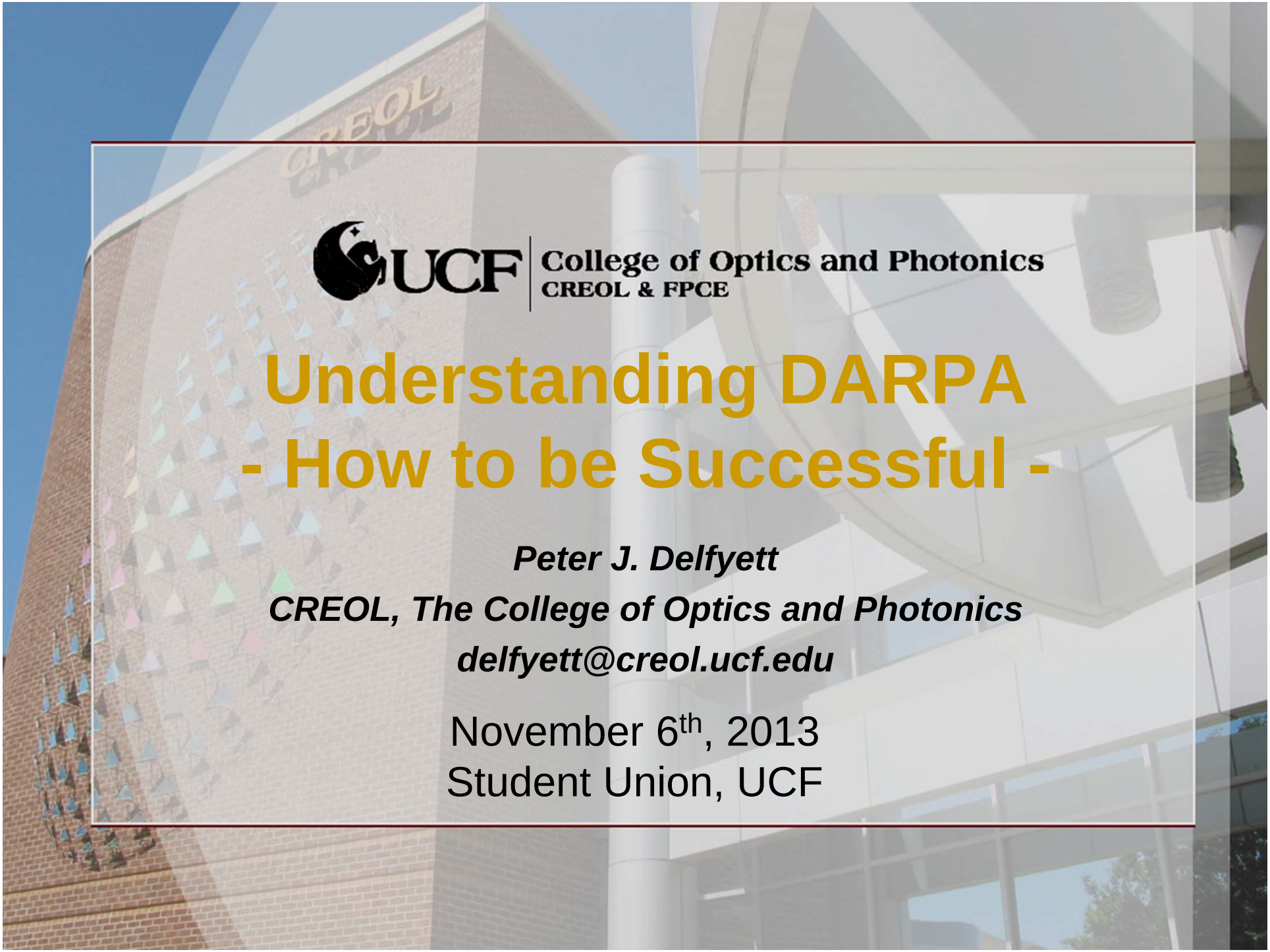

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Understanding DARPA
- How to be Successful -

Peter J. Delfyett

CREOL, The College of Optics and Photonics

delfyett@creol.ucf.edu

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.

