



College of Optics and Photonics
CREOL & FPCE

Understanding DARPA - How to be Successful -

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November 6th, 2013

Student Union, UCF

Outline

- **Goal and Motivation**
- **Some short stories (2) WDM Laser; XCPA**
Message: Don't give up.... And don't mess up...
- **Understanding Darpa: Things to know – do your homework**
- **Communicating with Darpa: Use “The Catechism”**
- **The “Silver Bullet”**

Goal and Motivation

Goal:

Provide faculty with an insight towards attracting and performing under Darpa contracts.

Motivation:

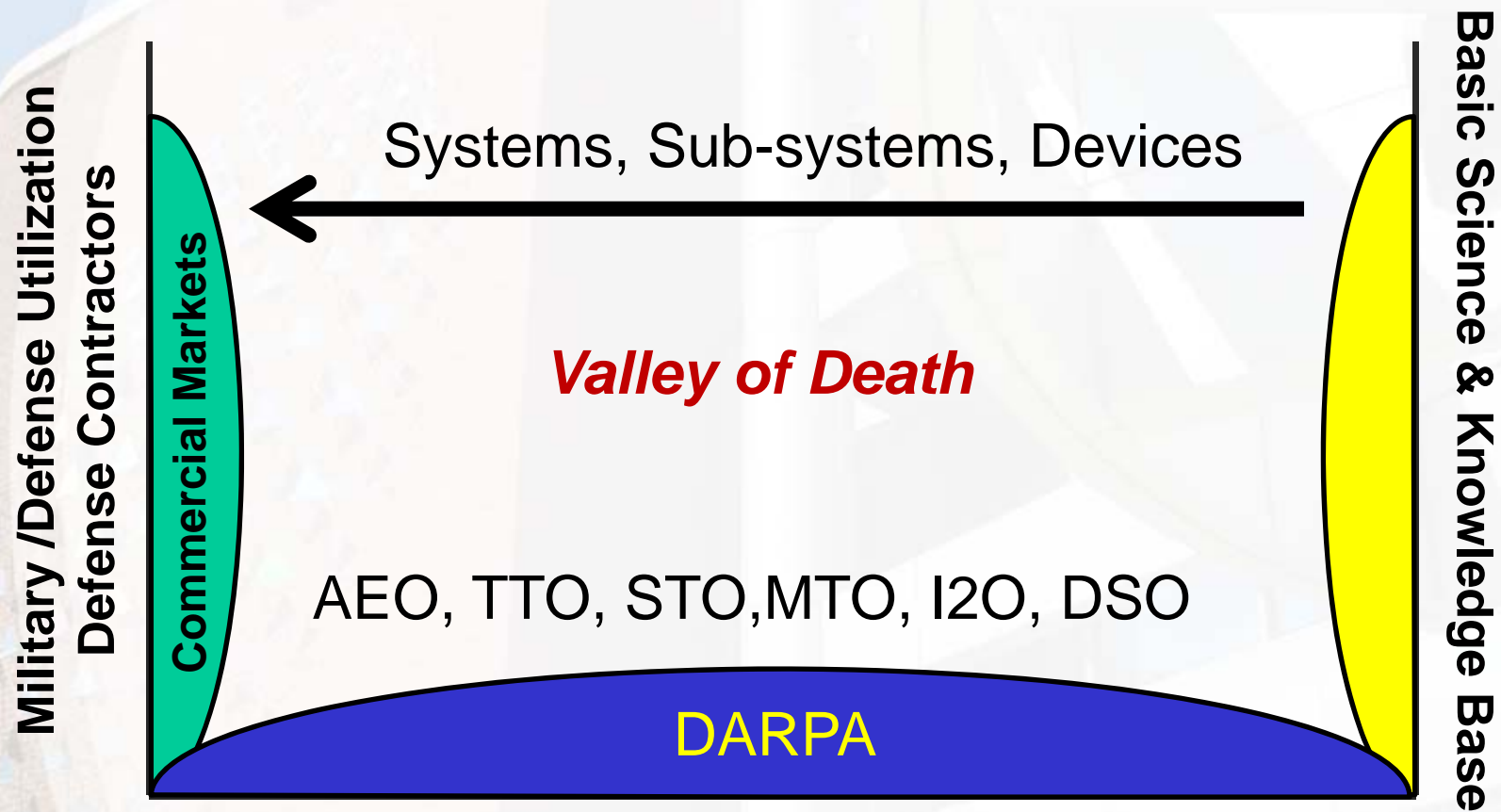
May allow for teaming across UCF for large interdisciplinary activities funded by Darpa.

