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"Science and Technology for the Future Force"

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DISCLAIMER

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CONFLICT OF INTEREST

Conflicts of interest did not become apparent as a result of the Panel's recommendations.

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13. ABSTRACT (Maximum 200 words)

The Army Science Board was tasked to: 1) Evaluate the present and planned S&T investment portfolio against the requirements of the future force and the GWOT; and 2) Evaluate how well Army S&T investments leverage the investments of other organizations both inside and outside of government.

The ASB approach to the study looked at five specific areas of Army response to S&T challenges: Strategic Outreach, Cross-Cutting Initiatives, Gap Analysis Process, Technology Transition, and Strategic Management. Major Study recommendations in these areas include:

Strategic Outreach: 1) Establish an office of Strategic Outreach for S&T focused on: a) 6.1 through 6.3 activities outside the Army; b) Exploiting global technologies; and c) Gaining Intellectual Property access where appropriate. 2) Establish an "Outreach Fund" to bring technologies into the Army from all sources.

Cross-Cutting Initiatives: 1) Establish an Office of Cross-Cutting Initiatives S&T Focused On: a) 6.2 and 6.3 activities inside and outside the Army; b) Developing cross-cutting technology solutions from any combination of Army stovepipes, traditional and non-traditional industry, universities, and foreign sources; and c) Rapidly transition candidate technologies to the next step. 2) Grow the Agile Implementation Demonstration and Experimentation (AIDE) program and raise its level in the organization

Gap Analysis Process: Capability Gap Analysis: a) Increase specificity of sub-capability gaps; b) Apply analytical processes to the product of the gap analysis to sort gaps into actionable, prioritized list; and c) Give more weight to other DOT_LPF solutions. Technology Shortfalls: a) Perform risk assessment on funded projects, including the output of red teaming, that are assumed to meet shortfalls; b) Consider external S&T that might provide solutions by filling shortfalls

Technology Transition: 1) Direct Early Collaboration Between S&T, TRADOC and PM/PEO Personnel. 2) Explore use of S&T Management Analytical Tools to Optimize Portfolio.
Evolve Role of Chief Scientist to Chief Technology Officer
Strategic Management: Evolve Role of Chief Scientist to Chief Technology Officer: a) Present duties continue; b) Increase influence over the RDECs and Labs; c) Increase funding to permit execution of strategic programs; d) Align the technology and business strategies of the Army.

14. SUBJECT TERMS

Science, Technology, Science and Technology, S&T, S&T Investment, Strategic Outreach, Cross-Cutting Technology, Gap Analysis Process, S&T Management, Technology Transition, Strategic Management, Technology Portfolio

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Science and Technology for the Future Force

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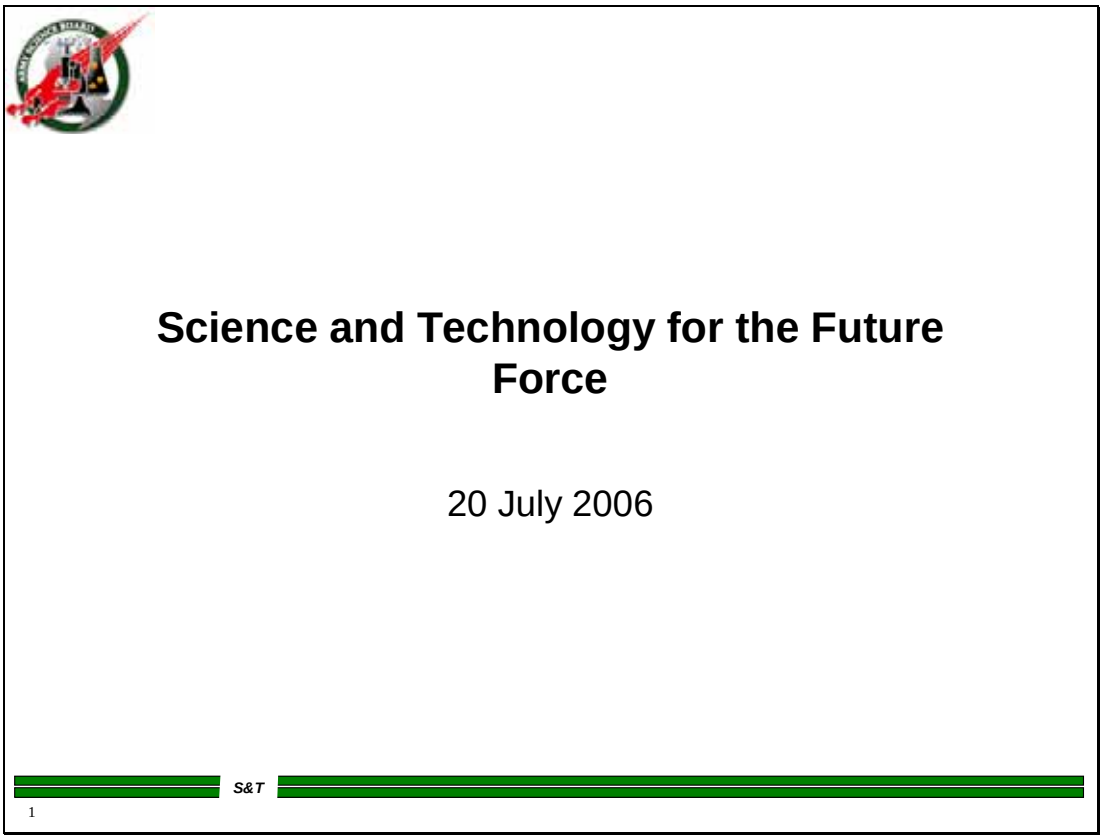
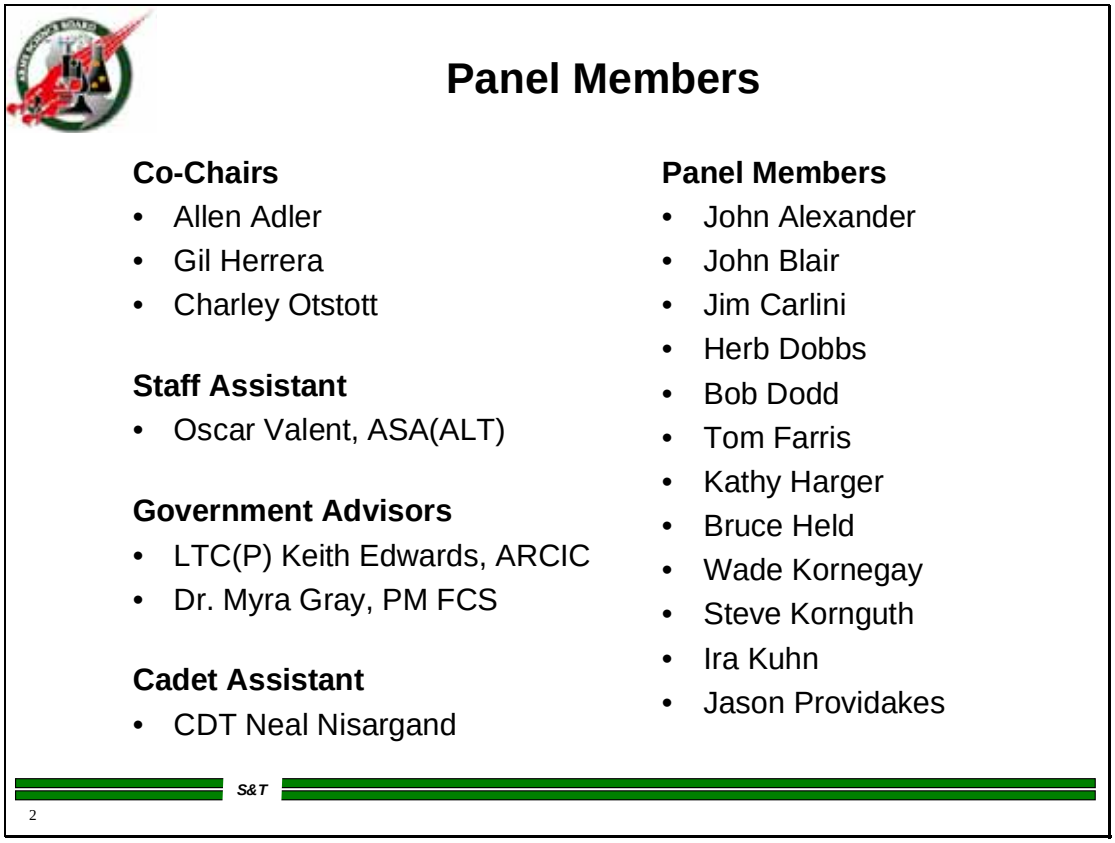


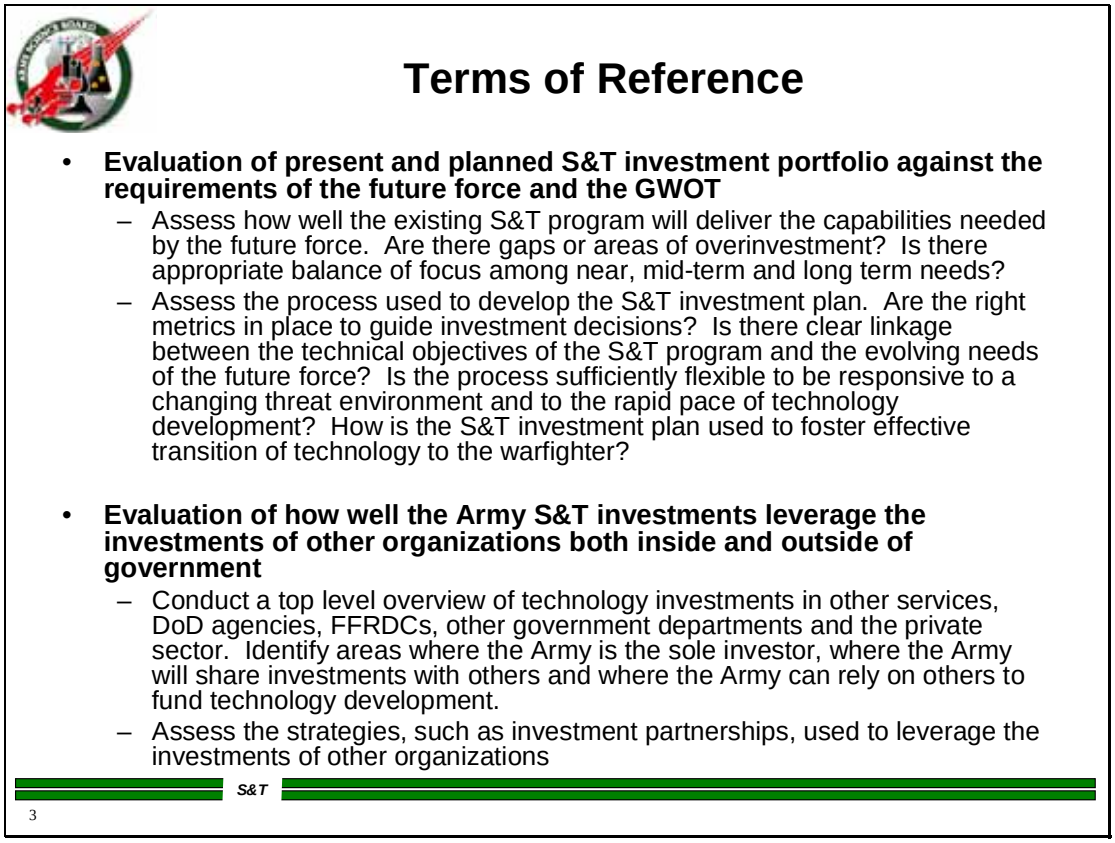
The panel on science and technology for the future force took on the task of assessing the processes involved developing the S&T strategy for the Army. Selected taskings from the TOR are listed below and are addressed in this effort.