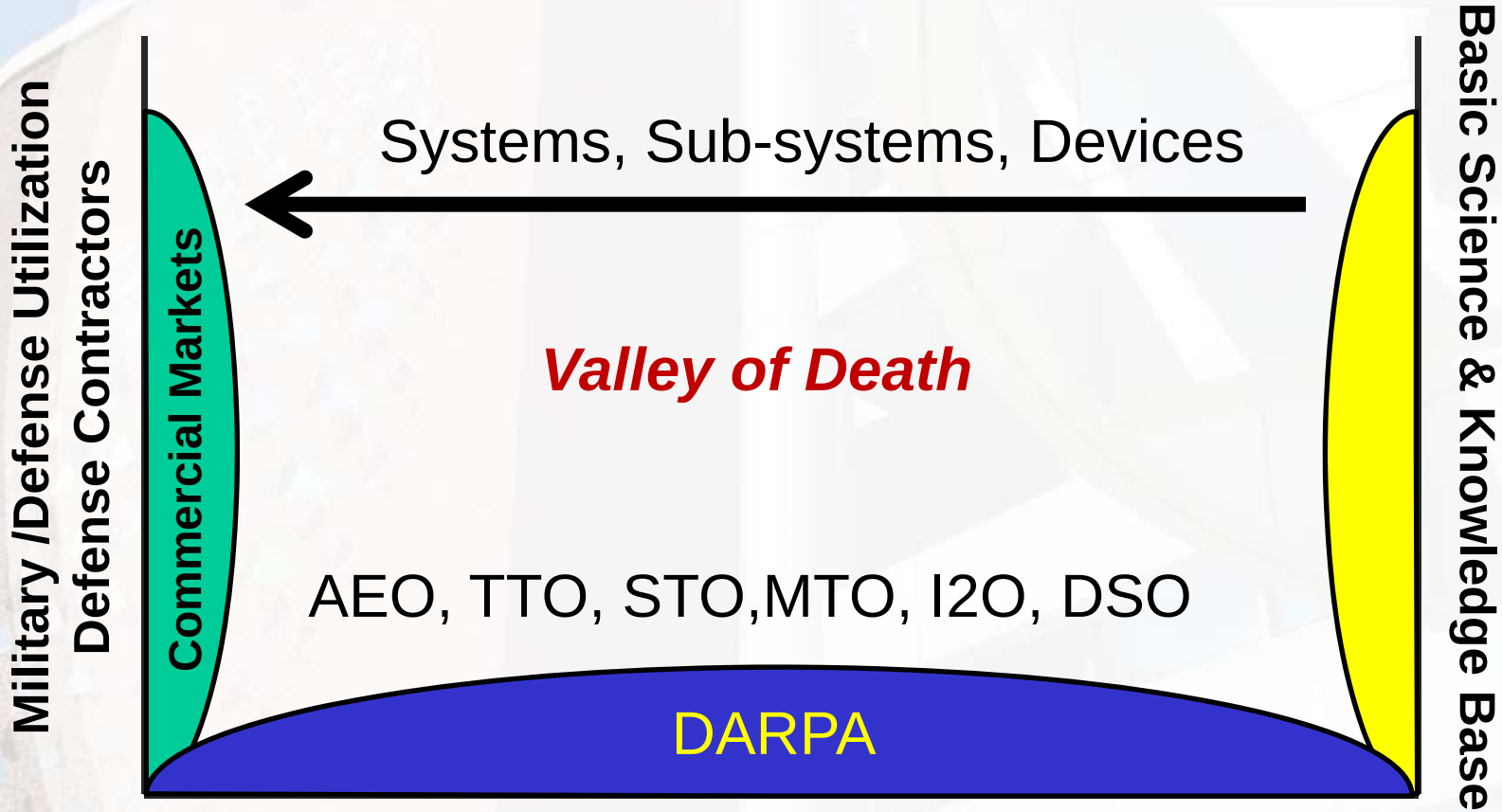
Motivation:
May allow for teaming across UCF for large interdisciplinary activities funded by Darpa.

Some Short Stories

WDM – Don’t give up –

XCPA - Don’t mess up.

Darpa's Role – To Bridge the "Valley of Death"



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DARPA - The Organization

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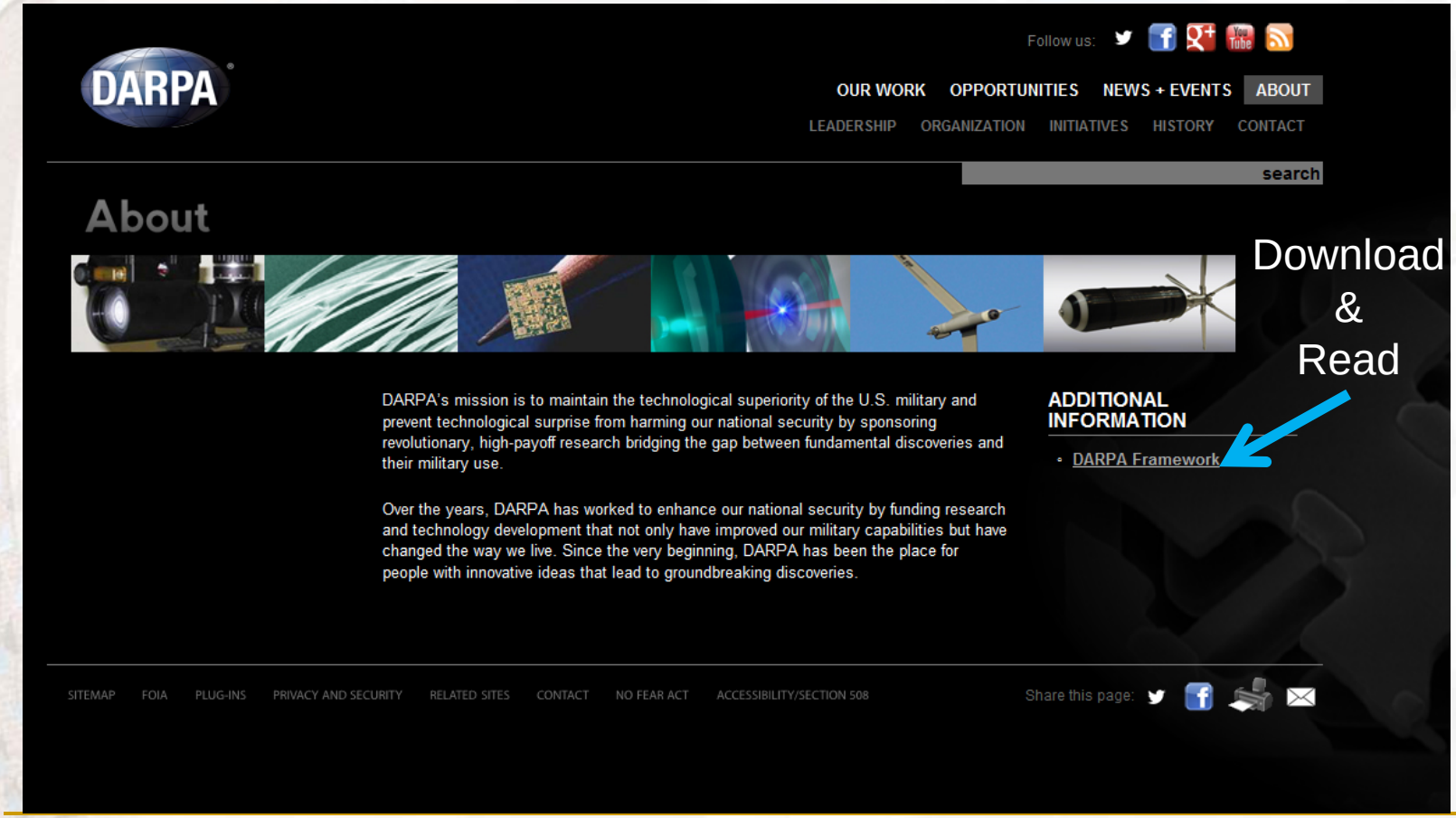