Some Short Stories

WDM – Don't give up –

XCPA - Don't mess up.

Darpa's Role – To Bridge the “Valley of Death”



<http://www.darpa.mil>

DARPA - The Organization

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About

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DARPA's mission is to maintain the technological superiority of the U.S. military and prevent technological surprise from harming our national security by sponsoring revolutionary, high-payoff research bridging the gap between fundamental discoveries and their military use.

Over the years, DARPA has worked to enhance our national security by funding research and technology development that not only have improved our military capabilities but have changed the way we live. Since the very beginning, DARPA has been the place for people with innovative ideas that lead to groundbreaking discoveries.

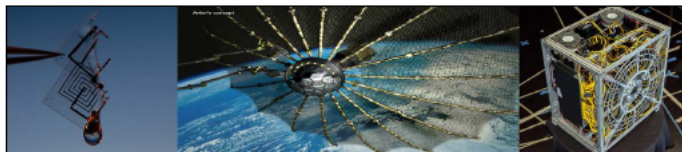
ADDITIONAL INFORMATION

- [DARPA Framework](#)

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Driving Technological Surprise: DARPA's Mission in a Changing World



April 2013



Defense Advanced Research Projects Agency

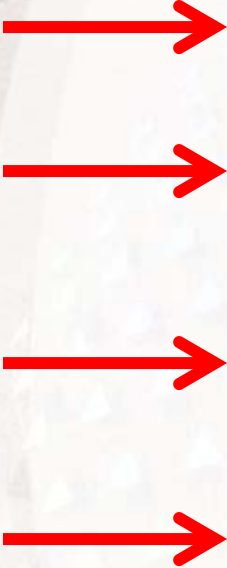
The estimated cost of report or study for the Department of Defense is approximately \$29,000 for the 2013 Fiscal Year. This includes \$0 in expenses and \$29,000 in DoD labor.
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This document gives a brief history of Darpa, some of its contributions, and the philosophy of its role and research & management style

Darpa's Research Style

Managing for Results



The ultimate objective of our work is revolutionary capabilities that result in positive national security outcomes. While keeping this long-term goal in mind, we actively manage our work to maximize our chances of delivering those results.

Because DARPA is a projects agency rather than a laboratory or institution, our work is executed in programs with defined start and end dates. When a program ends, we may move to another area that is more fruitful, or we may continue with a new project in the same field if we see high potential. But in every case, this is a conscious and deliberate decision, not an automatic default to perpetuate work in any one area.

Within each program, the DARPA program manager sets clear milestones according to the objectives for that effort. For a systems demonstration program, typical milestones include design reviews and tests at increasing levels of maturity. For a more research-oriented program, appropriate milestones are often first-of-a-kind lab experiments or meeting increasingly challenging performance criteria. As programs unfold, program managers work closely with their performer communities. They assess results and then redirect or eliminate less productive work and accelerate efforts that are making great progress.

Similarly, DARPA's technical leaders—technical office directors and deputies and the DARPA Director and Deputy—regularly weigh the progress of each program in the context of our overall portfolio. Programs that are on track continue. Those that are not meeting expectations are rescope or stopped. Those that are showing unexpected promise may be expanded to pursue new possibilities. Lessons are learned and integrated into our ongoing and future programs.

We balance the need to give our programs and performers the time and resources necessary to make progress toward our extremely challenging objectives with the need to curtail or redirect efforts that are not productive. These are judgment calls informed by data and direct interactions with the people doing the work. Our overall success lies in striking this balance across the broad portfolio of DARPA programs.

