



Interactions Among the Warfighter, Science & Technology, and Acquisition Communities

Development Planning Working Group, U.S. Department of Defense

1. INTRODUCTION

Early and continuous interaction among the Department of Defense (DoD) warfighter, science & technology (S&T), and acquisition communities is essential to delivering effective, affordable, and sustainable solutions to meet warfighter needs. Current acquisition guidance describes the roles and responsibilities of principal organizations and personnel but lacks a holistic description of how these organizations interact with one another throughout the acquisition life cycle. This paper describes the framework and important interactions among these three communities.

This paper is not intended to prescribe activities or behaviors among or within the communities, nor is it intended to represent an all-inclusive set of activities. It describes the existing framework in order to document and facilitate better understanding of the current interactions. In general, this paper applies to acquisition program models 1–3 (Hardware-Intensive Program, Defense Unique Software-Intensive Program, and Incrementally Deployed Software-Intensive Program) and models 5–6 (Hybrid Program A (Hardware Dominant) and Hybrid Program B (Software Dominant)) described in Department of Defense Instruction (DoDI) 5000.02, “Operation of the Defense Acquisition System” (2015); it does not address model 4 (Accelerated Acquisition Program) or capabilities that follow Rapid Fielding of Capabilities (*see* DoDI 5000.02, Enclosure 13). For this paper, the term “warfighter” signifies a community that may include the user and the requirements manager.

The Development Planning Working Group (DPWG), led by the Office of the Deputy Assistant Secretary of Defense for Systems Engineering (ODASD(SE)), developed this information. The DPWG includes representatives from each of the Services, the Joint Staff, the Office of the Secretary of Defense (OSD) office of Cost Assessment and Program Evaluation (CAPE), and other offices within the Office of the Under Secretary of Defense for Acquisition, Technology, and Logistics (OUSD(AT&L)).

2. INTERACTIONS

Figure 1 shows the current framework of interactions among the three communities as described during DPWG discussions. The diagram includes interdependent activities associated with the acquisition life cycle and illustrates the complex network of activities based on current business practices. It displays a holistic view of the interactions among the communities and is intended to be used as a notional model rather than an exact mapping of events and interactions. It represents the activities that most greatly influence the S&T developments that will be transitioned into acquisition programs.