- Evaluation of present and planned S&T investment portfolio considering both needs of the future force in conventional warfare and the global war on terror.

- Evaluation of how well the Army S&T investments leverage research and development conducted by other organizations both inside and outside the U.S. Government.



Contributors to this panel report are listed above. The panel members, consisting of ASB members and consultants, provided a multidisciplinary team for the panel's deliberations. The diversity of the team assured that consensus was achieved with a wide spectrum of perspectives. The government advisors, LTC(P) Keith Edwards from TRADOC and Dr. Myra Gray of PM Future Combat System provided key information on the requirements process, research programs and the integration of technology into future force systems. They were invaluable in assuring the completeness of the study. The staff assistant, Oscar Valent, supported the study in many ways and provided important insights into the efforts of the current OASA(ALT) office. CDT Neal Nisargand, of Cornell University, our cadet assistant, greatly assisted the panel members during the two-week effort at the Beckman Center.



Terms of Reference

This slide outlines the TOR as they were developed with, and approved by our study sponsor, Dr. Killion, DAS(R&T).

Selected taskings from the TOR are listed below and are addressed in this effort.

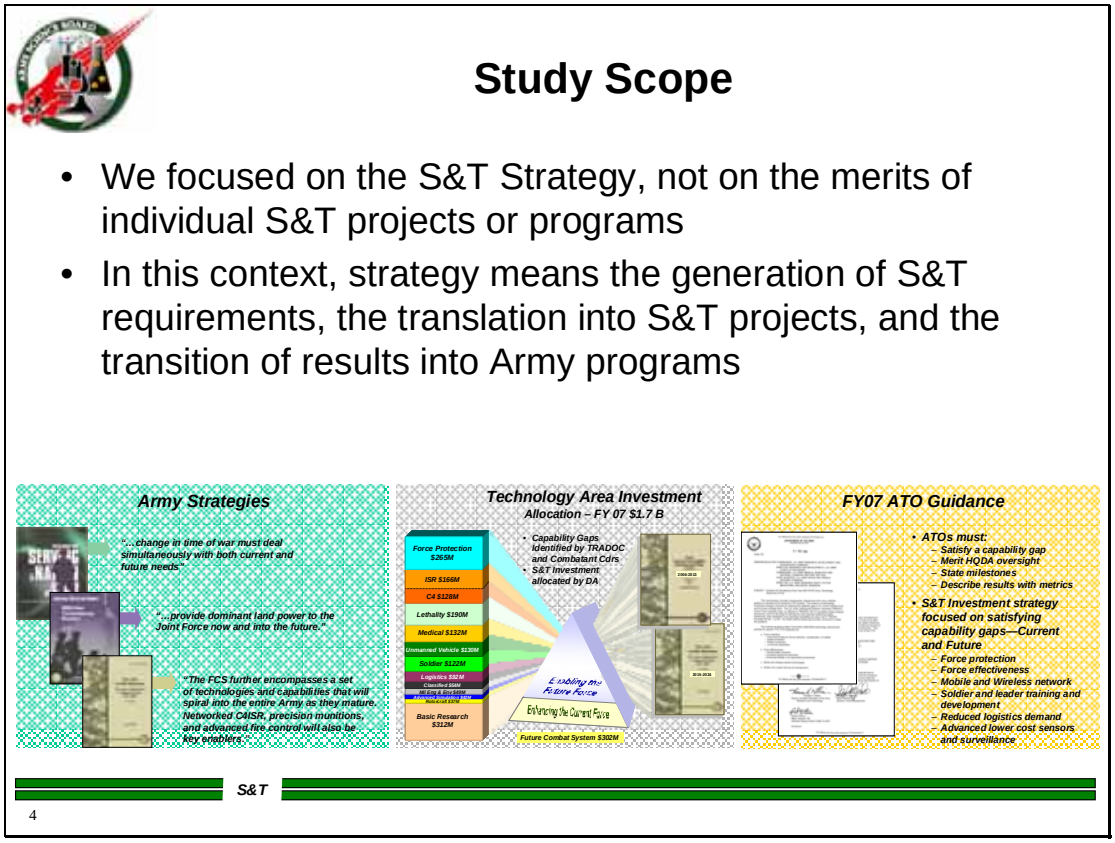
Evaluation of present and planned S&T investment portfolio considering both needs of the future force in conventional warfare and the global war on terror.

- Assess existing S&T programs to determine how effective they will be in delivering the capabilities needed by the future force
- Determine if there are either gaps in S&T development or areas of overinvestment in delivering the required capabilities
- Assess the appropriateness of the balance of S&T programs in addressing the near, mid, and long-term of the current and future force
- Assess the entire process used to develop the S&T investment plan to determine if:
    - The necessary metrics are employed to support investment decisions by Army leaders
    - There is clear linkage between the technical objectives of the S&T investment program and the evolving requirements of the future force.

- The current S&T process is sufficiently flexible to be responsive to both the constantly changing threat environment and the fast pace of technology development.
- The current S&T investment strategy is appropriate to transition new technology to the warfighter

Evaluation of how well the Army S&T investments leverage research and development conducted by other organizations both inside and outside the U.S. Government.

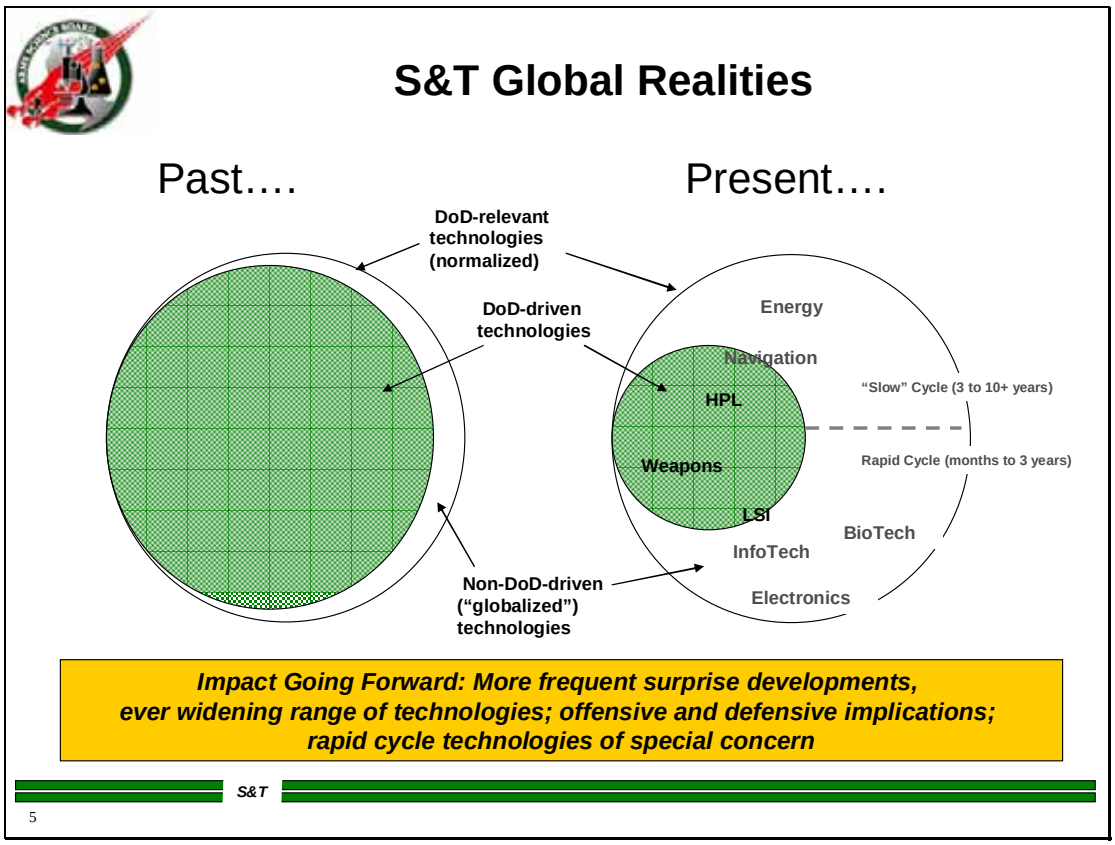
- To conduct a top level overview of other agencies including:
  - Other services
  - Other DoD organizations (such as DARPA, DTRA, etc.)
  - FFRDCs, National labs, NSF, NIH, and other USG organizations
- Determine appropriate investment strategies including
  - Where the Army is the sole investor,
  - Where the Army will share investment with others, and to what extent that is appropriate
  - And where the Army can rely on external source to fund technology development and still gain access to it for our purposes
- Assess the strategies used to leverage the investments of other organizations including partnerships, CRADAs, licensing, etc



Scope of the study

This study focused on assessing the Army's S&T strategy. We did not evaluate the merits of any current projects or programs nor comment on them. The strategy refers to the entire process including requirements generation, translation into S&T projects and then the transition from research into Army programs that are designed to develop future combat systems. The strategy must also accommodate introduction of technology advances into current and near-term systems.

The process begins with evaluation of the overall Army Strategies, such as providing dominant land power to the Joint Force, developing the Technology Area Investment plan to meet designated capability gaps, and tying that to the Army Technology Objectives (ATO) in the form of official guidance. To meet those criteria, ATOs must address gaps, have milestones and metrics, and merit HQDA oversight.



In the past, the DoD was the major driving force behind most of the technologies relevant to DoD functions. Therefore, it had access to virtually all of the technologies required to keep the force structure on the cutting edge of warfighting capability.

Today, a large portion of Army-relevant technologies are driven by sources outside of the Army (commercial, foreign, other US Government). This "globalization" of technology strains our ability to be aware of technology advancements and leverage (or harvest) them efficiently and affordably. Exacerbating this problem is the fact that many strategically important technologies evolve very rapidly. For instance, the cutting edge in the BioTech and InfoTech fields can drastically change on timescales as short as 18 months.

The globalization of technology is expected to continue for the foreseeable future. Therefore, as we look toward the Army Future Force, we expect that we will be in an environment with more frequent technological surprises in a growing number of technology fields. Without taking appropriate steps, it will be increasingly difficult for the Army to know of, access, and leverage important technology.