Understanding Darpa

Do your Homework

- Need to know / find out what they (Darpa PM) want
- Visit the Darpa Webpage: www.darpa.mil
- Read the strategic thrusts, BAA, current programs
- Identify program managers that are interested in your work
- Find out what they want – reading the funded programs, **future BAA's**, Open BAA's
- Once a project / research is identified, you develop a white paper, submitted to a BAA,
- PM can then “discuss” a particular emphasis
- White paper is accepted – write a full proposal.
- When writing your white paper / proposal, remember to use “The Heilmeyer Catechism”
- The ‘catechism’ philosophy is inherent in the ‘viewgraph’

http://www.darpa.mil

The screenshot shows the DARPA website homepage with a dark background. At the top left is the DARPA logo. To the right, there are social media icons for Twitter, Facebook, Google+, YouTube, and RSS, with the text "Follow us:". Below this is a navigation menu with links for "OUR WORK", "OPPORTUNITIES", "NEWS + EVENTS", and "ABOUT". A search bar is located on the right side of the page. The main content area features a large banner with the text "Creating & Preventing Strategic Surprise". Below the banner are several smaller images and text blocks: a vertical rainbow-colored graphic with the text "OUR WORK", a humanoid robot, a server rack with a red arrow, a "News" section with the text "Throughout history technical challenges have inspired generations...", a "CYBER GRAND CHALLENGE" logo, and a collage of images showing people working at computers. At the bottom of the page, there is a footer with links for "SITEMAP", "FOIA", "PLUG-INS", "PRIVACY AND SECURITY", "RELATED SITES", "CONTACT", "NO FEAR ACT", and "ACCESSIBILITY/SECTION 508". To the right of the footer is a "Share this page:" section with icons for Twitter, Facebook, Print, and Email.



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Organization

AEO	DSO	I2O	MTO	STO	TTO
Technology, Adaptability & Transfer	Basic, Materials & Biological Science	Information, Innovation & Cyber	Electronics, Photonics & MEMS	Networks, Cost Leverage & Adaptability	Weapons, Platforms & Space
Technology Transition Warfighter Engagement Technology Demonstrations and Field Trials Rapid Response Technology	Physical Science Neuroscience Materials Mathematics Biology	Cyber Data Analysis at Massive Scales ISR Exploitation	Biological Platforms Computing Electronic Warfare Manufacturing Novel Concepts Photonics Positioning, Navigation and Timing Thermal Management	Battle Mgmt, Command & Control Comms & Networks ISR Electronic Warfare Positioning, Navigation and Timing	Air Systems Ground Systems Marine Systems Space Systems
AEO Personnel	DSO Personnel	I2O Personnel	MTO Personnel	STO Personnel	TTO Personnel

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The Darpa Offices and Their Role

The Adaptive Execution Office (AEO) is chartered to accelerate game-changing DARPA technologies into DoD capabilities. AEO provides the agency with robust connections to the warfighter community and assists the agency with the planning and execution of technology demonstrations and field trials to promote adoption by the warfighter.

DARPA's Defense Sciences Office (DSO) programs bridge the gap from fundamental science to applications by identifying and pursuing the most promising ideas within the science and engineering research communities and transforming these ideas into new DoD capabilities.

The Microsystems Technology Office (MTO) supports DARPA's mission of creating and preventing strategic surprise by investing in areas such as microelectromechanical systems (MEMS), electronics, computing, photonics and biotechnology.

In recent years, the proliferation of commercial components and manufacturing processes has made advanced technologies accessible to all, leveling the playing field. In response, MTO is dedicated to leveraging, countering and transcending these commercial-off-the-shelf (COTS) approaches. MTO aims to multiply the power of COTS by aggregating, adapting and integrating components into networks and systems for the benefit of the warfighter. MTO seeks methods for countering threats (both incidental and intentional) that arise from sustained advancements in cheap and readily available technologies. Lastly, MTO develops high-risk, high-reward technologies outside and beyond the scope of the commercial industry to secure the DoD's technological superiority. By continuing to create revolutionary capabilities, MTO seeks to "un-level" the playing field.

The Defense Advanced Research Projects Agency's (DARPA) Strategic Technology Office (STO) is focused on technologies that enable fighting as a network to increase military effectiveness, cost leverage, and adaptability.