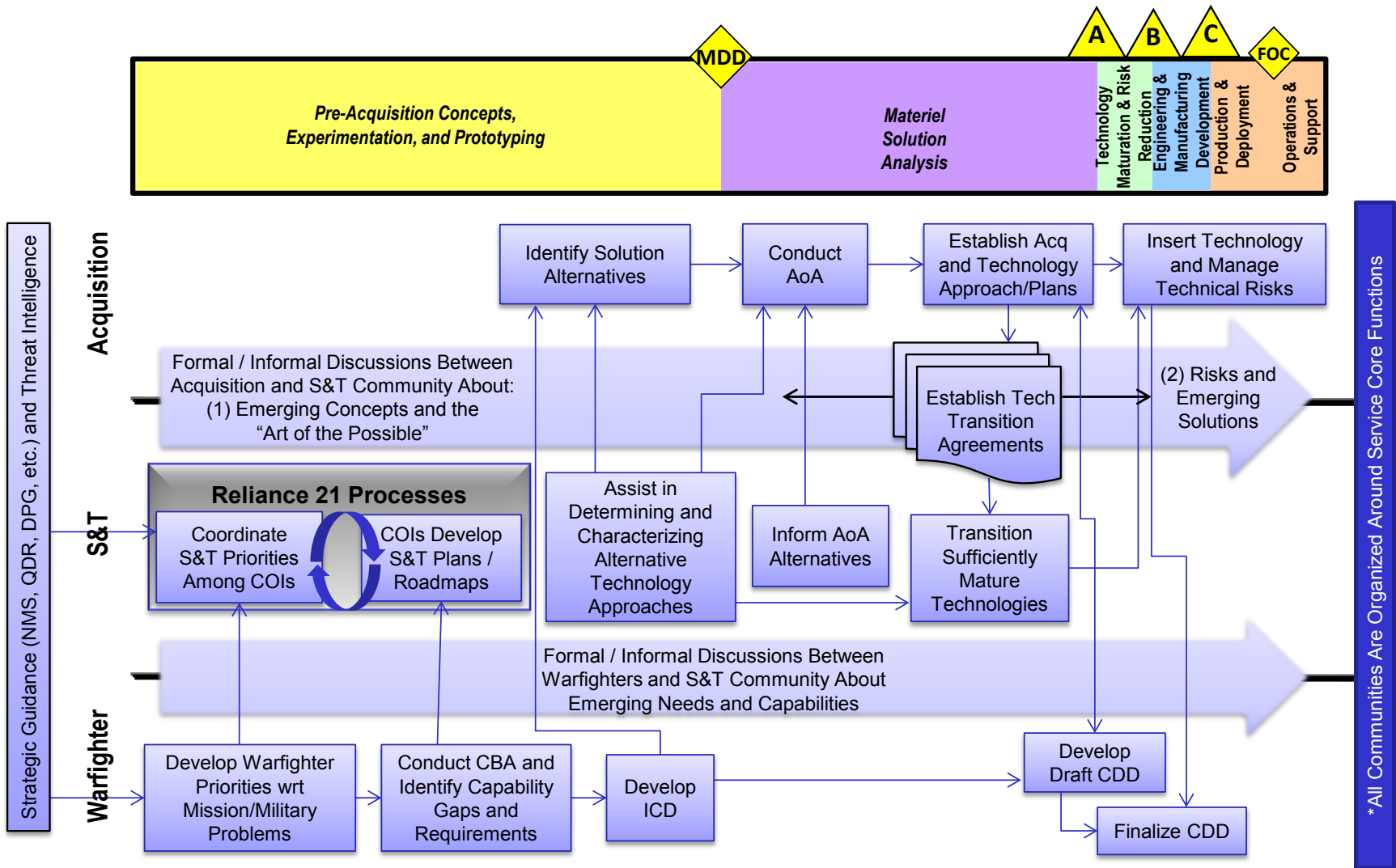


Figure 1: Warfighter, S&T, and Acquisition Communities Interaction Diagram

In the diagram, each block represents an activity that may occur in parallel with the acquisition life cycle. Defense acquisition programs should employ this model to help guide their interactions with the warfighter and S&T communities. Not every activity or interaction applies to every program; certain events may be isolated, repeated/continuous, or may not occur at all. Although the arrows imply a general chronology of events, programs may execute activities earlier or later in the acquisition life cycle. Acquisition organizations can use the interaction diagram as a tool for understanding the collaborative nature of successful technology development, implementation, and insertion into acquisition programs throughout the life cycle.

The warfighter community prioritizes capability needs according to strategic guidance and associated missions. As circumstances warrant, it performs Capabilities-Based Assessments (CBA) and other studies or analyses to characterize capability gaps in accordance with CJCSI 3170.01, “Joint Capabilities Integration and Development System.” If the community determines materiel approaches are required to mitigate or close capability gaps, it establishes capability requirements. The Initial Capabilities Document (ICD) formally documents the results of a CBA and describes associated operational capability gaps. The Analysis of Alternatives (AoA) is one activity that influences subsequent acquisition plans and drives the development of the draft Capability Development Document (CDD), one of the required Milestone A products. Discussions among the warfighter, S&T, and acquisition communities occur continuously throughout the acquisition life cycle, and any activity represented by the framework may be influenced by these discussions at any time.

The S&T community develops research and investment priorities, plans, and roadmaps through an iterative process informed by warfighter capability needs, strategic guidance, and threat intelligence. This dependent relationship ensures that the capabilities required by the warfighter are being addressed by S&T plans and roadmaps. A “technology pull” refers to S&T efforts or technologies developed in response to known warfighter requirements or capability needs. Alternatively, a “technology push” refers to S&T efforts and innovations driven by technologists who perceive how an emerging technology might enable a new operational capability in advance of a stated warfighter need. Through formal and informal discussions, the warfighter and S&T communities share information to set priorities with respect to emerging mission problems and technological capabilities. Discussions between the S&T and acquisition communities help identify a range of technically feasible candidate materiel solution approaches to fill the warfighter operational capability gaps. The S&T community identifies alternative and emerging technology approaches that inform the field of possible solutions considered in an AoA. Collaboration among all three communities ensures warfighter needs are met effectively by considering a wide range of feasible alternatives.