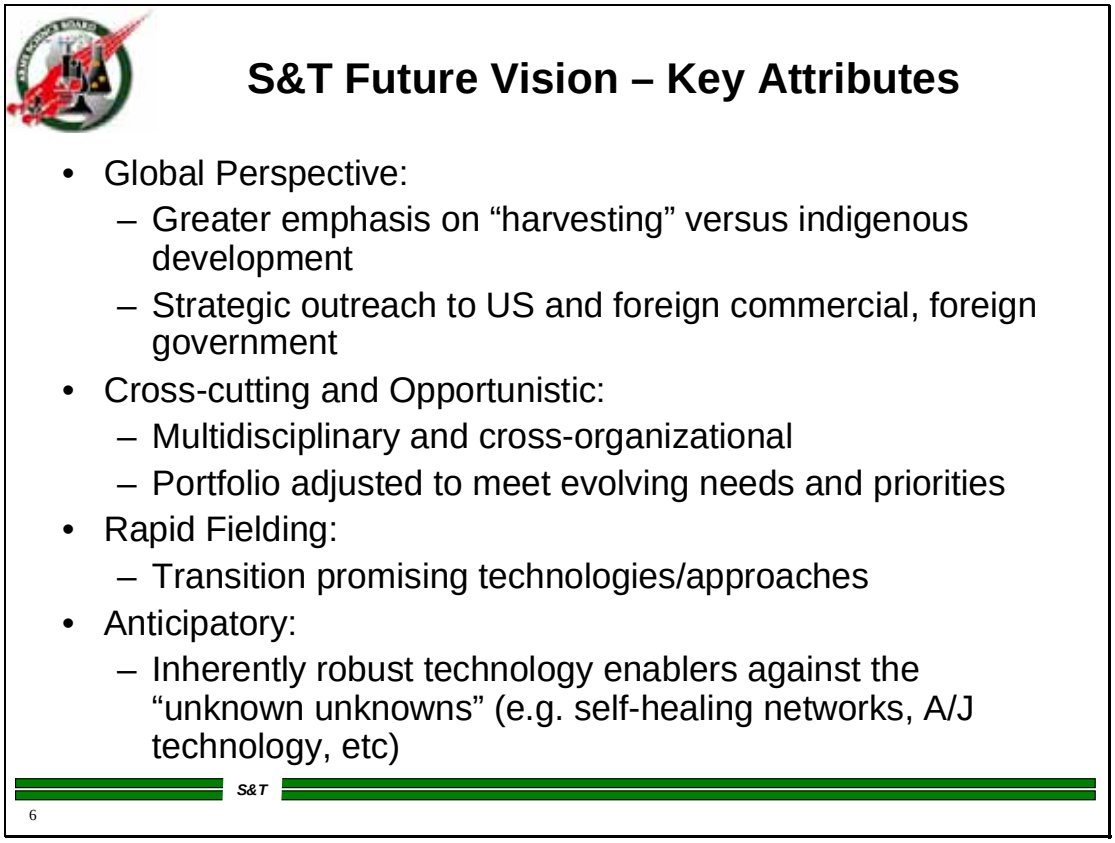
The S&T strategy for the Future Force must squarely address these global S&T realities to ensure the Future Force is equipped to address future national security challenges.

S&T Global Realities

This slide notionally depicts the significant changes that have occurred in the way the military is involved in research and development. In the past, a very large amount of the military of the S&T supporting military systems was done for DOD, or DOD was the driving force behind these developments. This occurred because the military was a specialized buyer and most of the products met their unique applications. On occasion military developed technology was spun off to civilian applications and the military has always benefited from some civilian developed S&T.

Now, however, many of the technologies included in military systems are derived from research conducted for civilian purposes and later adapted for military applications. There continue to be some military unique technologies, such as high energy lasers, explosive driven pulse power, or improved warheads. However, most military systems now incorporate technologies, such as, electronics, microprocessors, and information technology, for which the advances are being driven by civilian applications.

Going forward there will be more frequent developments that take us by surprise as the range of technologies continuously widens. As has been shown in development of information technology, chemistry, and bio-technologies, these advances may have both offensive and defense military applications. Of special concern are technologies, most notably information technologies, that advance on a very rapid cycle.

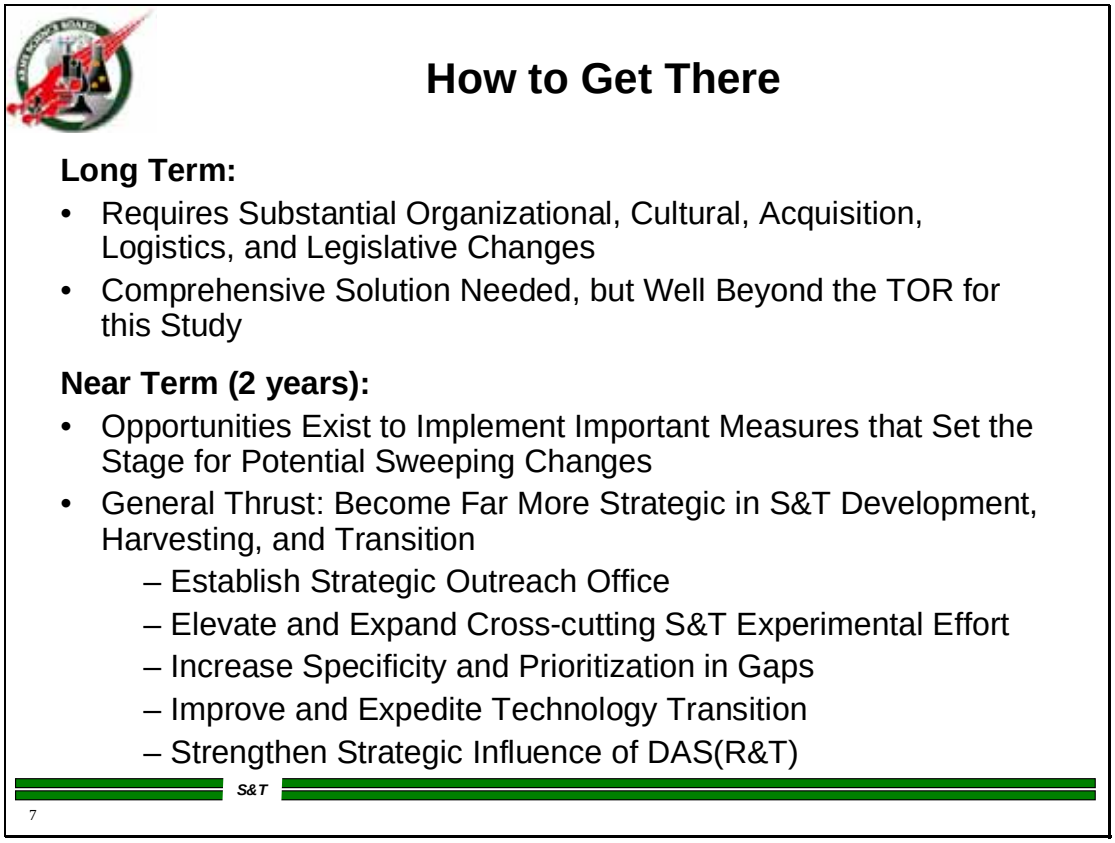


To thrive in the future global S&T environment, the Army S&T enterprise must have several key attributes: a global perspective, cross-cutting capability, routinely rapid transition, and an anticipatory outlook.

The future S&T force must continuously and systematically look toward the entire global S&T community to fulfill Army S&T needs. To do so, it must be aware of developments across the US government, commercial industry, and foreign entities and it must have mechanisms needed to successfully leverage this capability.

Science and technology is continuing to make breakthroughs in multidisciplinary research. Additionally, solutions for critical Army challenges are increasingly leveraging systems-of-systems approaches. Therefore, cross-cutting capability across scientific and systems stovepipes will be a critical attribute of the future S&T force.

With the expectation that our forces will continue to face agile enemies with an increasing array of technological options, it is imperative that the Army have the ability to identify and transition promising science and technology very quickly. This is particularly true in fields where technology "turnover" is very rapid. Furthermore, an anticipatory outlook must be maintained, whereby possible future threats are routinely and systematically considered in S&T strategic planning and inherently robust technologies are consequently emphasized.



Realizing the attributes of the future S&T vision will require substantial changes in the Army S&T enterprise and across the Army as a whole. These changes range from internal organizational adjustments to legislative and budgeting changes that enable far more outward looking S&T and new funding mechanisms for robust cross-cutting initiatives. Additionally, responding to the very rapid cycle time of many critical technologies (e.g. IT, BioTech) will require changes in business and logistics approaches and infrastructure.

Addressing the sweeping changes required to reach our far-term vision is beyond the scope of this study. However, we believe that opportunities exist in the next 2 years to take important steps that set the stage for more sweeping transformation.

These steps will be described throughout the remainder of the briefing and include; the establishment of a strategic outreach office, the elevation and expansion of an existing cross-cutting S&T effort, a tailoring of the gap and technology shortfall process, specific measures to expedite technology transition, and the strengthening of the strategic influence of the DAS(R&T).

We believe that these initial steps form the basis of moving Army S&T toward a far more strategic approach to S&T development, harvesting, and transition. The development of a detailed path toward the ultimate vision for Army S&T is left to future study efforts.

Study Organization

Strategic Outreach

Cross-Cutting Initiatives

Gap Analysis Process

Technology Transition

Strategic Management

S&T

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Study Organization

Strategic Outreach

Cross-Cutting Initiatives

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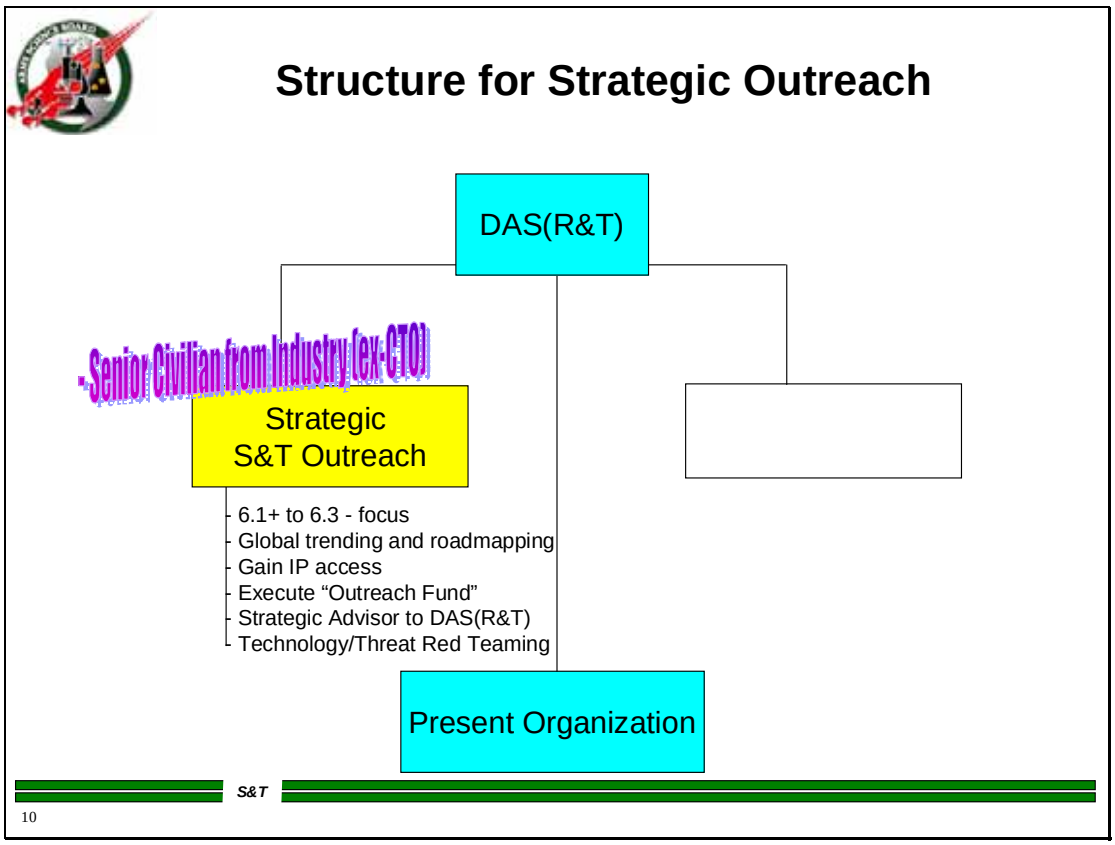