STO's areas of interest include: Battle Management, Command and Control (BMC2); Communications and Networks; Intelligence, Surveillance, and Reconnaissance (ISR); Electronic Warfare (EW); Positioning, Navigation, and Timing (PNT); and Foundational Strategic Technologies and Systems.

TTO will rapidly develop new prototype military capabilities that create an asymmetric technological advantage and provide U.S. forces with decisive superiority and the ability to overwhelm our opponents.

TTO's objective is to provide or prevent strategic and tactical surprise with very high-payoff, high-risk development of revolutionary new platforms, weapons, critical technologies and systems, approaches addressing affordability, as well as rapid agile development.

The Darpa Offices and Their Role

I2O – Information Innovation Office

I2O explores game-changing technologies in the fields of information science and software to anticipate and create rapid shifts in the complex national security landscape. Conflict can occur in traditional domains such as land, sea, air, and space, and in emerging domains such as cyber and other types of irregular warfare. I2O's research portfolio is focused on anticipating new modes of warfare in these emerging areas and developing the concepts and tools necessary to provide decisive advantage for the U.S. and its allies.

As much of the world-wide economy has moved into cyberspace, protecting and assuring information flows over these networks has become a priority. Most networks today rely on the successive discovery of vulnerabilities and deployment of patches to maintain security. Even after patching, new vulnerabilities are often introduced in successive releases, and may even be introduced by the patches themselves. The I2O defensive cyber portfolio is largely focused on changing this paradigm through a variety of methods such as heterogeneity, formal methods proofs, secure code generation, and automation. Exploration of offensive methods is essential to expand and inform defensive work. The I2O portfolio covers a broad space, investigating enterprise networks, secure communications, industrial systems, and purpose-built military systems.

I2O is also pursuing information technologies to change the way we perceive and interact with our surroundings. Exponential improvements in computing power, network bandwidth and storage density combined with ever more pervasive sensing and measurement technologies provided new and powerful ways to gain insight into the world. Essentially all human activities that can be measured, from mercantile to military, are being quantitatively re-examined in the context of this new, "big data", capability. Early demonstrations have produced remarkable insights into human activities and enabled quantitative decision making. I2O's investment portfolio begins at the fundamental science level with programs investigating varied topics from the mathematical properties of graphs, to online correlation for societal unrest. The portfolio also addresses fundamental computational issues such as novel algorithm design, natural language processing, and architectures for efficient processing of streamed data. Closer to the customer, I2O is working closely with agencies within the national security community on operational data to ensure continuous transition of tools as the programs progress.



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Adaptive Execution Office



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The Adaptive Execution Office (AEO) is chartered to accelerate game-changing DARPA technologies into DoD capabilities. AEO provides the agency with robust connections to the warfighter community and assists the agency with the planning and execution of technology demonstrations and field trials to promote adoption by the warfighter.

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Defense Sciences Office



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- [Materials](#)
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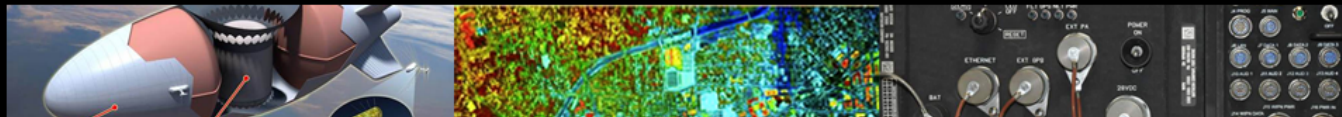
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Strategic Technology Office



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- [Communications and Networks](#)
- [Intelligence, Surveillance, and Reconnaissance \(ISR\)](#)
- [Electronic Warfare \(EW\)](#)
- [Positioning, Navigation, and Timing \(PNT\)](#)
- [Foundational Strategic Technologies and Systems](#)

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Tactical Technology Office



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VISION

TTO will rapidly develop new prototype military capabilities that create an asymmetric technological advantage and provide U.S. forces with decisive superiority and the ability to overwhelm our opponents.