The acquisition community considers warfighter and S&T input to identify the set of alternatives analyzed in the AoA. The Materiel Solution Analysis (MSA) phase activities, including the AoA, additional technical analyses of candidate materiel solutions, and development of the draft CDD, establish the acquisition and technology approach for the preferred materiel solution. These MSA phase activities and discussions influence the establishment of Technology Transition Agreements to ensure that sufficiently mature technologies are appropriately transferred to a program. After Milestone Decision

Authority (MDA) approval at Milestone A, the program technology is further matured and integrated into the defense system as part of a delivered capability. The S&T and acquisition communities focus on managing technical risks related to the technologies and selected materiel solution throughout the acquisition life cycle.

3. DETAILS OF INTERACTION DIAGRAM BY COMMUNITY

The following descriptions further detail each element of the interaction diagram shown in Figure 1. **Figure 2** illustrates continuous influences and boundaries. The succeeding sections discuss activities of the warfighter, S&T, and acquisition communities, respectively. Although the descriptions are divided into these four groups, the list does not imply a specific order of occurrence. Unless specifically noted, the arrows between activities indicate influence, not necessarily that formal delivery of a product is required to initiate or conclude an activity.

3.1 Continuous Influences and Boundaries Among Communities

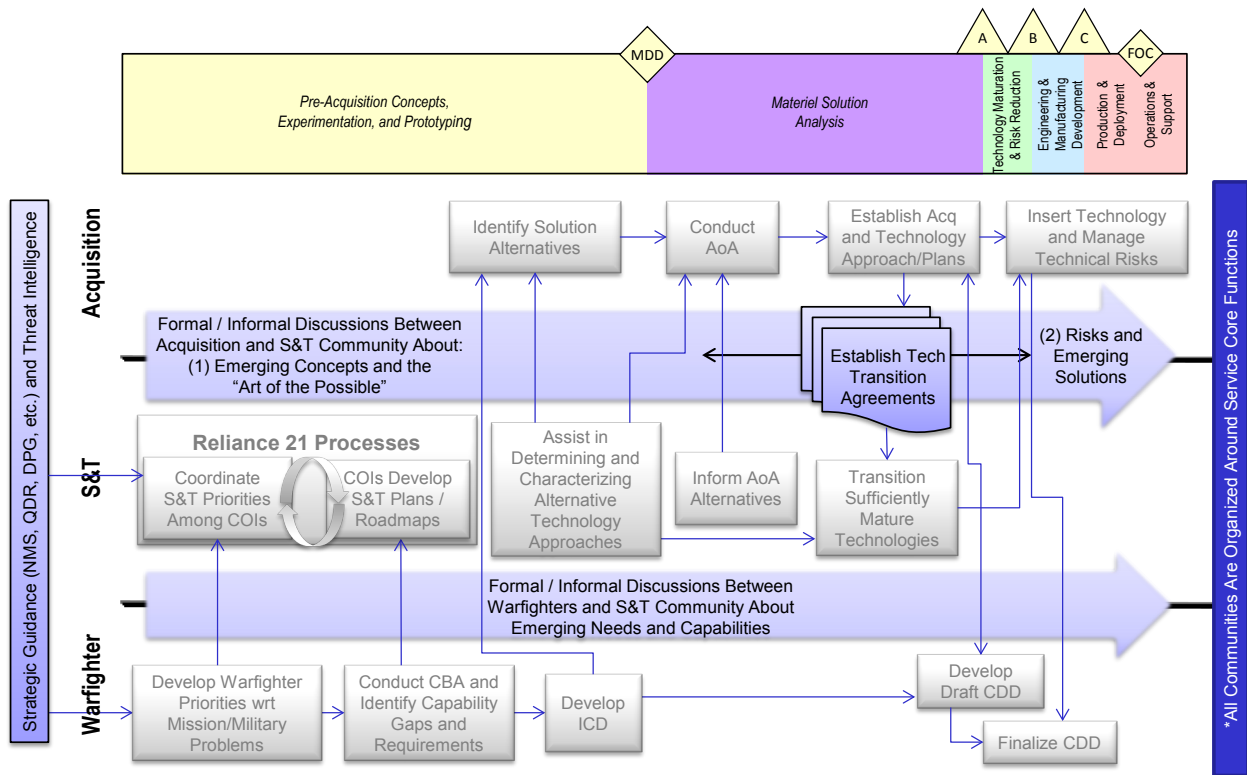


Figure 2: Continuous Influences and Boundaries Among Communities

3.1.1 Strategic Guidance and Threat Intelligence

The Department of Defense regularly publishes guidance including the National Military Strategy (NMS), the Quadrennial Defense Review (QDR), and Defense Planning Guidance (DPG) to define the strategic direction for the Armed Forces under current global and fiscal conditions. Volatile factors such as threat intelligence may not be included formally in published guidance but may significantly influence