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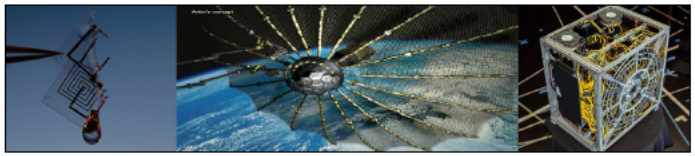

Driving Technological Surprise:
DARPA's Mission in a Changing World

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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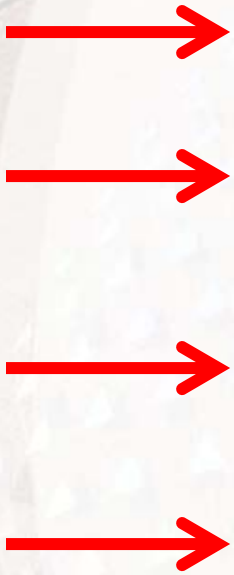
This document gives a brief history of Darpa, some of it's contributions, and the philosophy of its role and research & management style

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 rescoped 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.

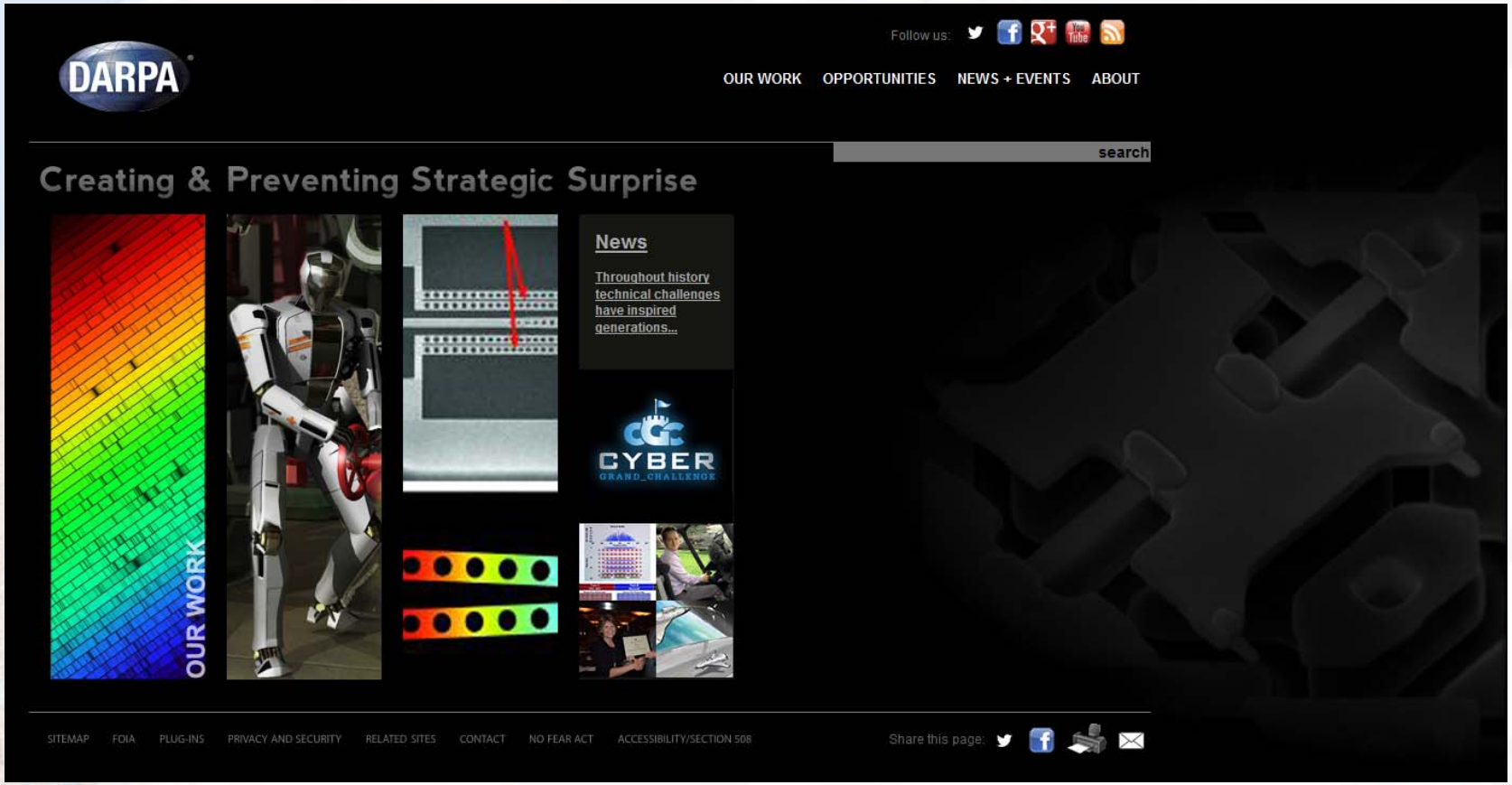
We balance the need to give our programs and performers the time and resources necessary to make progress toward our extremely challenging objectives with the need to curtail or redirect efforts that are not productive. These are judgment calls informed by data and direct interactions with the people 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 Heilmeier Catechism"
- The 'catechism' philosophy is inherent in the 'viewgraph'