As was discussed above (Chart 5), a large and rapidly growing portion of S&T innovation that is potentially valuable to the Army is done outside of the Army's direct sphere of influence. We believe that an important objective of the Army's S&T strategy should be to leverage this global innovation. To formulate this strategy the DAS(R&T) should work closely with a small Strategic Outreach group who understand global technology trends and the worldwide S&T investment environment.

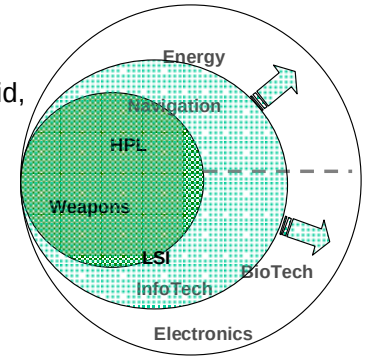
Within commercial companies, there are people who have considerable experience with strategic outreach, and recommend that the DAS(R&T) seek out people with such experience to staff the Strategic Outreach function.

Another role of the strategic outreach function is to help the Army harvest global innovation through the formation of a variety of business relationships. We anticipate that the strategic outreach group will have access to limited outreach funds to help initiate these business relationships.

Strategic Outreach

Direct Metrics:

- Estimate of global accessible IP
- Number of commercial companies accessible (have bid, joined consortia with favorable IP terms, etc)
- Number of foreign companies accessible
- Number of leveraged S&T projects from other parts of USG
- Knowledge management system coverage and use



Indirect Metrics:

- Lag for adaptation of commercial IP (in short cycle industries – IT, Biotech)
- Average period of obsolescence of deployed systems
- Number of internal Army S&T efforts centered on adaptation (vs development) in commercially dominated technology areas

Strategic Outreach Recommendations

- Establish an office of Strategic Outreach for S&T focused on: [Action: DAS(R&T)]
  - 6.1 through 6.3 activities outside the Army
  - Exploiting global technologies
  - Gaining IP access where appropriate
- Establish an "Outreach Fund" to bring technologies into the Army from all sources [Action: DAS(R&T)]

Study Organization

Strategic Outreach

Cross-Cutting Initiatives

Gap Analysis Process

Technology Transition

Strategic Management

S&T

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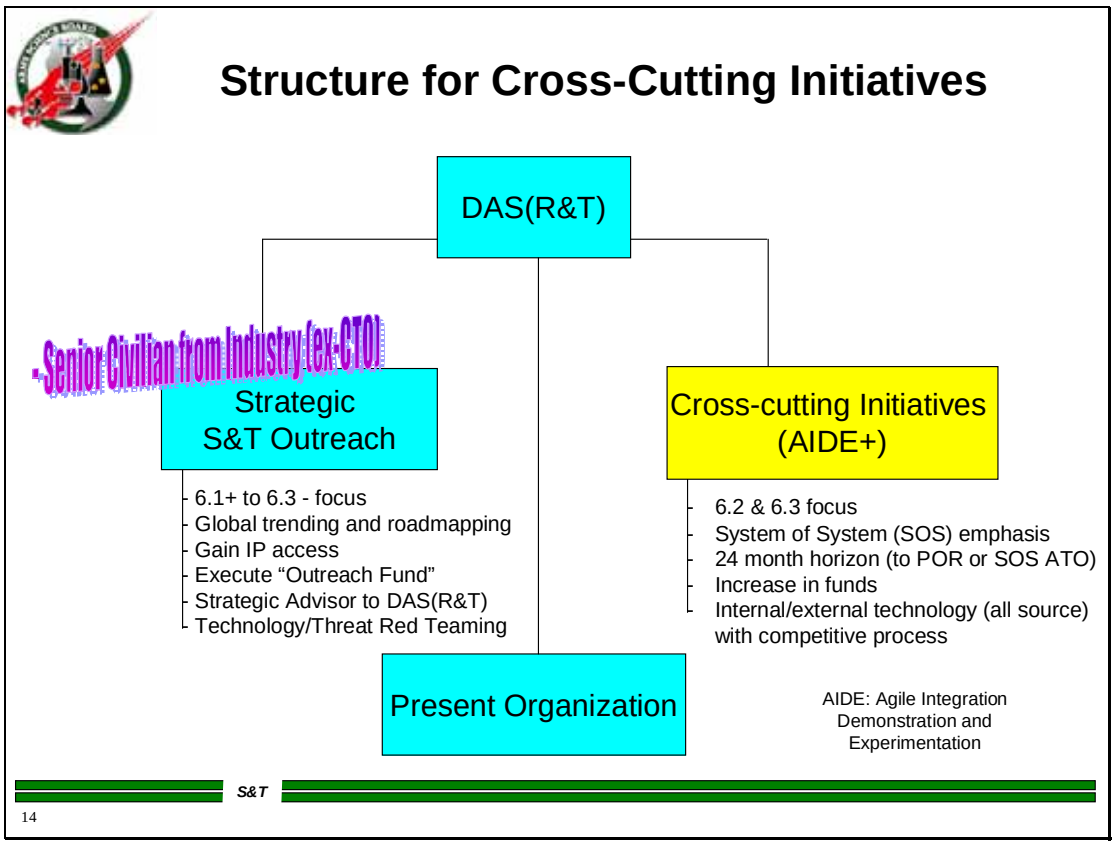
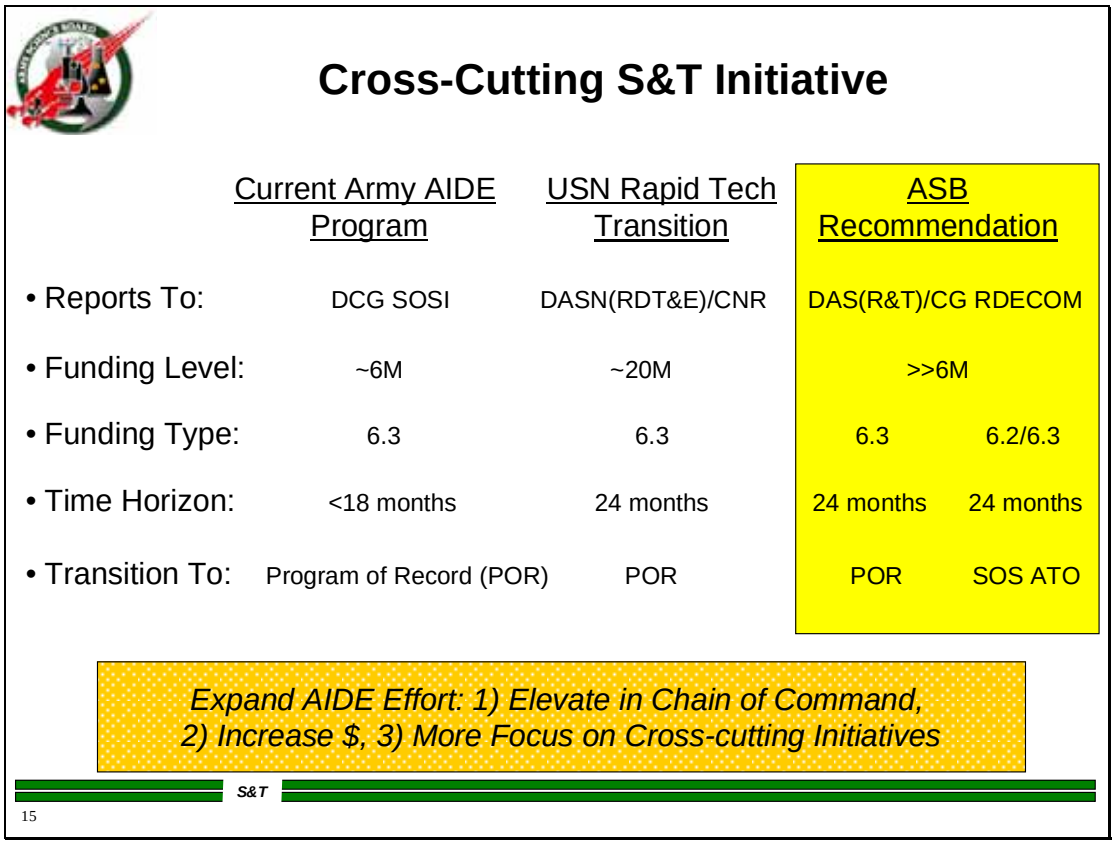
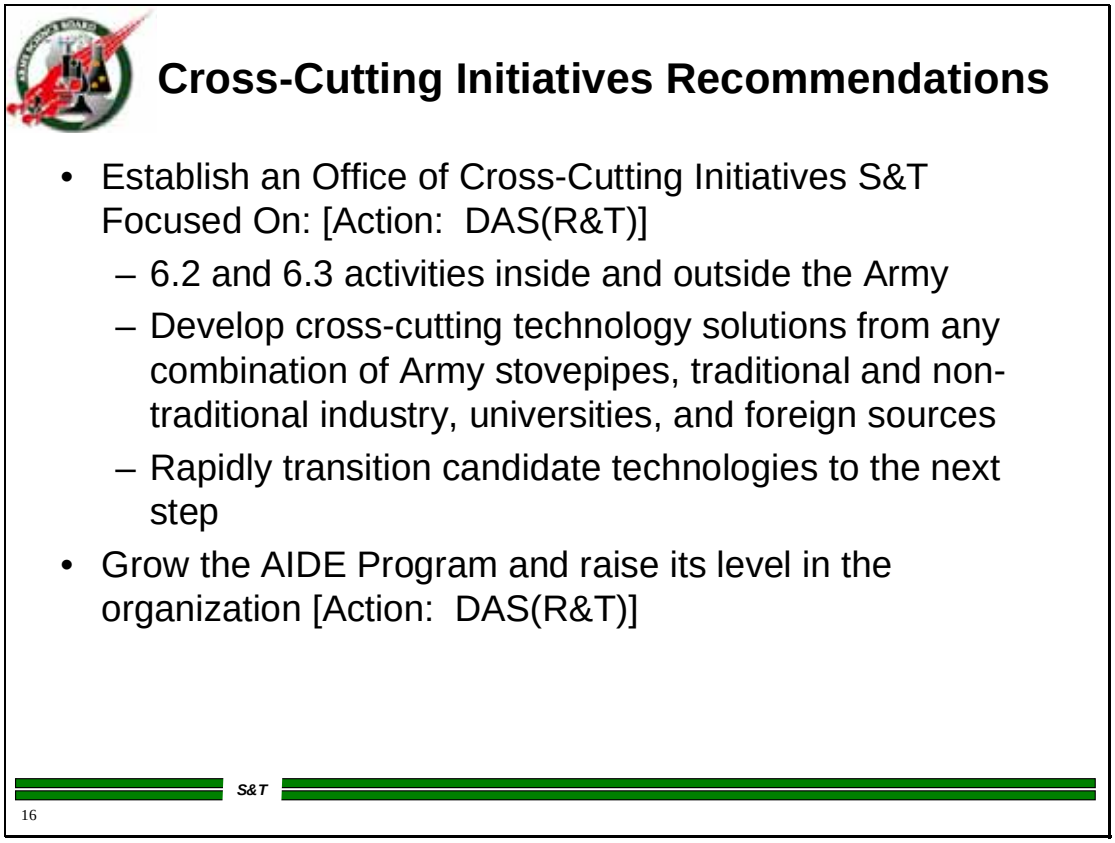