warfighter, S&T, and acquisition priorities. Strategic guidance documents and threat intelligence provide initial information to aid in the identification of warfighter needs.

3.1.2 Formal and Informal Discussions Between Warfighter and S&T Communities: Emerging Needs and Capabilities

The discussions between the warfighter and S&T communities serve to inform the warfighters about emerging technology while simultaneously focusing the S&T community on emerging gaps in operational capabilities. Interactions may take the form of S&T workshops and capability reviews. Advanced defense science efforts are typical outcomes of such workshops. Joint Capability Technology Demonstrations (JCTD) also may result from these discussions and interactions. Some technologies may mature later during the life cycle of a system, and a balance must be struck between perturbing a program's schedule versus the operational value of later technology insertion and integration.

3.1.3 Formal and Informal Discussions Between S&T and Acquisition Communities: Emerging Concepts, Risks, and Solutions

Service Components have various mechanisms for interaction between the S&T and acquisition communities, as indicated by the arrows extending across the diagram. The S&T community initiates a technology push to influence alternative technology approaches considered by the acquisition community. Similarly, the acquisition community frequently initiates a technology pull to use the expertise and participation of the S&T community in identifying and analyzing solution alternatives. As a system develops throughout the life cycle, these discussions evolve to focus on managing risks and emerging solutions.

3.1.4 Technology Transition Agreements

Technology Transition Agreements are considered a non-binding tool and best practice to facilitate transition; not all transitioned technology goes through established Technology Transition Agreements. Although often associated with the MSA phase, these agreements may occur at various points along the life cycle. Technology Transition Agreements are frequently employed for programs in sustainment as technology insertion and refresh are used to increase and maintain needed capabilities.

