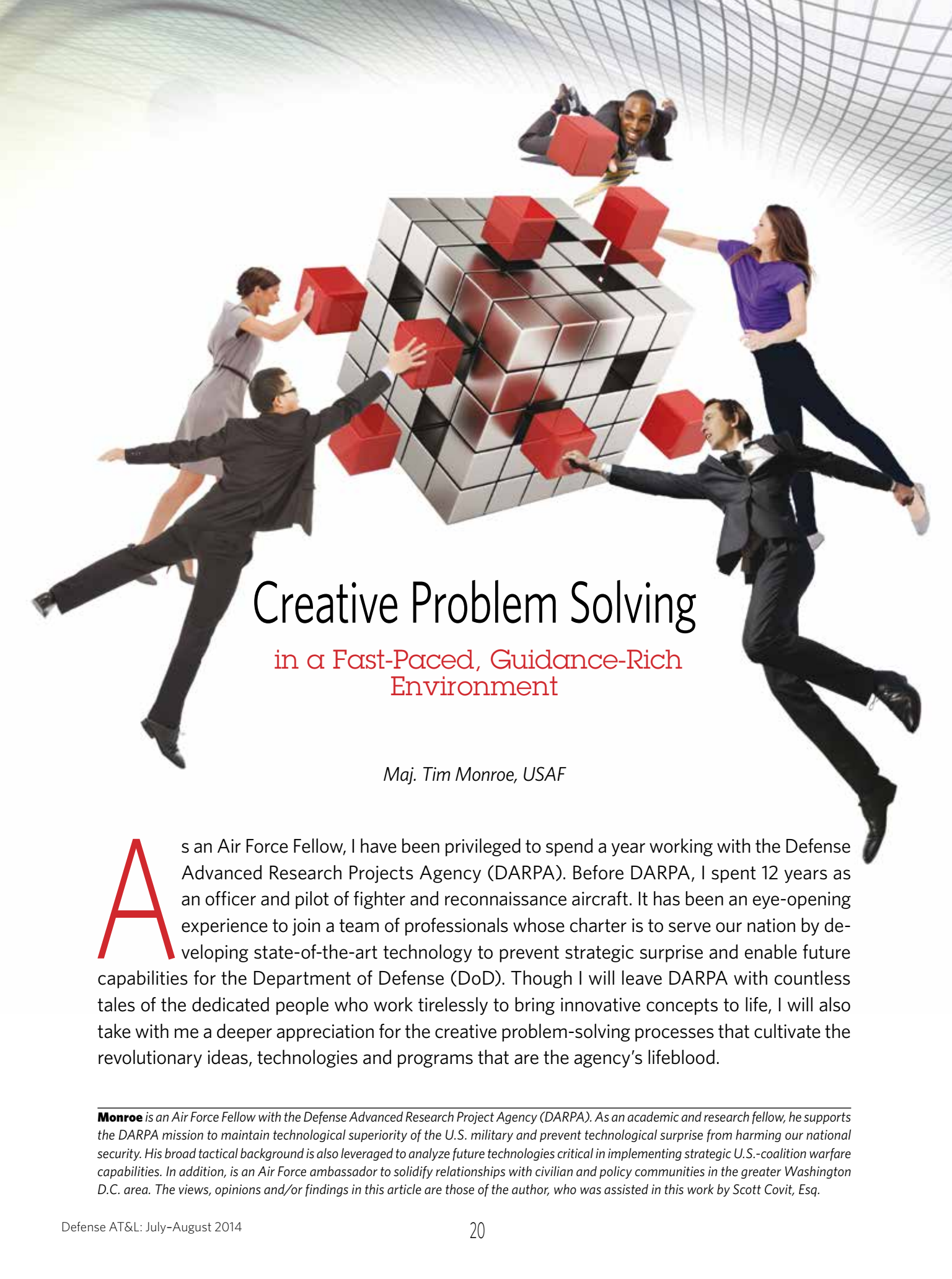




Creative Problem Solving

in a Fast-Paced, Guidance-Rich Environment

Maj. Tim Monroe, USAF

As an Air Force Fellow, I have been privileged to spend a year working with the Defense Advanced Research Projects Agency (DARPA). Before DARPA, I spent 12 years as an officer and pilot of fighter and reconnaissance aircraft. It has been an eye-opening experience to join a team of professionals whose charter is to serve our nation by developing state-of-the-art technology to prevent strategic surprise and enable future capabilities for the Department of Defense (DoD). Though I will leave DARPA with countless tales of the dedicated people who work tirelessly to bring innovative concepts to life, I will also take with me a deeper appreciation for the creative problem-solving processes that cultivate the revolutionary ideas, technologies and programs that are the agency's lifeblood.

Monroe is an Air Force Fellow with the Defense Advanced Research Project Agency (DARPA). As an academic and research fellow, he supports the DARPA mission to maintain technological superiority of the U.S. military and prevent technological surprise from harming our national security. His broad tactical background is also leveraged to analyze future technologies critical in implementing strategic U.S.-coalition warfare capabilities. In addition, is an Air Force ambassador to solidify relationships with civilian and policy communities in the greater Washington D.C. area. The views, opinions and/or findings in this article are those of the author, who was assisted in this work by Scott Covit, Esq.

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Guidance-rich environments can have the unintended consequence of stifling creativity when those who work in them do not feel empowered to adapt the existing guidance to the situation or develop new guidance if existing regulations are found irrelevant or inappropriate for the problem at hand.

The core cog of the fast-paced DARPA machine is the program manager. Talent is selected from academia, industry and government to lead pivotal early investments in innovation. One element of DARPA's environment about which all program managers are acutely aware is the mandatory short-term service that typically lasts two to five years. No one can escape the short service periods because DARPA is always searching for fresh perspectives. The mandate for short-term service extends to technical office directors and the director of DARPA. This is intentional and is the driving force behind the agency's fast pace. It motivates performance and is central to DARPA's rapid business practices, but presents the agency with unique challenges, including the risk management and thinking required to take on and resolve complex problems.