The S&T strategy the Army uses to address the current and future technology needs of the Army is based, to a large extent, on the historically developed structure of the Army's S&T community**.** The Research, Development and Engineering Centers (RDEC) are organized around specific commodities, for example ground vehicles or aviation. The Army Research Laboratory has also developed internal stovepipes to better support the RDEC community, which is its primary customer. This "stove-piped" structure has served the Army well and there is a need to continue resourcing it to preserve and enhance Army unique S&T capabilities. Nevertheless, a stove-piped organizational model is challenged by today's multidisciplinary S&T environment. Many of the innovations occurring today require a multidisciplinary approach that brings a number of scientific and engineering areas together. Additionally, systems and systems-of-systems engineering and integration are becoming more and more important to Army development and acquisition programs. This evolving S&T environment, as well as the needs of the Army acquisition community, suggest that the Army needs additional flexibility to configure cross-cutting programs in its S&T community. We therefore recommend that the Army improve its ability to fund and manage S&T initiatives that are multidisciplinary and not initiated within its established S&T stove-pipes.

The Army's Agile Integration Demonstration and Experimentation (AIDE) program is a good start and could serve as a basis. The current AIDE program is somewhat limited in funding and scope, however, so if it is used as a basis for this recommendation, it should be expanded. In addition to the AIDE program's current 6.3 funding focus, 6.2 funding

should be included. Additionally, the size of the fund should be increased, though the increase may need to occur over several years. The AIDE program currently aims to move technology to the next stage within 18 months. With the addition of 6.2 funding, this cross-cutting initiative should allow a longer time frame for the research; at least 24 months. Finally, Army cross-cutting S&T initiatives should look for technology from all sources. In other words, projects should be competitively sourced and funding should go to whatever source of technology will provide the best solutions, whether those technology sources reside in the Army, other DoD agencies, other governmental laboratories or from the commercial sector.





The Army needs to configure an agile complimentary S&T funding and management process:

To configure and generate cross cutting S&T programs outside traditional lines.

To embrace rapidly and leverage the growth in Army applicable areas.

To make funding available to conduct programs of sufficient magnitude by growing the AIDE funding placed in the office of DAS (R&T), and giving it additional emphasis to challenge cross-cutting S&T partnerships across Army laboratories, RDEC-s and external entities, and to produce demonstrable new impact to show the way to new methods of conducting the business of S&T.

The programs are to be competitively selected with funding authority in the office of the DAS (R&T) with its vested cross cutting visibility and authority over the entire Army S&T program, and be managed by an Army integrating office, such as the AIDE office's program management arm.

Study Organization

Strategic Outreach

Cross-Cutting Initiatives

Gap Analysis Process

Technology Transition

Strategic Management

S&T

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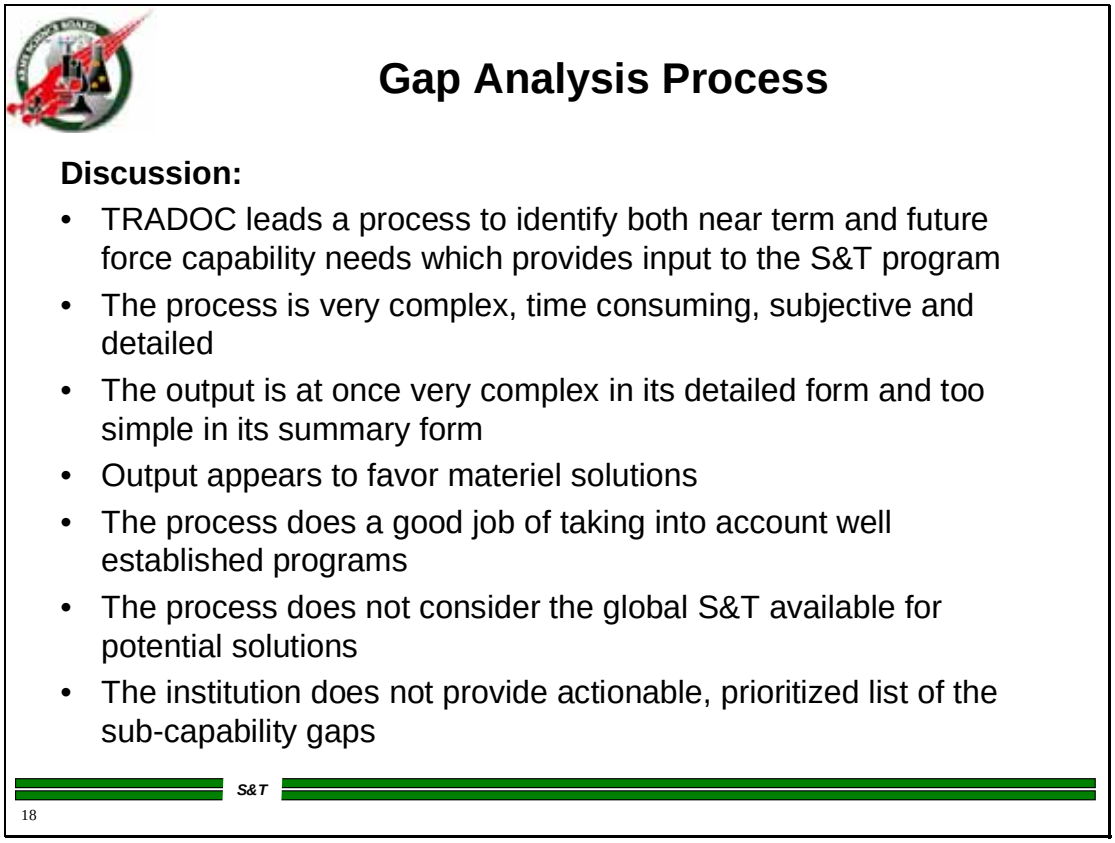


Gap Analysis Process

TRADOC leads the process to identify force capability gaps for both the current and the future force. This gaps analysis becomes input to the S&T community for the building of the S&T program.

It is a very complex and time consuming annual process. It suffers from being highly subjective in the meetings and decision making bodies that contribute to the various steps of the process. The process delivers a very detailed series of charts that highlight the sub-category gaps but does not do so with enough specificity to drive specific solutions.

The output of the process in the series of very detailed charts is cumbersome to display to senior leaders and difficult for action officers to understand if they do not remain immersed in the process that produces the end result. When summary level charts are created for executive use, they tend to be too general in nature to be of great utility. The output of the process seems to favor the Materiel solutions over the other elements of the DOTMLPF paradigm. In fact this may not be the case. The process itself may cause addressing of certain gaps by Doctrine or Organizational or Training initiatives which can be brought to bear during the annual process. It may only have the appearance of favoring the Materiel solution, but that impression persists.

While the process is designed to take account of potential solutions documented within the Program, it does not appear to provide much opportunity for considering solutions that might come from outside Army programs.

There is no analytical technique employed to prioritize the gaps into an actionable list of 1 through N. Such a prioritized list of force capability gaps would be more useful as input to the S&T program community than the mere listing of potential gaps against broad categories of capability needs.

Within the Capabilities Needs Analysis (CNA) process, Required Capabilities (RCs) are drawn from approved Army/Joint concepts…solutions are identified across all DOTMLPF domains…and ***Future Force Capability Gaps*** are determined and rated, based upon impact to mission failure and level of accommodation.

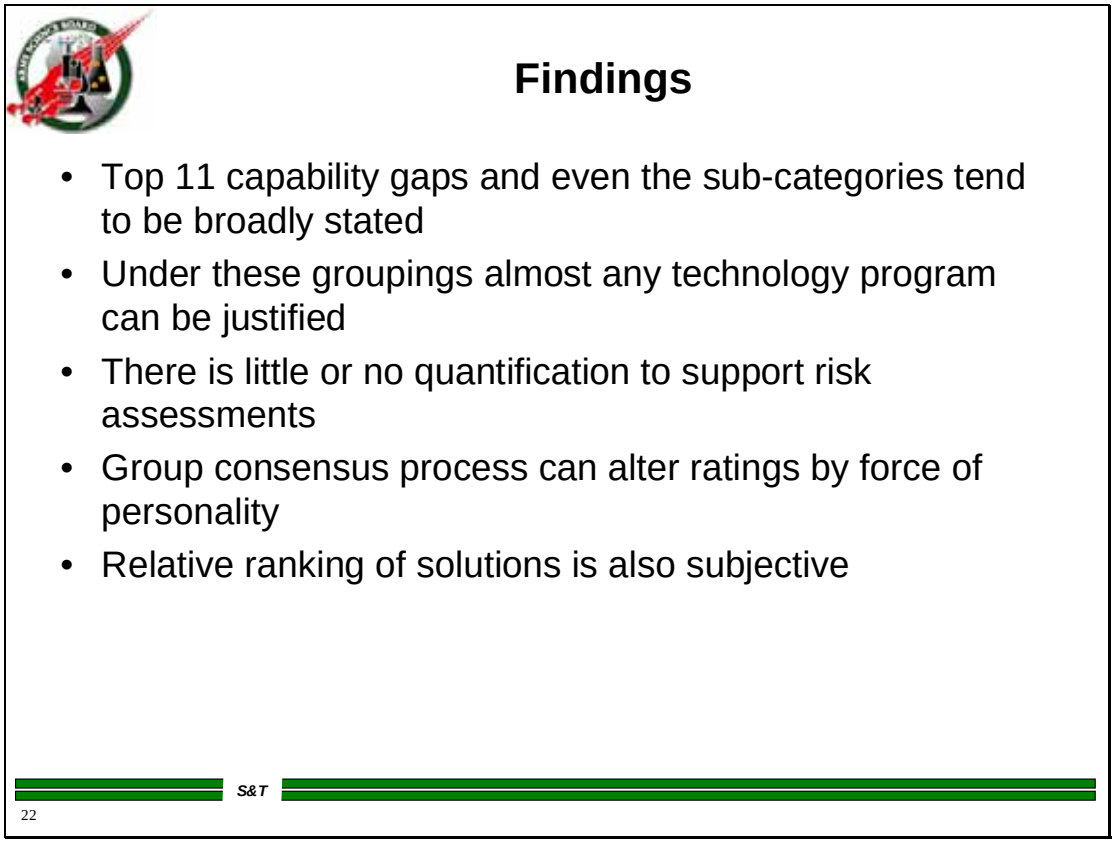
At this point in the process, S&T initiatives are acknowledged/recorded within the CNA database, but not considered/credited with addressing the Future Force Gaps. The determination of S&T shortfalls (i.e. the next step in the process flow) considers the known S&T initiatives (primarily 6.2 and 6.3 ATOs), determines which efforts address each high-priority gap, and identifies residual "at risk" areas.