3.2 Warfighter Community Activities

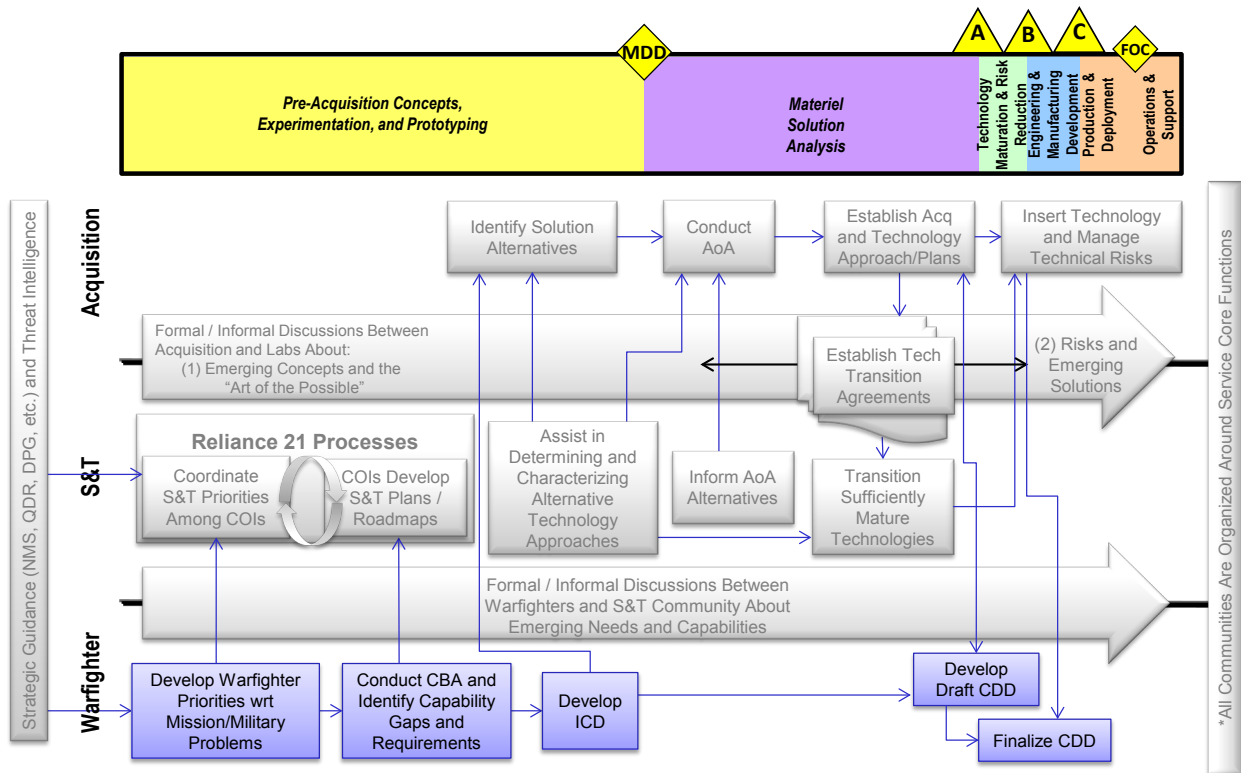


Figure 3: Warfighter Community Activities

3.2.1 Develop Warfighter Priorities

The warfighter community develops its priorities using strategic guidance documents and threat intelligence describing the Nation’s defense interests, objectives, and priorities. For example, the Combatant Commands submit annual Integrated Priority Lists (IPL) to the Joint Staff for review under the Capability Gap Assessment (CGA) process. The IPLs may include capability gaps prioritized across Service and functional lines, risk areas, and long-term strategic planning issues. The Joint Staff also reviews issues and perspectives from the Services and other DoD Components relative to existing materiel and non-materiel efforts that may already be under way to address the capability gaps. If a materiel solution capability is needed but technology is lacking, the recommended solution from the CGA may be an S&T investment.

3.2.2 Conduct Capabilities-Based Assessment and Identify Capability Gaps and Requirements

The warfighter conducts a CBA or equivalent analysis to provide recommendations to pursue a materiel or non-materiel solution to close an identified capability gap and assess the potential operational risk associated with each capability gap. A CBA often leads to the identification of new or modified capability requirements. Following completion of the CBA, the warfighter may offer recommendations for the most appropriate approach(es) to close or mitigate capability gaps and reduce operational risk by generating and submitting one or more capability requirement documents (i.e., an ICD) and submitting

the documents for review and validation by the appropriate validation authority. The identified capability gaps and requirements influence the S&T plans and roadmaps.

3.2.3 Develop Initial Capabilities Document

The results of the CBA form the source material for the ICD or for other JCIDS documents when an ICD is not required. The ICD documents the need for a materiel approach, or an approach that is a combination of materiel and non-materiel, to a specific capability gap. The capability gaps described in the ICD influence the materiel solution alternatives to be considered during the AoA.

3.2.4 Develop Draft and Final Capability Development Document

The warfighter community develops and finalizes the CDD using the ICD (or approved substitute) as a guide. Operational requirements in the CDD are informed by a system-specific body of knowledge that grows over time and facilitates an understanding of capabilities and performance levels achievable in relation to cost, schedule, and risk. The draft CDD is required before Milestone A, and the final CDD is required before the Development RFP Release Decision point during the Technology Maturation and Risk Reduction (TMRR) phase leading to the Preliminary Design Review and Milestone B. The technology should be sufficiently mature to support the capabilities and systems described in the CDD.