Program managers are surrounded by teams of experts to support their ideas and project development. These teams are diverse and represent specialties ranging from contracting and budget management to technical expertise. The agency's fast-paced, revolutionary work demands forethought and is a major reason these teams have such diversity but also why they must think through numerous problem sets at the earliest inception of a program.

To this end, the DARPA Security Team has developed a creative problem-solving process. Security traditionally is a compliance function. The developmental curve for personnel working in compliance-oriented functions usually evolves from learning relevant guidance to following and enforcing that guidance, adapting existing guidance to new problems and, occasionally, developing new guidance. For DARPA security, this is a developmental curve that must be accelerated and is a thought process worth sharing. This simple process, while discussed in terms of security for the purpose of this article, has many applications to work environments and career specialties that are guided by innumerable rules, regulations and policies. These concepts may also guide acquisition professionals referencing the *Federal Acquisition Regulation* and the *Defense Acquisition Regulation* as their primary regulatory manuals. Guidance-rich environments can have the unintended consequence of stifling creativity when those who work in them do not feel empowered to adapt the existing guidance to the situation or develop new guidance if

existing regulations are found irrelevant or inappropriate for the problem at hand. The key reasons behind the development and sharing of this process were:

- To empower the entire security staff to be part of the problem-solving process.
- To communicate clearly the need and expectation for the staff to think.
- To develop a staff that can operate in the gray space "beyond compliance."

The steps used to guide creative problem solving when working through challenging situations are described below, and the figures in this article illustrate the process.

Understand the problem. The problem-solving rubric starts with a well informed clear understanding of the problem. It is essential to invest time in accurately diagnosing the root issue(s) and not simply react to symptoms. Investing quality time at this point permits immediate focus on developing an appropriate solution. Conversely, not investing the time to understand the problem set may result in lost time and productivity or, worse, make the original problem more difficult to solve.