http://www.darpa.mil



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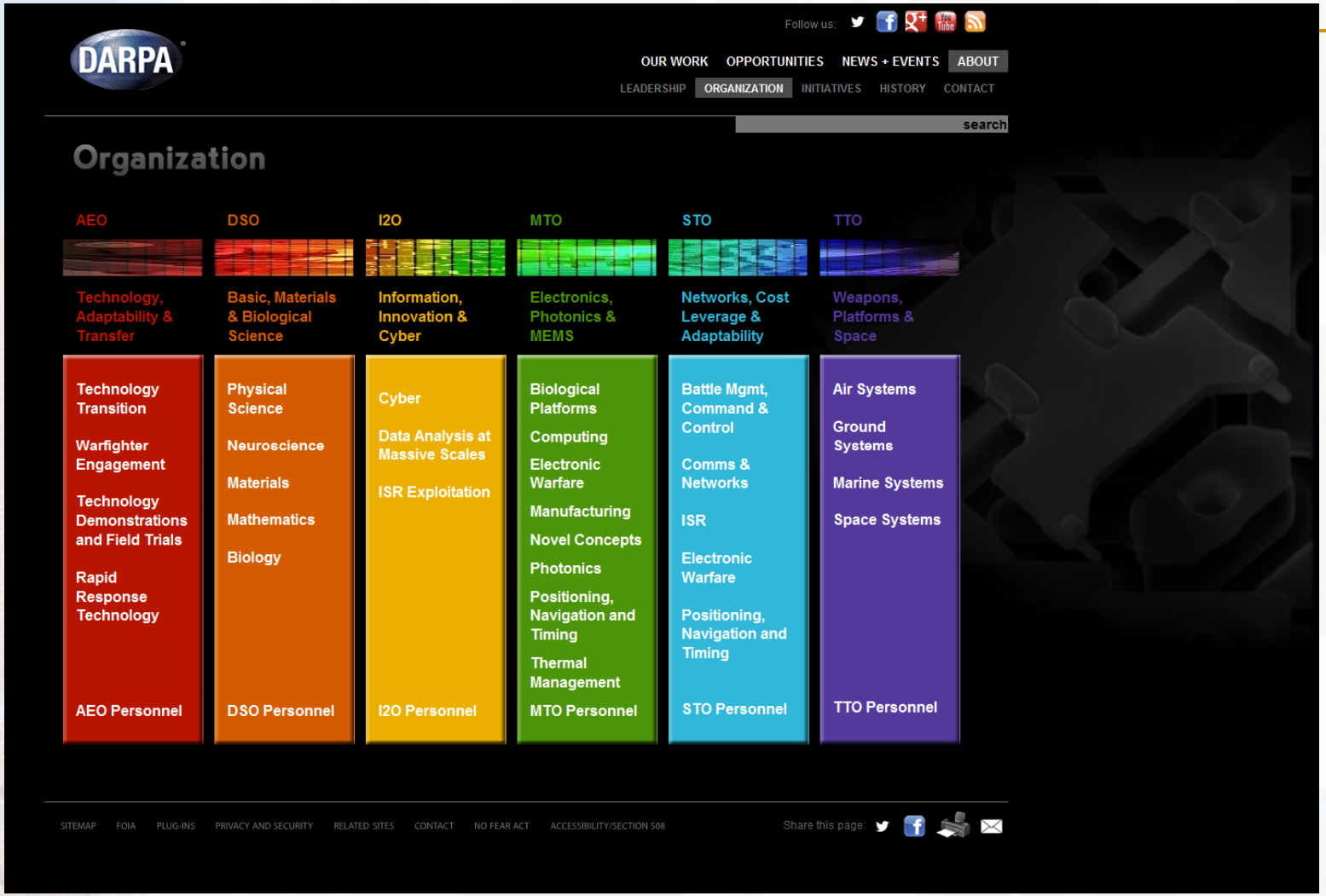
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The Darpa Offices and Their Role