OBJECTIVE

TTO's objective is to provide or prevent strategic and tactical surprise with very high-payoff, high-risk development of revolutionary new platforms, weapons, critical technologies and systems, approaches addressing affordability, as well as rapid agile development.

LATEST NEWS

• The materials posted below were briefed at the TTO Office Wide BAA Proposers' Day on Tuesday, April 23, 2013 at the DARPA Conference Center in Arlington, VA. They are provided for informational purposes only. In the event of any inconsistency with the DARPA/TTO Office Wide BAA (DARPA-BAA-13-22: Innovative Systems for Military Missions), the BAA takes precedence.

- [Video](#)
- [Introduction](#)
- [Ground Systems Panel](#)
- [Maritime Systems Panel](#)
- [Air Systems Panel](#)
- [Space Systems Panel](#)
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Please direct all media queries to Outreach@DARPA.mil

TTO OPPORTUNITIES

[DARPA-SN-14-04: Adaptive Vehicle Make \(AVM\) Tool Suite Transition, Response Date 10/31/2013](#)

[DARPA-BAA-13-22: Innovative Systems for Military Missions - DARPA Tactical Technology Office \(TTO\), Response Date 4/9/2014](#)

[DARPA-SN-14-04: Adaptive Vehicle Make \(AVM\) Tool Suite Transition, Response Date 11/04/2013](#)

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Information Innovation Office



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ABOUT I2O

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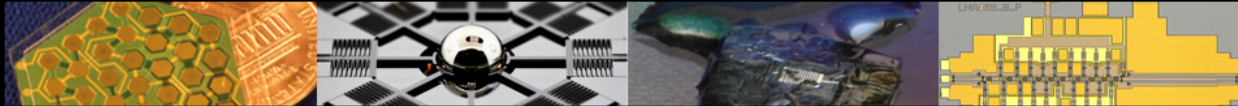
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Microsystems Technology Office



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- [Photonics](#)
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Microsystems Technology Office



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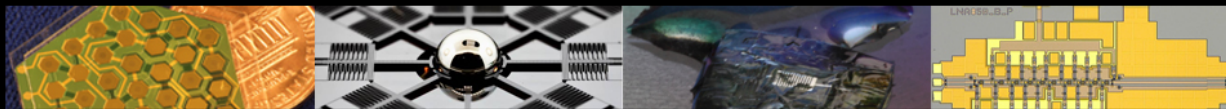
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Microsystems Technology Office



FOCUS AREAS **PERSONNEL** PROGRAMS SOLICITATIONS

Dr. Josh Conway

Program Manager
Microsystems Technology Office
joshua.conway@darpa.mil

Bio

Dr. Josh Conway joined DARPA in August 2012 as a program manager for the Microsystems Technology Office. His interests include linear and non-linear nano-photonics from UV to LWIR frequencies, active integrated photonic devices, RF photonics, advanced imaging systems and revolutionary space systems.

Dr. Conway came to DARPA from Kinsey Technical Services (KTSi) where he was senior principal engineer of special programs at the Los Angeles Air Force Base. Prior to joining KTSi, Dr. Conway joined the technical staff of The Aerospace Corporation in 2003. There he performed basic research on RF photonic systems and led research in electrically-driven, sub-wavelength light sources. Dr. Conway also worked as Boeing Satellite Systems starting in 2001 where he designed, built and tested fiber-optic subsystems for inter-satellite laser communication systems.

Dr. Conway has received numerous awards, has authored more than 30 technical papers and conference proceedings and holds nine patents.

Dr. Conway received a Bachelor of Science in Physics and Master of Science in Electrical Engineering from University of Illinois in Urbana, Illinois. He earned his Doctor of Philosophy in Electrical Engineering from University of California in Los Angeles for research in optical structures able to efficiently couple to deeply sub-wavelength dimensions.