Core functional knowledge is critical. Understanding the foundational guidance of a career specialty is paramount. As a military aviator, I have often spent weeks in professional courses meant to bolster my knowledge as a pilot and tactician. In some cases, my technical orders, regulatory manuals and headquarters' guidance amounted to thousands of pages of text, diagrams and tables. These manuals were essential to learn the basics of my mission and continue to operate safely and proficiently. As it applies to this process, it is a foundation built on a compilation of the many hours spent scrolling through source documents, online training modules, classroom sessions and miscellaneous handouts describing examples and vignettes meant to grow a knowledge base. This general knowledge prescribes the black and white of one's duties. It is further developed through management-level standards, procedures, and expectations and applied with judgment informed by real-world experience. It continuously expands and is absolutely critical to a person's professional

Having core functional knowledge is critical in determining the relevancy of existing guidance but doesn't eliminate the need for reasoned judgment and problem solving when existing guidance does not prescribe a solution.

credibility and competence. A constant closeness and review of career educational opportunities will keep an individual prepared when the tough situations arise. If a problem does arise and the appropriate solution can be found in existing guidance, the solution should be applied. Having core functional knowledge is critical in determining the relevancy of existing guidance but doesn't eliminate the need for reasoned judgment and problem solving when existing guidance does not prescribe a solution.

Explore the essence of each problem. When building concepts and ideas for a revolutionary new idea, it is common to move beyond the intended purpose of existing guidance. By its very nature, guidance can become dated soon after it is published since it is typically anticipatory or reactive in nature. Tearing down boundaries and pushing the limits of what is possible is a necessary element to innovation. In turn, this may result in situations where there is no existing guidance or readily available precedent or standard. However, to protect these ideas and the sensitive work to develop them, a great deal of time is invested to understand the key elements of what is new, different and revolutionary. An example is from the 1970s, when engineers and scientists began looking for

novel methods to reduce the radar signature of U.S. aircraft. This concept was born out of a desire to avoid detection in the skies above enemy territory and, especially, avoid radar systems looking to track and destroy U.S. aircraft. DARPA began a program—code named “HAVE BLUE”—to develop technologies for stealthy aircraft.

Due to stealth's revolutionary concept and anticipated change to the world of tactical aviation, it was considered especially sensitive when being developed, and elements still remain classified. However, no regulation 40 years ago prescribed how to effectively safeguard it or how security would be applied if it became a part of the legacy of U.S. military aviation. Furthermore, what, if any, application could be made to other defense technologies? Challenges such as these, that stretch the bounds of existing policy, require us to ask questions, such as: What is the most sensitive or revolutionary element(s) of this program? How would a threat counter it? Is there anything sensitive about the engineering process? What would the enemy do with this sensitive information? The point of these questions is to apply experience through dialogue and identify critical points of security in order to begin shaping a tailored solution. This dialogue and

assessment is an iterative process, attempting to think a step ahead and always consider the consequences from probable or perceivable angles.

As a program or project grows in maturity, changes or new discoveries will be made requiring further creative and tailored security solutions. The question-and answer elements identified in these conversations will inevitably be helpful to shape the best solutions.

Analyze the problem against the constraints of existing guidance. With an understanding of what needs to be safeguarded, primary regulations and policy must be reviewed. At this point, core functional

Figure 1. Program Protection Profession Pyramid



Where are you in regard to knowledge, comprehension and experience?

knowledge is very important. This may seem intuitive and a repeat of the first step, but functions with intense, voluminous guidance can be cumbersome to navigate and are challenging when assessing from narrow or specific perspectives. In the case of stealth technology, it was quickly evident that no known safeguards were in place for such a concept. They simply didn't exist because the entire program was revolutionary to tactical aviation.

This thorough review of the current guidance and assessing relevance to the problem is critical. It is essential to the problem-solving process for a few reasons: Valuable time is wasted when a "new" solution is developed that is already prescribed elsewhere. Time is lost applying an inappropriate solution based on irrelevant or inappropriate guidance. Past examples can show what not to do. Identifying whether existing guidance is relevant and appropriate may be low risk and status quo, but requires thought. Either a solution can be applied or the need to continue assessing options will be apparent.