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
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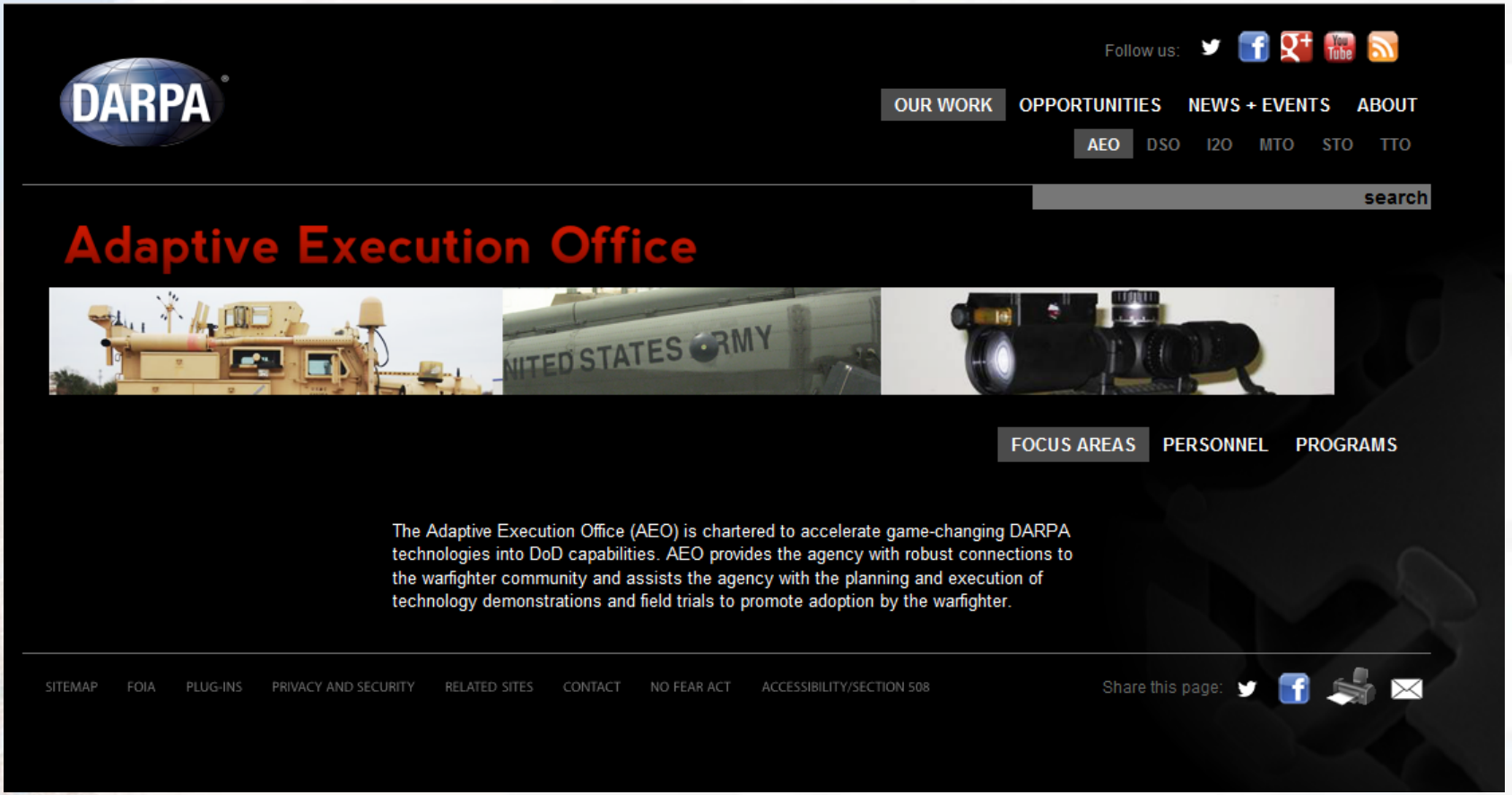
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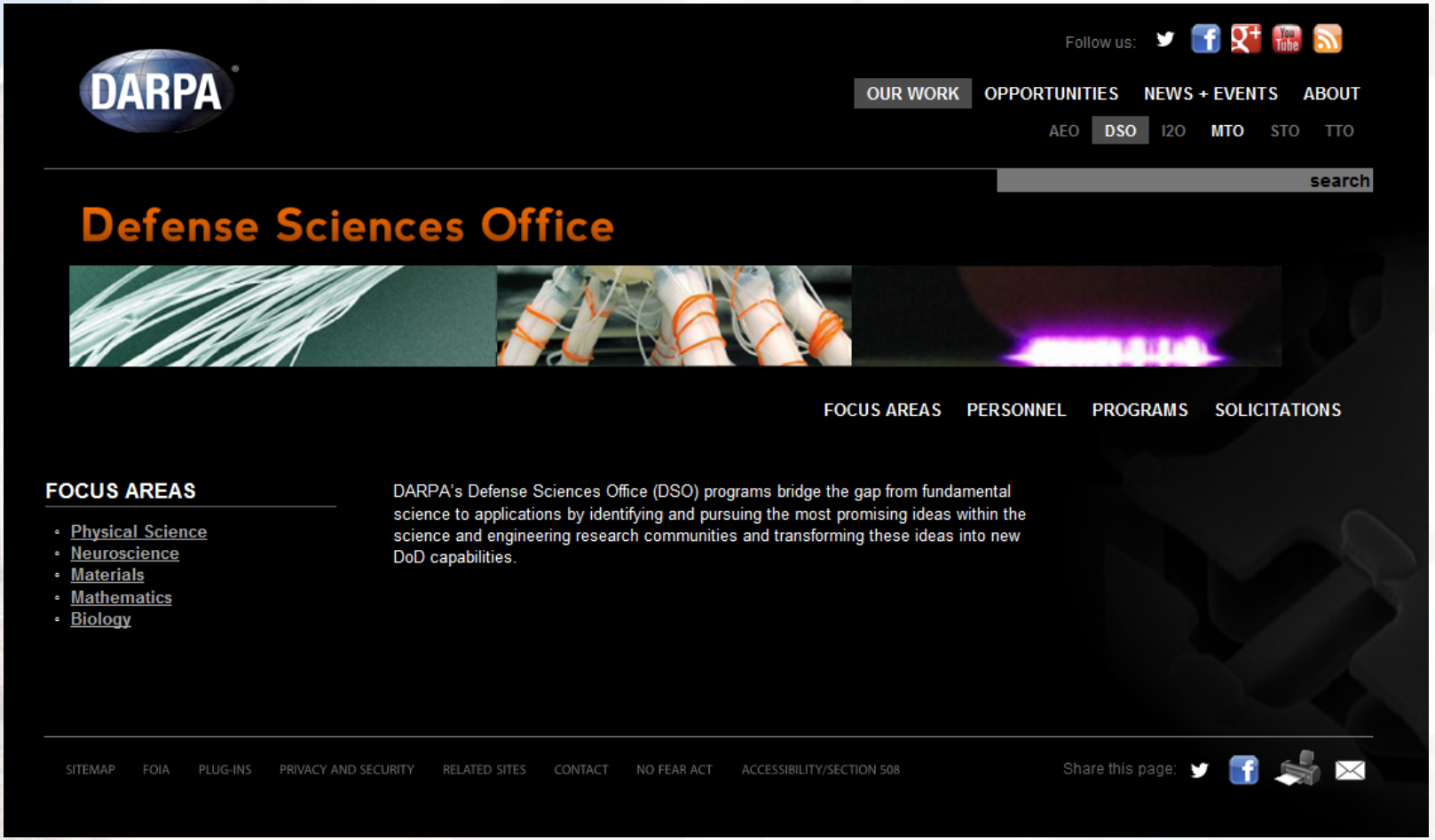