There are three sets of Gaps/Shortfalls – one for the current force, another for the future force and those remaining for what we refer to as the "conceptual force" – looking beyond the POM years. As we evaluate the high priority residual gaps from Current and Future Gap Areas and look at the long term Force Operating Capability needs out into the Extended Planning Period, we identify areas requiring Science and Technology (S&T) investments. When existing S&T investments are compared to these requirements, gaps and shortfalls in S&T investments are identified to be addressed in the next cycle of preparation of the S&T program details.

Of the 129 sub-capability gaps associated with the over-arching "Top 11" Future Force Capability Gaps, fully 112 are materiel in nature. This seems to suggest that the process is materiel-focused, possibly to the detriment of the other domains of DOTML-PF. Another partial explanation could be that other domain solutions are more quickly/readily implemented within the force. As an example, modification of training procedures might be a partial, rapidly fielded solution to the IED threat …whereas a materiel solution for the same identified gap may be represented herein due to the significantly slower development/fielding cycle-times. Regardless, this area is considered appropriate to review to ensure a balanced focus on all the elements of the DOTMLPF paradigm throughout the CNA process.

Additionally, the analysis revealed that a prioritization of the sub-capability gap areas is in order. Of the 112 materiel solutions recorded, it is currently not possible to determine which are the highest (and lowest) priorities. For instance, it is very likely that a sub-gap area associated with a lower-priority top-level gap would (very possibly) be more pressing (i.e. have a higher-priority) than one associated with a higher-priority top-level gap. Said another way, it is too simplistic to say that the ordering associated with the top-

level gaps applies equally to the sub-gaps within. There is a need to apply analytical and quantitative techniques to reduce this list of sub-capability gaps to an ordered list showing priority 1-112. This will not be an easy process, but it will produce a better result as input to the S&T community for building the S&T programs. In addition, there may be an opportunity to further describe the urgency of the needs through a tiering process.



Findings

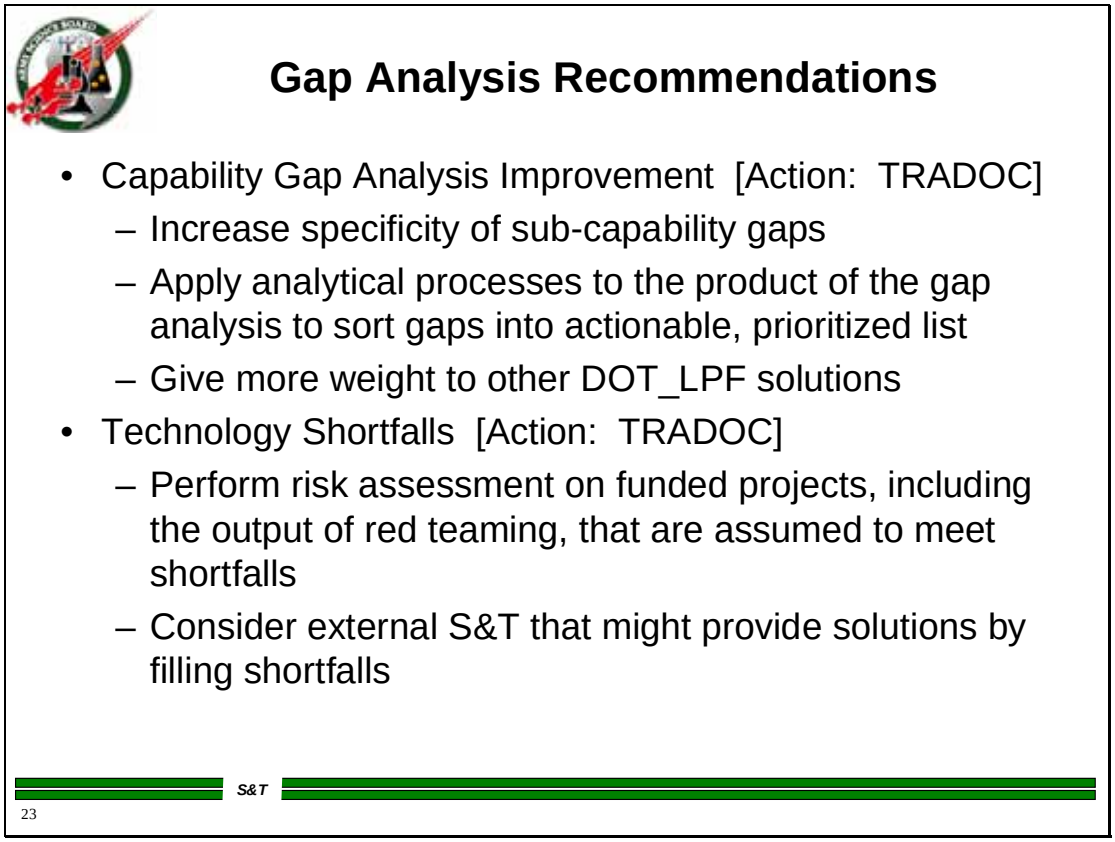
The output of the Gaps Analysis Process is presented in too general a fashion to be of optimum use to the S&T community.

Under the groupings and summary categories, almost any technology program could be justified.

There is too much subjectivity in the final product and not enough analytical quantification to support the risk analysis process.

The output results from a group consensus which is highly influenced by the personalities of the participants at every stage.

This subjective handling without much quantitative rigor can have a dramatic effect on the final outcome.



Gap Analysis Recommendations

TRADOC is the Action Agent for all these recommendations.

Increase the specificity of the sub-capability gaps to make them more useful to the S&T community.

Apply analytical processes to the current product to take it the next step to produce an actionable, prioritized list.

Give more apparent weight to the other elements of the DOTMLPF paradigm rather than depending too heavily on the materiel solutions.

Perform risk assessment on the assumed solution programs to include red teaming to make sure we are not over relying on unrealistic programs to solve the capability gaps. Give broader consideration to solutions from outside Army programs to fill the gaps.

Study Organization

Strategic Outreach

Cross-Cutting Initiatives

Gap Analysis Process

Technology Transition

Strategic Management

S&T

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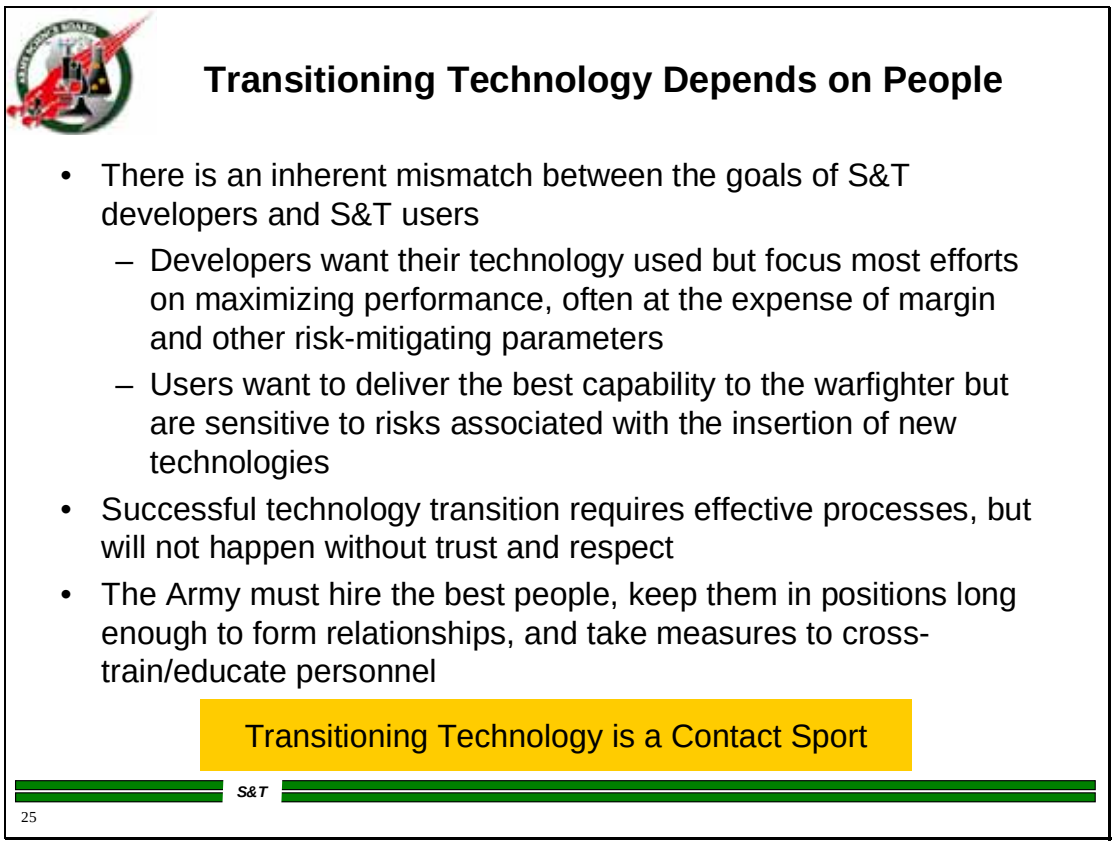
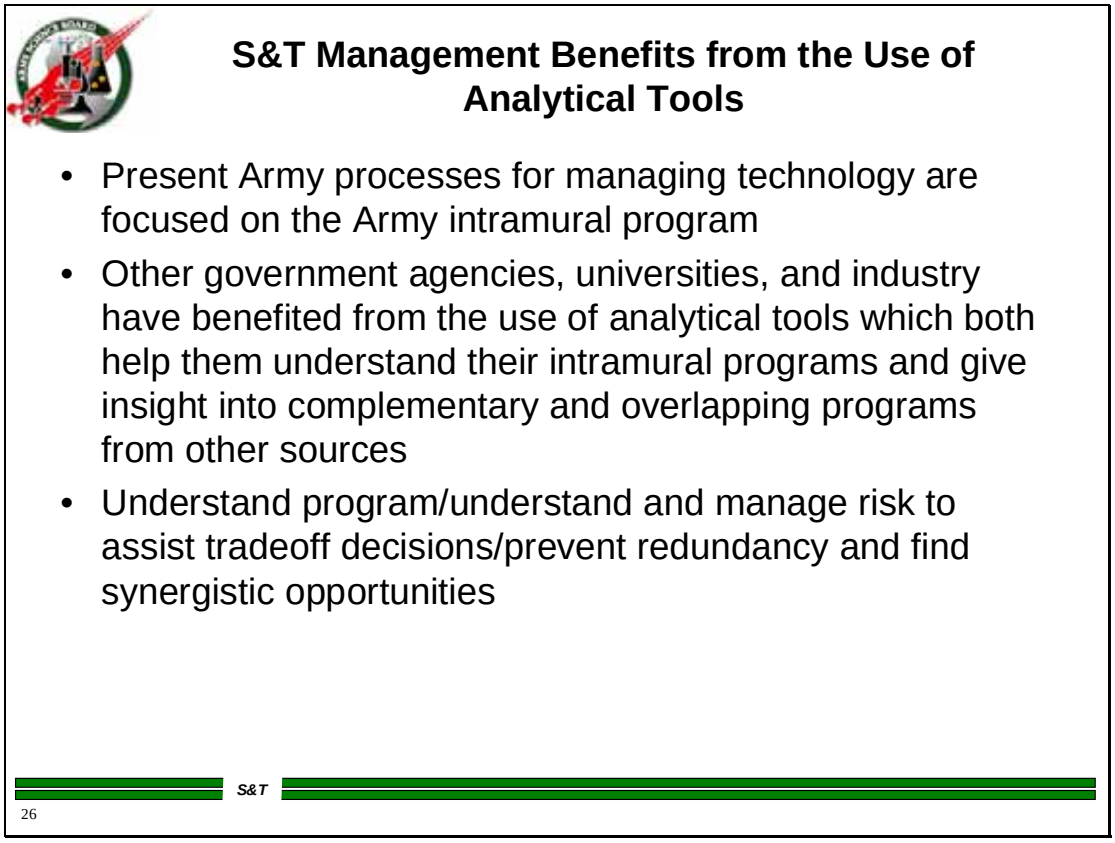