PROGRAMS

- [Compact Ultra-Stable Gyro for Absolute Reference \(COUGAR\)](#)
- [Electronic-Photonic Heterogeneous Integration \(E-PHI\)](#)
- [Integrated Photonic Delay \(iPhoD\)](#)
- [Remoted Analog-to-Digital Converter with De-serialization and Reconstruction \(RADER\)](#)
- [Short-Range, Wide Field-of-View Extremely agile, Electronically Steered Photonic Emitter \(SWEEPER\)](#)
- [Transmit and Receive Optimized Photonics \(TROPHY\)](#)

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Communicating w/ Darpa

- **Use The Catechism when writing to Darpa (will explain shortly)**
- **Once a project / research is identified, you develop a white paper, submit to a BAA. PM can then “discuss” a particular emphasis.**
- **White paper is accepted – write a full proposal.**
- **When writing your white paper / proposal, remember to use “The Heilmeier Catechism”.**
- **The ‘catechism’ philosophy is inherent in the ‘viewgraph’.**

Heilmeier – Darpa Catechism

- As director of [ARPA](#) in the 1970's [George H. Heilmeier](#) developed a set of questions that he expected every proposal for a new research program to answer. He referred to them as the "Heilmeier Catechism".
- These questions still survive at DARPA and provide high level guidance for what information a proposal should provide.
- It's important to answer these questions for any individual research project, both for yourself and for communicating to others what you hope to accomplish.

The Heilmeier – Darpa Catechism

- **What are you trying to do? Articulate your objectives using absolutely no jargon. What is the problem? Why is it hard?**
 - **How is it done today, and what are the limits of current practice?**
 - **What's new in your approach and why do you think it will be successful?**
 - **Who cares?**
 - **If you're successful, what difference will it make? What impact will success have? How will it be measured?**
 - **What are the risks and the payoffs?**
 - **How much will it cost?**
 - **How long will it take?**
 - **What are the midterm and final "exams" to check for success? How will progress be measured?**
-



Study Name

PM Name (if known)



Study Problem Statement

- Provide a single-sentence statement of the problem that the study is expected to answer. Be as specific as possible. Ideally, this should be expressed as a physics problem.
- (if relevant) How is the problem solved now? What is lacking in this approach?

Illustration

Study Approach

- Describe how the study performer plans to address the problem.
- State what is new about this approach compared to previous work.
- (More information can be provided in backup charts)

Illustration

Long-Term Path Forward

- Give a brief description of the envisioned path to utilization by the Department of Defense.

Illustration

Relevance

- Explain how this problem is relevant to Department of Defense needs.

Study Metrics / Deliverables

- Provide one or more metrics which, if achieved, would show that the study has succeeded; i.e., that problem being addressed has been satisfactorily answered.
- What deliverable(s) will result from the study?

Performer(s):

Amount: \$K

Duration: months



The Silver Bullet



**...and if all else fails,
Pray!**





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Initiatives



- INITIATIVES
- ALUMNI OUTREACH**
- THE SOCIETAL IMPLICATIONS OF NEW TECHNOLOGIES

ALUMNI CONNECTIONS

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ALUMNI OUTREACH

The short tenure of DARPA technical staff (Program Managers, Deputy Program Managers, Office Directors, Deputy Office Directors, Directors and Deputy Directors), means that even though the technical staff numbers at around 120 any given year, the number of Scientists and Engineers who have done a 3-5 year turn at DARPA, is a generous and well-placed group. The majority of the DARPA alumni consider their tenure at DARPA a life-changing experience.

The DARPA Alumni are loyal to DARPA and the DARPA mission. They continue to contribute to the DARPA mission and they continue to be useful to each other and to the United States global leadership in scientific and technical disciplines through their ongoing promotion of DARPA's research investment.

There are several formal events that permit DARPA alumni to learn about the current 'state of DARPA'. These events help the Alumni in their roles as ambassadors of DARPA. They reacquaint current DARPA technical staff with technical staff from other years to facilitate the sharing of lessons learned, useful contacts and new ideas. DARPA Alumni are the living repository of DARPA history: the successes, the failures, the challenges, the experiments and the archives. For formal exchange and substantive discussion between DARPA and the DARPA alumni, DARPA is sponsoring regular workshops.

DARPA is also a moderator of the LinkedIn group "DARPA Alumni" ([Join Group](#)), where DARPA alumni can discuss things that interest them and can raise discussion topics for the DARPA Alumni Workshops. DARPA alumni are always welcome to send questions and comments to alumni@darpa.mil.

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