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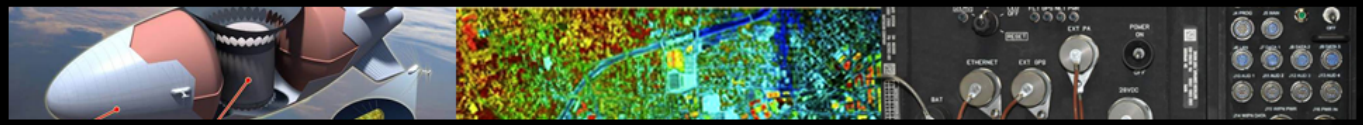
Strategic Technology Office



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FOCUS AREAS

- Battle Management, Command and Control (BMC2)
- 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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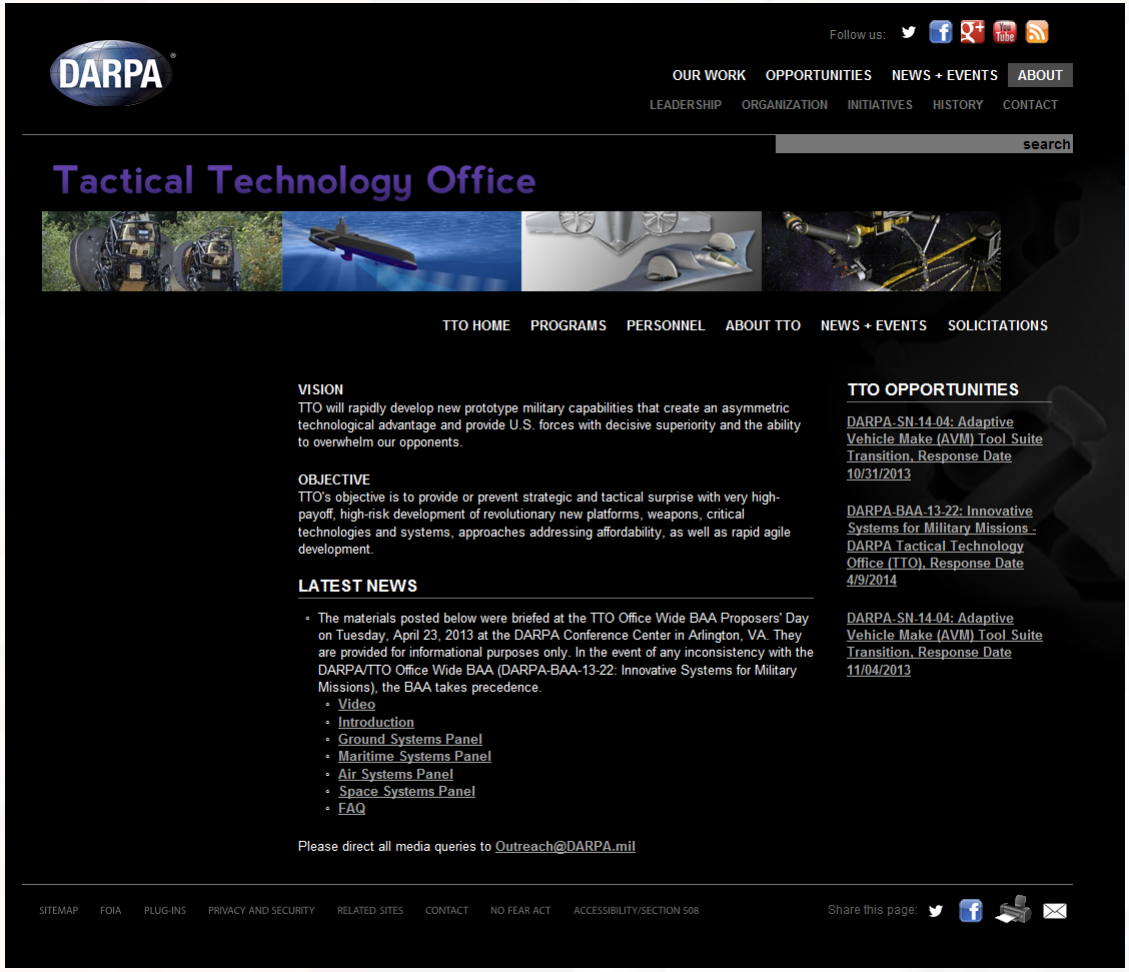

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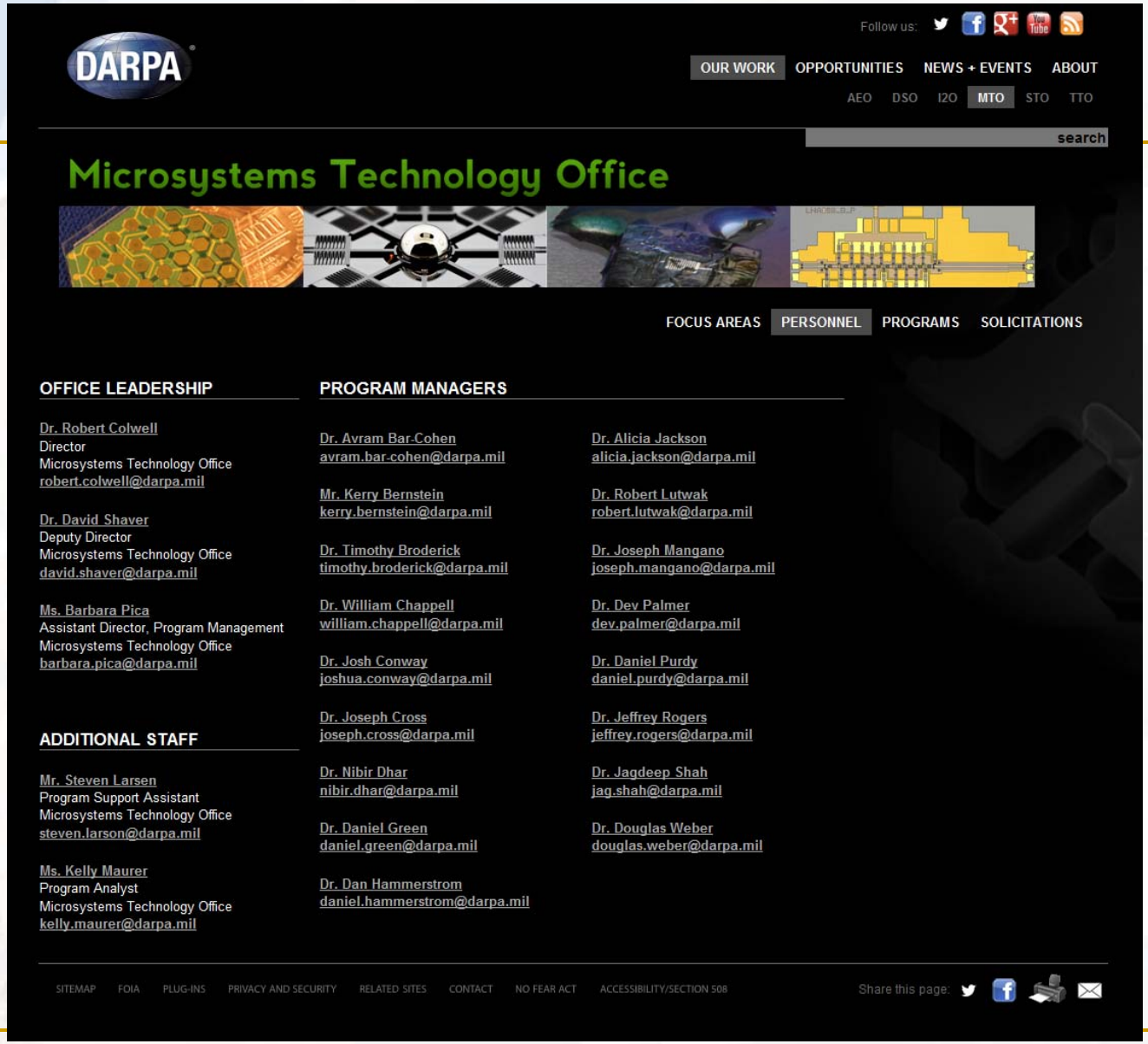

