propensity towards marking their own programs as having low technical risk opens the forum for more stringent observation. Those plans that have failed to provide a thorough analysis have opened themselves up for the possibility of termination or a serious degradation in their support.

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.73743
R Square	0.54381
Adjusted R Square	0.50355
Standard Error	0.35702
Observations	38

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	3	5.16616	1.72205	13.50994	0.00001
Residual	34	4.33384	0.12747		
Total	37	9.5			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	1.17339	0.55039	2.13191	0.04032	0.05486	2.29192	0.05486	2.29192
Budget Matches Schedule	0.77935	0.14193	5.49106	0.00000	0.49091	1.06779	0.49091	1.06779
Technology Maturity	-0.36725	0.14892	-2.46604	0.01886	-0.66990	-0.06460	-0.66990	-0.06460
Risk Assessment	-0.21433	0.13300	-1.61151	0.11631	-0.48461	0.05596	-0.48461	0.05596

Table 8. Regression Model for Significant Variables Only (From: Wideman/Phelps Analysis, 2007)

3. Correlation between Significant Variables – Could we Simplify the Model Further by Eliminating Anything Else?

Once the significant variables were identified we looked at the correlation between the three.

The three variables that we found to be correlated were technology maturity, Budget matches Schedule, and risk assessment. These three had a positive correlation. The relationship between three variables is such that as one variable's values tend to

increase, then the other variable's values also tend to increase. This is represented by a positive correlation coefficient (Statsoft, 2003). We also found that some of the variables had negative correlations. This means that the relationship between two variables is such that as one variable's values tend to increase, while the other variable's values tend to decrease. If the budget increases then the maturity level would tend to decrease (Statsoft, 2003).

	Total Managers Identified	*Budget Matches Schedule*	*Military Need Established*	*Technology Maturity*	*Transition Strategy*	*2-4 Year Requirement*	*Parties Involved*	*Technology Complexity*	*Risk Assessment*	*Page Count (Plan Depth)*	*Capital Investment*
Total Managers Identified	1										
Budget Matches Schedule	0.55817	1									
Military Need Established	0.43561	0.43503	1								
Technology Maturity	0.32664	**0.41750**	-0.03499	1							
Transition Strategy	0.34858	0.29011	0.66989	-0.05051	1						
2-4 Year Requirement	0.07191	-0.04942	-0.20404	0.35085	-0.19280	1					
Parties Involved	0.54582	0.32021	0.44129	0.05774	0.39214	-0.26816	1				
Technology Complexity	-0.08823	-0.31208	0.25035	-0.52671	0.17046	-0.13318	0.01922	1			
Risk Assessment	-0.35662	**0.47130**	-0.02527	**0.77122**	0.07443	-0.24736	-0.10886	0.67607	1		
Page Count (Plan Depth)	0.59889	0.49521	0.63518	0.09658	0.65794	-0.12157	0.46631	-0.07085	-0.21105	1	
Capital Investment	0.26217	0.16029	0.02544	0.04517	0.18892	-0.20567	0.13642	-0.01376	-0.03373	0.09782	1

Figure 5. Correlation Table from Data Set (From: Wideman/Phelps Analysis, 2007)

4. Non-Significant Variables

Non-significant results for variables are just as important as significant variables. There are two particular variables that were non-significant that are especially worth mentioning. Though the technology maturity was deemed to be significant to the determination of an ACTD's success prospects, technology complexity did not. What may be underlying this phenomenon is the coding method chosen. While technology maturity lends itself to more objective coding, technology complexity is a subjective measure applied in consideration of all programmatic features. Through an attempt to summarize the program in a single metric, the metric mirrors the program. By not singularizing within the metric, the program's success is inherently tied to the metric.

In addition to the occurrence of technology complexity is an issue of parties involved. The negligence of this metric to play a critical role in a program's ultimate resolution is born out of management foresight from the ACTD program office (and is hinted at in the coding process). Though a multiple players may be involved in a program's development, their potential disputes may have been are filtered by the time

the management plan is in place, i.e., the management plan may be considered an indicator of dispute resolution, without which it would have never been completed. This might explain the non-significance of this variable.

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V. RECOMMENDATIONS AND CONCLUSIONS

A. RECOMMENDATIONS

After comparing 38 programs of which half transitioned into the normal acquisition process we have found that some variables within the management plans of ACTDs are powerful predictors of whether ACTD programs will transition or not. These results suggest recommendations to make the ACTD process more successful, as follows:

1. Ensure that the over all technology maturity level is high. This means the appropriate interoperability of all the sub-systems must achieve a certain maturity level. Having COTS sub-systems is a good start but without bringing them all together to prove military utility will be less favorable to transition. Earlier in this paper we talked about Technology Readiness Levels. These seem to be very important in the transition process. Although the management plans don't specify exactly what TRL the program enters into the ACTD our judgment was based on how much of the program was partial or all Commercial Off The Shelf (COTS). By introducing a program that is lower on the TRL scale will most likely decrease its chances of having a successful transition. It is very important to obtain the highest maturity level when entering a program into the ACTD process. The more items in a program that are COTS the better chance of a transition will occur. A future study of program TRLs is recommended due to the fact that we found it to be statistically significant in our study. This would entail finding the TRL for each and every COTS item used in a program to determine the overall Technology Readiness Level.