Recognize the need for an adaptive solution. At this stage, there is no immediate answer for the assessed problem. It is not black and white, but rather exists in the gray area and has extended into the realm of "beyond compliance." Identifying an adaptive solution requires a complement of experience, creativity, critical thought and risk management. Often guidance only partially prescribes how to deal with issues. In other cases, potential solutions may be found in precedence. For some of the work at DARPA, there are historic experiences to fall back on. Most often this is the case in air, land and sea technology programs because of the decades of experience within these domains. Newer domains like space and cyber are more challenging. These domains have less

historically relevant policy. However, when an adapted solution is required, it is important to consider unintended consequences. We don't want to fix one problem while creating another one elsewhere. Finally, consider if existing guidance should be updated to help those who may face the same problem in the future.

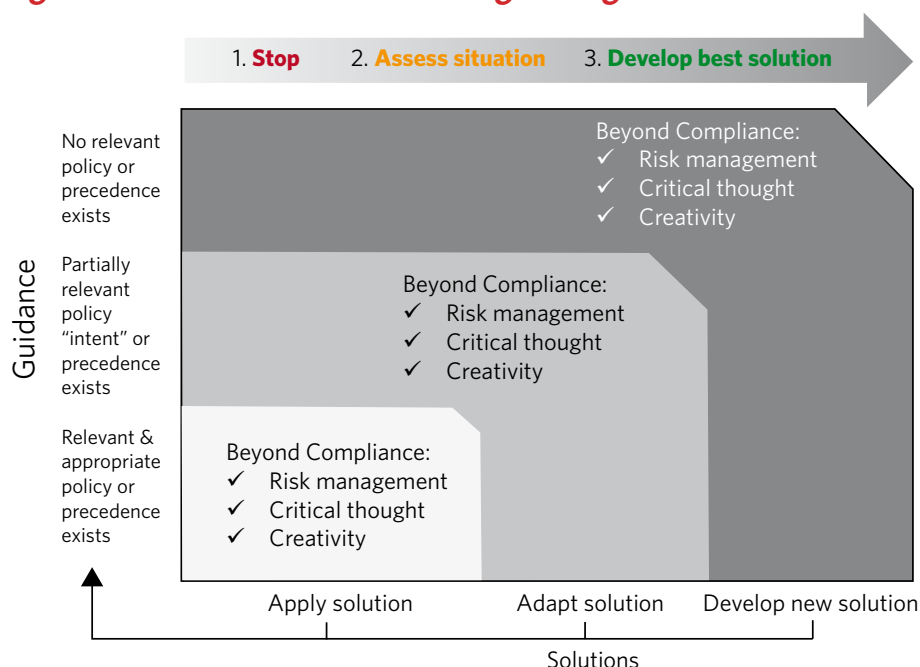
Recognize the need for an entirely new solution. For a DARPA employee, this is seen as another great opportunity to shape the future. This is the design space in which we thrive and is the grayest area of the problem-solving process. There will be no way to immediately confirm whether a proposed new solution will succeed, but the approach is likely to be as close to a sum total of all the previous steps as possible. Ultimately, the desired outcome is conceived guidance that helps to address the problem set and is inclusive of the analysis and thought invested in the previous steps. Shaping guidance should be broad and address not simply the specific problem that led to its inception but the larger application of a technology or security concept. Again, when a new solution is required, it is important to consider unintended consequences.

The key reasons behind the development and sharing of this process were to:

- Empower the entire staff to be part of the problem-solving process.
- Clearly communicate the need and expectation to think.
- Develop a staff that can operate in the space "beyond compliance."

For someone in security or other compliance functions who wants to accelerate the developmental curve to include adapting or creating guidance to support novel problems, this process may be useful.

Figure 2. DARPA Problem-Solving Thought Process



Working as a team has propelled DARPA to continually expand the frontiers of technology as a leader within the DoD creating off-scale effect for our nation's leaders and warfighters. The organization's culture and approach to innovation have led to technologies that have forever changed how we protect and defend the United States and its allies. Those technologies began as ideas that were nurtured, guarded and secured by professionals who think differently about solving problems.

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