Technology transition from the S&T community to the acquisition community remains an ongoing issue. This is not surprising since the goals and incentives that drive these two communities are inherently mismatched. Technology developers tend to be most interested in developing new capabilities or maximizing the performance of existing technologies. Doing this necessarily requires pushing the technical envelope; which in turn means accepting substantial risk of technical failure and making issues such as ultimate cost and manufacturability, secondary issues. The acquisition community has different concerns. These can be summed up in the three words; cost, schedule and performance. An acquisition program manager is responsible for delivering a product on time, on budget and with performance characteristics that meet a set of predetermined requirements. As a result, acquisition program managers tend to avoid actions that would add time or cost to their programs, or that could risk the performance characteristics of their products. Trying to insert new technology into an acquisition program usually has a high potential to increase both the cost of the program and time it takes to deliver the product. Importantly, unproven and non-integrated technologies also pose a performance risk, even when there is a potential for high performance payoff. Acquisition program managers are thus, normally averse to transitioning technology from the S&T community as their programs mature.

Overcoming the divergent goals of the two communities to transition technology is difficult enough, but is often exacerbated by personnel rotations and a certain amount of insularity in the communities. Process change will have only a limited effect within these

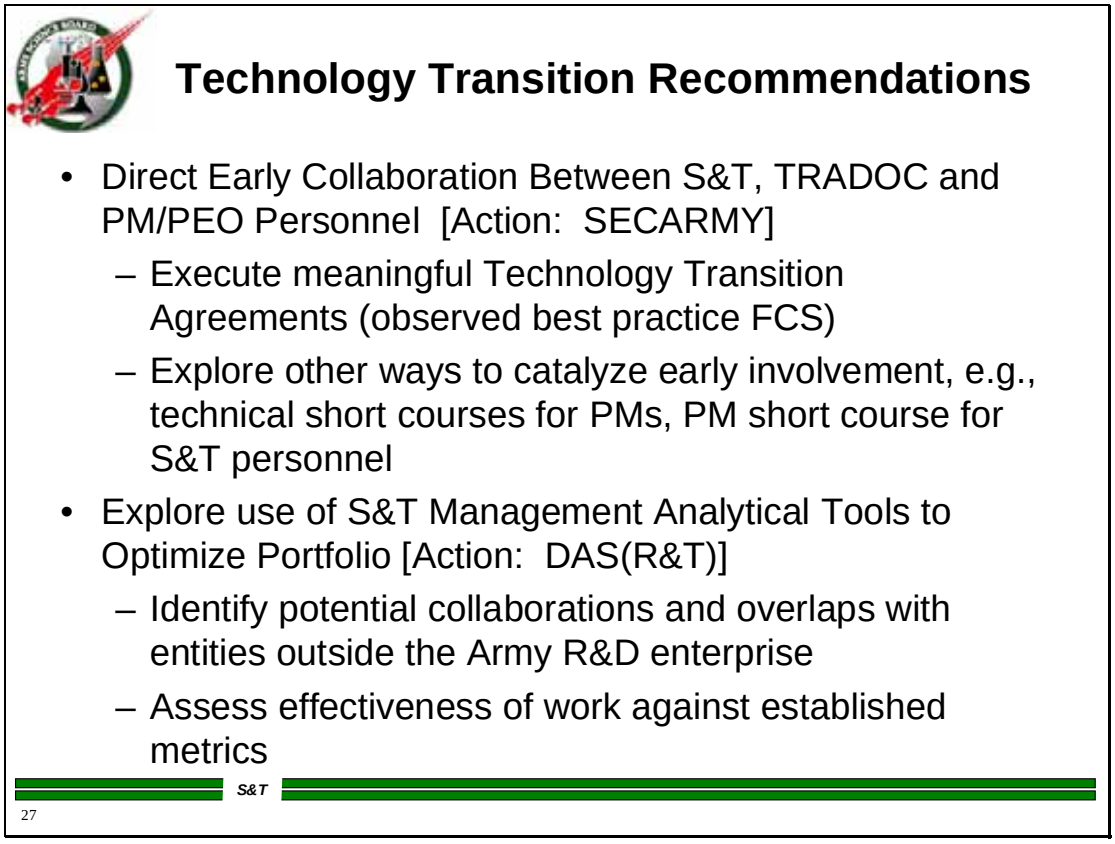
organizational dynamics. Making technology transitions more routine will require more interaction between the two communities to build the trust and respect that only happens with regular person-to-person contacts.

Building such positive relationships also implies that the people in the S&T and acquisition communities need to stay in their respective positions long enough to allow the relations to develop. The members of the two communities must also have the cross-training or cross-experience that will provide them an appreciation for the goals and incentives that drive the partner community. The bottom line is that technology transition is a "contact sport." Transition will not happen automatically. It requires constant communication, developed relationships and an ability to establish common aims, despite divergent incentives.



The sources of technology that can potentially fulfill SS&T shortfalls and gaps, either partially or fully, will include ATOs, FCS, DARPA, government laboratories and global industries. Analytical tools, similar to those used in industry and several government agencies, will enable assessment of performance enhancement expected from technology insertion. These tools are based on systematic selection process that includes consideration of added capability, risk assessment, tradeoff analysis, and analysis of sensitivity and uncertainty. It is important to view the complete set of parameters in a systems context, since some technologies may seem to provide significant value when

examined in a stand-alone mode but provide only marginal capability enhancement in an integrated system.



Study Organization

Strategic Outreach

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Gap Analysis Process

Technology Transition

Strategic Management

S&T

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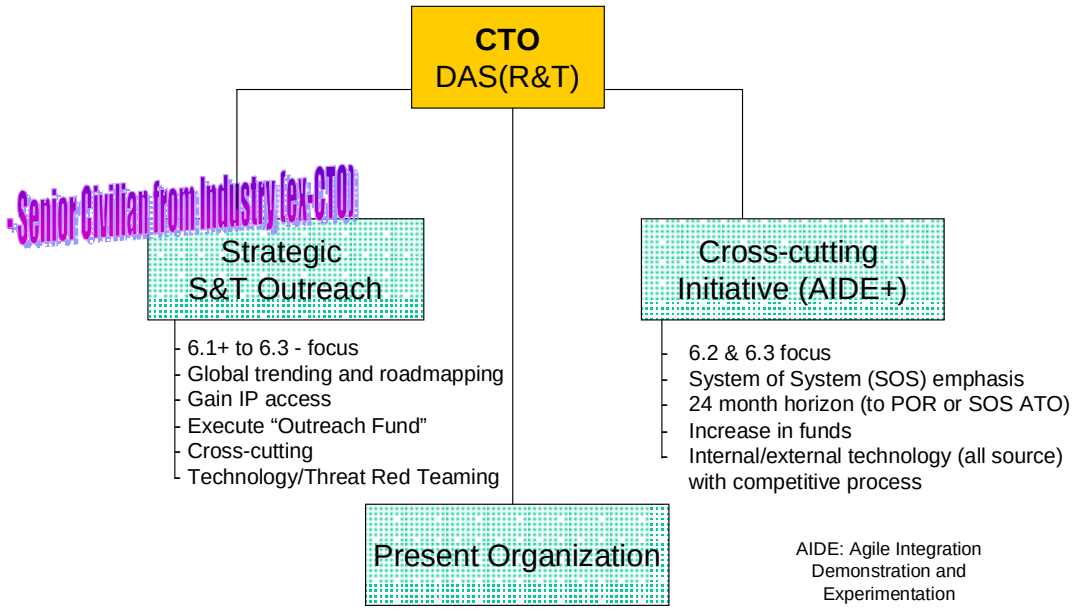
A Concept for Strategic Management of Army S&T



S&T

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Role of the Army Chief Technology Officer

- Army S&T Strategic Planner
  - Sets Army S&T plan and program investment priorities
- Functional Leader for Army Scientists and Engineers
  - Oversees vitality of personnel
- Global Technology Assessment and Understanding
  - Objective assessment of emerging technologies inside and outside the Army
  - Mediate and champion the transition between the S&T and acquisition programs
- Army S&T Principal for DDR&E, DARPA, OSTP, Congress, and other important entities
- Responsibility for Lab and RDEC Vitality and Effectiveness
- Creates the Business Case for S&T Investments