3.3 Science & Technology Community Activities

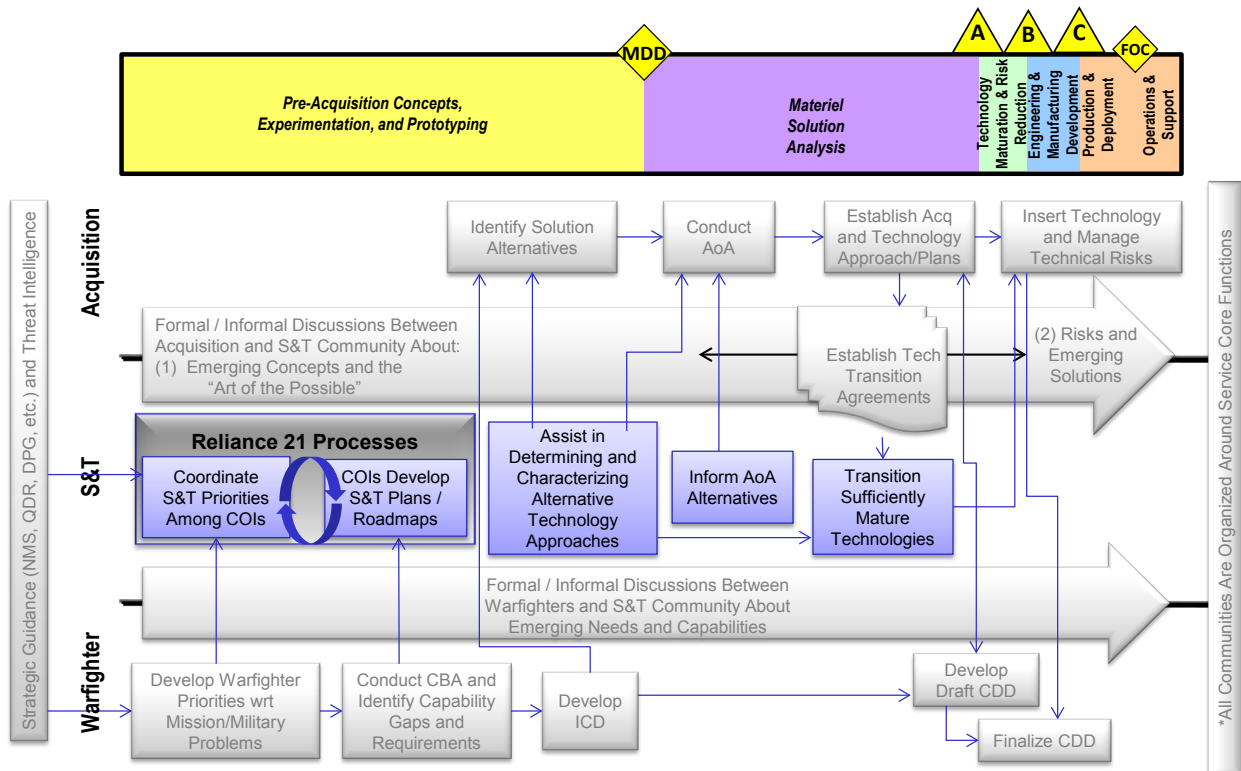


Figure 4: Science & Technology Community Activities

3.3.1 Coordinate S&T Priorities and Develop S&T Plans and Roadmaps

The overarching framework of the DoD's S&T joint planning and coordination process is known as Reliance 21. The framework is effective in continuously improving support to the warfighter, by propagating and coordinating an understanding of military capability gaps and defense needs throughout the S&T community. Technical groups, known as Communities of Interest (COI), span the cross-cutting S&T focus areas. COIs provide a forum for coordinating S&T strategies across the Department; sharing new ideas, technical directions, and technology opportunities; planning joint programs; measuring technical progress; and reporting on the general state of health for specific technology areas. The principal products of COIs are strategic plans and roadmaps with a 10-year horizon that capture technical goals and mission impact. COIs work closely with program executives and warfighters throughout the Department, including supporting the Joint Staff in identifying potential solutions to warfighter needs. S&T priorities, plans, and roadmaps are coordinated continuously, as influenced by overarching strategic guidance and warfighter input.

3.3.2 Assist in Determining and Characterizing Alternative Technology Approaches

This activity represents the unstructured knowledge transfer between the S&T and acquisition communities that informs pre-Materiel Development Decision (MDD) and MSA phase activities and decisions. It includes identifying and facilitating the technology push from the S&T community to the acquisition community. The acquisition community uses the S&T community's expertise to identify solution alternatives, support AoA planning, and conduct the resulting AoA.