2. Adequate and coordinated funding is a must for any program. As we stated earlier the funding must match the schedule in order for the program to have a chance to transition. Having the budget in place will increase the chances of a transition. This is not anything new. We concentrated on whether the budget actually matched the schedule. This seemed to have an effect on the outcome of the program. If a program had a 3 year budget set in place and it was scheduled as a 4 year process then this will most likely prevent the program from transitioning. By requiring the lead service to plan a budget around the schedule would help the process. This would require the program to initiate a request for Planning, Program, and Budgeting system funds associated with the expected Fiscal Year of transition. Correct planning will prevent the program from loosing momentum or being stalled to the point of no longer being of value 2 years later when the budget is approved. A closer look at the budget compared

to the schedule will be in order. Our study shows that this is another statistically significant issue on whether a program transitions or not.

3. A realistic risk assessment must be included within the management plan. Including a lessened estimate of programmatic risk may make the immediate plan more readily acceptable but does not institute a stable framework to further develop the program. In addition to realism, the risk assessment must also be detailed enough to delineate mitigation efforts to offset known risks. Mitigation efforts must be at a detail to demonstrate a competent understanding that the risks facing a program are acknowledged and understood. This may make the initial plan harder to accept, though it portrays a realistic understanding of the program being developed. Risk assessment is important to the transition process. Even though a subjective analysis was used to categorize this particular variable having a solid risk mitigation plan in place will help any program. By making the lead sponsor put the risk level in the management plan will force the teams to understand where the program stands and how difficult the transition can be. The programs that we coded as high risk normally did not address risk in any form within the management plan. A recommendation to specifically address the actual risk the program involves will possibly enhance the transition of ACTDs.

We also made another observation during this study, which we mention here for completeness. It seems that the military in general lives off a Standard Operating Procedure (SOP) in everything we do. Looking through multiple ACTD management plans the lack of standardization was very obvious. If a standardized template along with what information is required was put into place it would eliminate submission of a sub-standard plan. Our observations in general were the management plans that incorporated every suggestion that is listed on the ACTD website transitioned. Even though many that did not follow these suggestions also transitioned but over all the plans that transitioned addressed a majority of the ACTD suggestions. On average the programs that transitioned had a page count of 29.3 pages where the non-transition programs had 14.3 pages.

B. CONCLUSIONS

The problem with any acquisition program is the time acquired for implementation. By changing an ACTD program today the results will not surface for a minimum of two years. Even though we would like to be proactive in improving the

process, it is very hard when the time line for the results is in the distant future. The best action to take is make the change and wait. The dilemma is by only changing one thing at a time will take forever to get the process efficient enough to rely on. On the other hand if you change to many things at once you might not be able to determine the true reason for the change. One change may be less relevant than another. If you continue to improve on the lesser of the changes this may actually give a negative result in the long run. Therefore improving the ACTD process may take time. It seems that the best course of action would be patience and change one recommendation at a time and see what the results bring. This method would narrow down the most important problems that are keeping ACTDs from transitioning into the normal acquisition process. By changing multiple issues at the same time will prevent the largest problem from surfacing. This could cause a much larger delay in correcting the more important issues.

In May of 2003 new acquisition instructions were approved for implementation following the Secretary of Defenses August 2002 cancellation. Associated with these processes are mechanisms that are designed to foster efficiency and innovation in conjunction with future Evolutionary Acquisition Strategies. Evolutionary acquisition strategies are the preferred approach to satisfying operational needs. The two mechanisms that have been identified include incremental development and spiral development. Under incremental development the end-state requirement is known and will be met over time through several system increments, or configurations. Under Spiral development the desired capabilities are identified but the end-state capabilities/requirements are not specifically known at program initiation. Spiral development is an iterative process that links users to developers through an approach of continuous development and deployment of both software and hardware. The end-state capabilities/requirements for the future increments are dependent upon technology maturation and user feedback from the initial increments. Of these two mechanisms, spiral development shall be the preferred process (Department of Defense, 2003).

We have examined 11 variables to determine their effect on the outcome of an ACTD program. Of the 11 variables investigated, three proved to have a measurable relationship to the ultimate determination of an ACTD's success. Budget Matched to

Schedule, Technology Maturity, and Risk Assessment were the three variables that demonstrated a correlation to an ACTD's transition. It is our conclusion that when supplied with management plans for ACTD programs, decision authorities should further scrutinize these areas as they have an impact on the life of the program.

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