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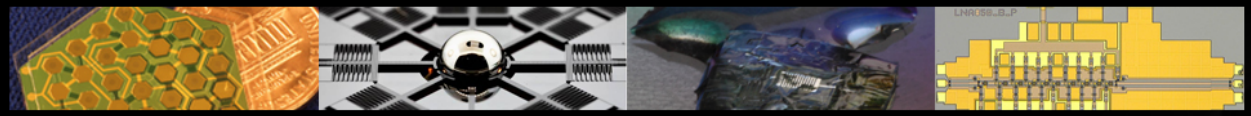

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Dr. Josh Conway

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

Long-Term Path Forward

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

Illustration

Performer(s):

Amount: $K

Duration: months

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

Relevance

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

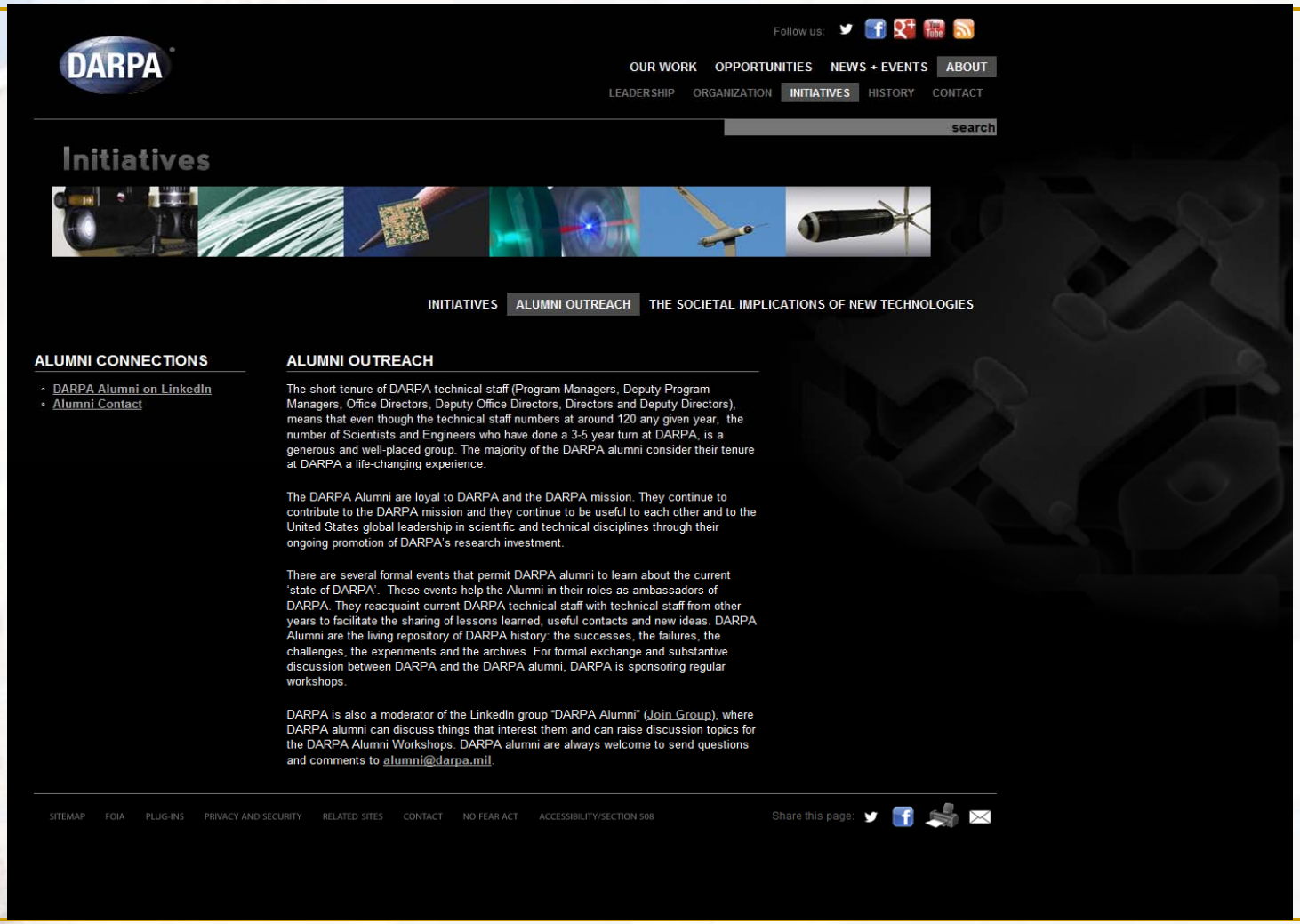
Study Metrics / Deliverables

- 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?

DARPA

The Silver Bullet

…and if all else fails, Pray!



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