3.3.3 Inform Analysis of Alternatives

In preparing for and conducting the AoA, the acquisition community may consider a technology push from the S&T community or initiate a technology pull to balance the S&T focus of identified alternatives. A technology push from the S&T community is used to formulate potential materiel solutions to be assessed during the AoA. Early and frequent collaboration informs the acquisition community on the technological maturity and technical risk associated with critical technologies considered during the AoA. The applicable S&T communities and Component acquisition leadership should influence technology investment planning based on inputs from PMs.

3.3.4 Transition Sufficiently Mature Technologies

The S&T community should bridge the gap between immature technology and the maturity needed for successful transition into acquisition in order to reduce technology-related problems in the products. Technologies that have reached sufficient maturity will transition to the acquisition program as documented in associated Technology Transition Agreements, if applicable. This activity can occur at any point along the life cycle, not only during early acquisition phases. System maturity level and risk are vital considerations when deciding where in the life cycle to insert a technology.

3.4 Acquisition Community Activities

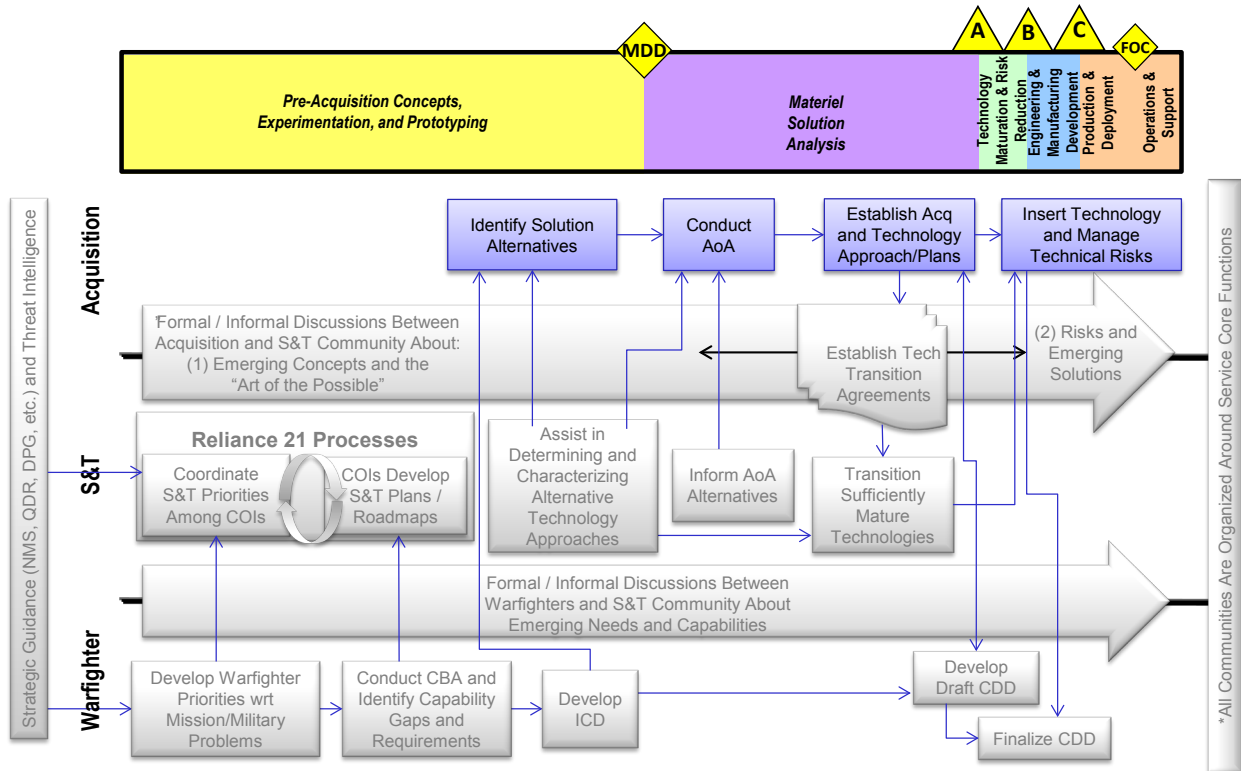


Figure 5: Acquisition Community Activities

3.4.1 Identify Solution Alternatives

The acquisition community identifies potential materiel solutions during pre-MDD efforts and captures the potential solutions in the AoA Study Guidance and AoA Study Plan. The AoA Study Guidance informs the AoA Study Plan, which, along with the ICD, is required at the MDD. The MDD is the entry point into the Defense Acquisition System and is the point at which the MDA directs execution of the AoA. In developing feasible alternatives, the AoA evaluates a range of solutions that have a reasonable likelihood of providing the needed capability. The S&T community aids in characterizing alternative technology approaches that inform the solution alternatives considered before the MDD as well as during the AoA.

3.4.2 Conduct Analysis of Alternatives

The Director of Cost Assessment and Program Evaluation (CAPE) develops and approves the AoA Study Guidance for potential and designated Acquisition Category (ACAT) I and IA programs and for each joint military or business requirement for which the Chairman of the Joint Requirements Oversight Council (JROC) or the Investment Review Board is the validation authority. Under CAPE’s guidance, the lead Service conducts the AoA to inform decision makers regarding an affordable solution to meet the validated capability requirement(s). The AoA informs and is informed by affordability analysis,

cost analysis, sustainment considerations, early systems engineering analyses, threat projections, and market research.

3.4.3 Establish Acquisition and Technology Approach and Plans