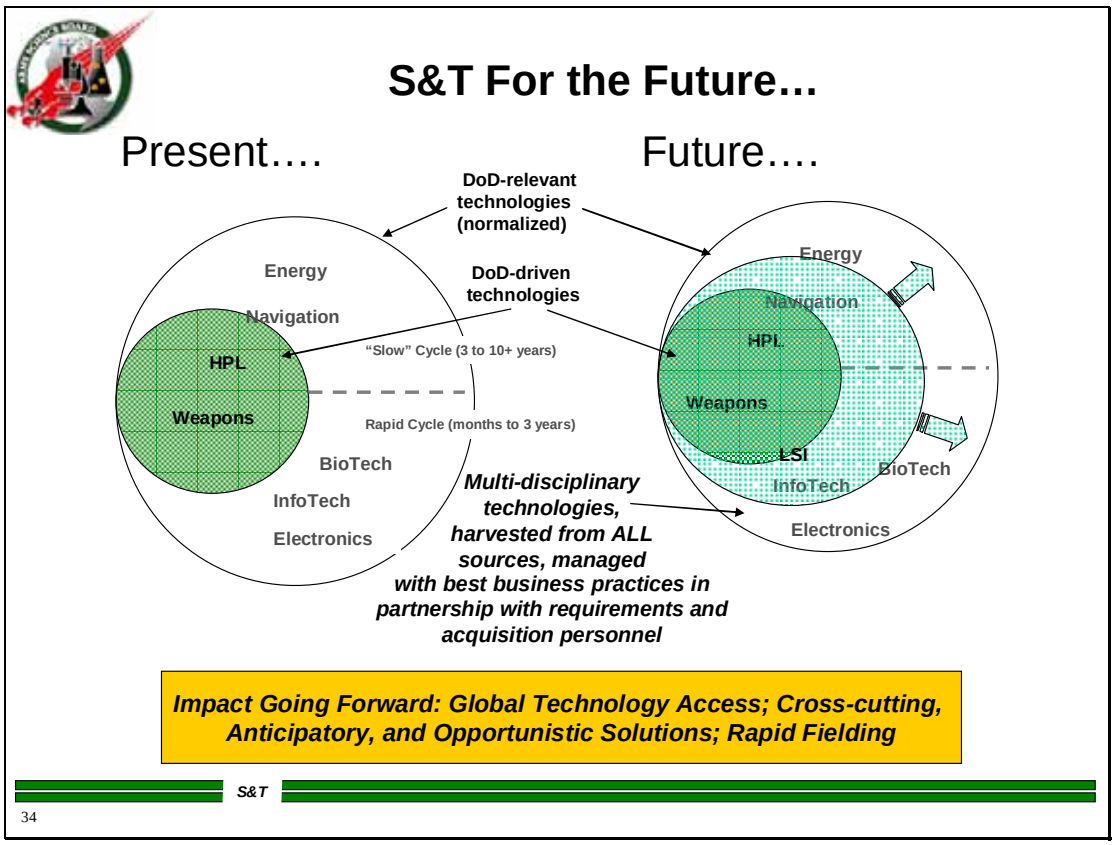
Recommendations

- Evolve Role of Chief Scientist to Chief Technology Officer [Action: SECARMY, ASA(ALT) and DAS(R&T)]
  - Present duties being done well and should continue
  - Increase influence over the RDECs and Labs
  - Increase funding to permit execution of strategic programs
  - Align the technology and business strategies of the Army

Summary and Conclusions

Actions for the Next Two Years

- Strategically-driven Investments [DAS(R&T)]
  - Create a Strategic Outreach function to exploit global, cross-cutting technologies and manage an Outreach Fund
  - Grow the AIDE program and increase its impact by elevating in chain of command, increasing funding, and increasing focus on cross-cutting initiatives
- Capability Gap Analysis & Technology Shortfall Improvement [TRADOC]
  - Increase specificity of sub-capability gaps, prioritize, and consider all DOTMLPF
  - Perform risk assessment on funded projects and consider external sources of solutions
- Technology Transition [SECARMY, ASA(ALT) & DAS(R&T)]
  - Direct Early Collaboration Between S&T and PM/PEO Personnel
  - Explore use of S&T Management Analytical Tools to Optimize Portfolio
- Chief Technology Officer [ASA(ALT) and DAS(R&T)]
  - Evolve Role of Chief Scientist to Chief Technology Officer with an emphasis on strategically planning and managing the Army S&T portfolio and aligning the technology and business strategies of the Army



Currently the DoD relies heavily on external S&T while focusing its investments in weapons-unique research. Trends indicate that future S&T will be even more multidisciplinary in nature and available from an ever-widening array of sources both domestic and foreign. Non-military applications will drive the vast majority of global S&T. However, many of the advances in interdisciplinary fields such as biotechnology, materials sciences, nanotechnology, energy, and information technology will be incorporated in military systems. Therefore, the Army must ensure it has the ability to harvest technologies from ALL sources world-wide.

This will require a fundamental shift in S&T strategy and management to accommodate programs that fundamentally integrate multiple technologies. Best business practices must be employed and be supported by innovative cooperative development and acquisition concepts. To keep pace with accelerating technological opportunities demands highly skilled personnel who can anticipate emerging fields and be capable of working in agile organizations with responsive contracting mechanisms. The S&T focus will not be limited to basic research alone but will incorporate an integration process for rapid transition and fielding of systems that constantly increase the warfighting capability of the Army.

APPENDIX A

TERMS OF REFERENCE

DEPARTMENT OF THE ARMY
OFFICE OF THE ASSISTANT SECRETARY OF THE ARMY
ACQUISITION LOGISTICS AND TECHNOLOGY
103 ARMY PENTAGON
WASHINGTON DC 20310-0103

JUL 26 2006

Dr. Frank H. Akers, Jr.
Chair, Army Science Board
2511 Jefferson Davis Highway, Suite 11500
Arlington, Virginia 22202

Dear Dr. Akers:

I request that the Army Science Board conduct a study on "Science and Technology (S&T) for the Future Force." The study should be guided by, but not necessarily be limited by the Terms of Reference (TOR) described below.

Background:

The U.S. Army is currently involved in tactical operations in Iraq and Afghanistan as part of the Global War on Terrorism (GWOT) as well as an ambitious S&T program for the Future Force. The U.S. Army will need to make difficult decisions on S&T investments to adequately meet both the operational needs of fielded forces and investment in long-term Future Force requirements. Early stage analyses for Future Combat Systems and the Future Force showed a relative pre-occupation with tank versus tank "set-piece" ground combat operations typical of clashes between national forces. Direct experience in GWOT operations highlights the need for Future Force capabilities not appreciated in the early analyses. The purpose of this study is to evaluate the U.S. Army S&T portfolio against the anticipated requirements of the Future Force, and to recommend options for addressing the gaps.

Issues for the TOR:

a. Evaluation of present and planned S&T investment portfolio against the requirements of the future force and the GWOT.

(1) Assess how well the existing S&T program will deliver the capabilities needed by the future force. Are there gaps or areas of overinvestment? Is there appropriate balance of focus among near-, mid-term and long-term needs?

(2) Assess the process used to develop the S&T investment plan. Are the right metrics in place to guide investment decisions? Is there clear linkage between the technical objectives of the S&T program and the evolving needs of the future force? Is the process sufficiently flexible to be responsive to a changing threat environment and to the rapid pace of technology development?

b. Evaluation of how well the U.S. Army S&T investments leverage the investments of other organizations both inside and outside of government.

(1) Conduct a top level overview of technology investments in other services, Department of Defense agencies, Federally Funded Research and Development Centers, other government departments and industry. Identify areas where the Army is the sole investor, where the U.S. Army will share investments with others and where the U.S. Army can rely on others to fund technology development.

(2) Assess the strategies, such as investment partnerships, used to leverage the investments of other organizations.

Study Sponsorship: The sponsor for this study is the Army Chief Scientist and Deputy Assistant Secretary of the Army for Research and Technology, Dr. Thomas H. Killion.

Study Duration: The final report should be provided by August 15, 2006. A draft report for review and comment will be provided upon request.

Sincerely,

Claude M. Bolton, Jr.
Assistant Secretary of the Army
(Acquisition, Logistics and Technology)

APPENDIX B

PARTICIPANTS LIST

Panel Members

Co-Chairs

- Allen Adler
- Gil Herrera
- Charley Otstott

Staff Assistant

- Oscar Valent, ASA(ALT)

Government Advisors

- LTC(P) Keith Edwards, ARCIC
- Dr. Myra Gray, PM FCS

Cadet Assistant

- CDT Neal Nisargand

Panel Members

- John Alexander
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- Jim Carlini
- Herb Dobbs
- Bob Dodd
- Tom Farris
- Kathy Harger
- Bruce Held
- Wade Kornegay
- Steve Kornguth
- Ira Kuhn
- Jason Providakes

APPENDIX C

ACRONYMS

6.1 6.2 6.3	DoD S&T Budget Activity Categories: 6.1 = Basic Research, 6.2 = Applied Research, 6.3 = Advanced Technology Funding.
A/J AJ	Anti-Jamming
AIDE	Agile Integration Demonstration and Experimentation
ARCIC	Army Capabilities Integration Center
ASA(ALT)	Assistant Secretary of the Army for Acquisition, Logistics and Technology
ASB	Army Science Board
ATO	Army Technology Objectives
CDT	Cadet
CNA	Capabilities Needs Analysis
CNR	Chief of Naval Research
CRADA	Cooperative Research and Development Agreement
DARPA	Defense Advanced Research Projects Agency
DAS(R&T)	Deputy Assistant Secretary for Research and Technology
DASN(RDT&E)	Deputy Assistant Secretary of the Navy for Research, Development, Test and Evaluation
DCG	Deputy Commanding General
DDR&E	Director, Defense Research and Engineering
DoD	Department of Defense
DOTMLPF	Doctrine, Organization, Training, Materiel, Leadership and Education, Personnel and Facilities
DTRA	Defense Threat Reduction Agency
FCS	Future Combat System
FFRDC	Federally Funded Research and Development Center
GWOT	Global War on Terrorism
HPL	High Power Laser
HQDA	Headquarters, Department of the Army
IED	Improvised Explosive Device
IP	Intellectual Property
IT	Information Technology
LSI	Lead Systems Integrator
LTC	Lieutenant Colonel
NIH	National Institutes of Health
NSF	National Science Foundation
OASA(ALT)	Office of the Assistant Secretary of the Army for Acquisition, Logistics and Technology
OGAs	Other Government Agencies
OSTP	Office of Science and Technology Policy
PEO	Program Executive Office
PM	Program Manager
POM	Program Objective Memorandum
POR	Program of Record
RC	Required Capability
RDEC	Research Development and Engineering Center
S&T	Science and Technology

SECARMY	Secretary of the Army
SOS	System of Systems
SOSI	System of Systems Integration
TOR	Terms of Reference
TRADOC	Training and Doctrine Command
USG	U.S. Government
USN	U.S. Navy