The acquisition community's role becomes more formalized during the MSA phase when the preferred materiel solution is selected and the Program Manager (PM) is assigned. The PM conducts capability requirements trades as well as plans for the next phase by developing the acquisition strategy, test plans, and technical plans. The PM develops the path for the materiel development to follow to deliver the capability to the warfighter.

3.4.4 Insert Technology and Manage Technical Risks

Technology should be sufficiently mature before it can transition to an acquisition program. The PM organization assumes responsibility for managing subsequent risks as the technology is integrated into the system solution and brought to full operational capability for the warfighter. Technical risk management informs various activities such as conducting effective trades to support the detailed design during the Engineering and Manufacturing Development (EMD) phase. Management of the technical integration risk also informs the requirements feasibility to be documented in the final CDD.

4. SUMMARY

As defined in this paper, the interaction and collaboration of the warfighter, S&T, and acquisition communities are necessary to ensure DoD capability meets defense priorities. It is essential that the proper level of interaction take place during each phase of the acquisition cycle to deliver effective, affordable, and sustainable solutions to meet the warfighter needs.

REFERENCES

Department of Defense Instruction (DoDI) 5000.02, "Operation of the Defense Acquisition System." Under Secretary of Defense for Acquisition, Technology, and Logistics, January 7, 2015.
<http://www.dtic.mil/whs/directives/corres/pdf/500002p.pdf>

CJCSI 3170.01, "Joint Capabilities Integration and Development System." Chairman of the Joint Chiefs of Staff, January 23, 2015.

ACRONYMS

ACAT	Acquisition Category
AoA	Analysis of Alternatives
CAPE	Cost Assessment and Program Evaluation
CBA	Capabilities-Based Assessment
CGA	Capability Gap Assessment
COI	Community of Interest
DoD	Department of Defense
DoDI	Department of Defense Instruction
DPG	Defense Planning Guidance
DPWG	Development Planning Working Group
EMD	Engineering and Manufacturing Development
FOC	Full Operational Capability
ICD	Initial Capabilities Document
IPL	Integrated Priority List
JCIDS	Joint Capabilities Integration and Development System
JCTD	Joint Capability Technology Demonstration
JROC	Joint Requirements Oversight Council
MDD	Materiel Development Decision
MSA	Materiel Solution Analysis
NMS	National Military Strategy
ODASD(SE)	Office of the Deputy Assistant Secretary of Defense for Systems Engineering
OSD	Office of the Secretary of Defense
OUSD(AT&L)	Office of the Under Secretary of Defense for Acquisition, Technology, and Logistics
PM	Program Manager
QDR	Quadrennial Defense Review
RFP	Request for Proposals
S&T	Science and Technology
TMRR	Technology Maturation and Risk Reduction

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