Defense Advanced Research Projects Agency: Biological Technologies Office
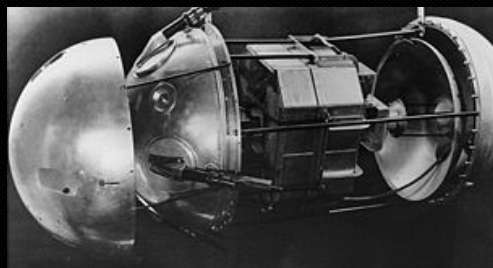
Dr. Kristen Jordan

Deputy Director

NYC Defense & Intelligence Forum

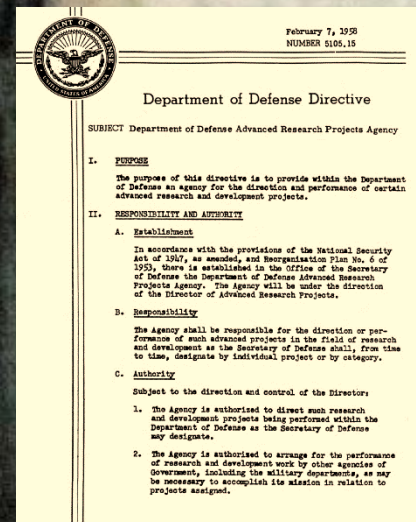6 May, 2022

October 4, 1957

U.S.S.R. beats U.S. to space with Sputnik satellite; U.S. should never again be surprised by technology.
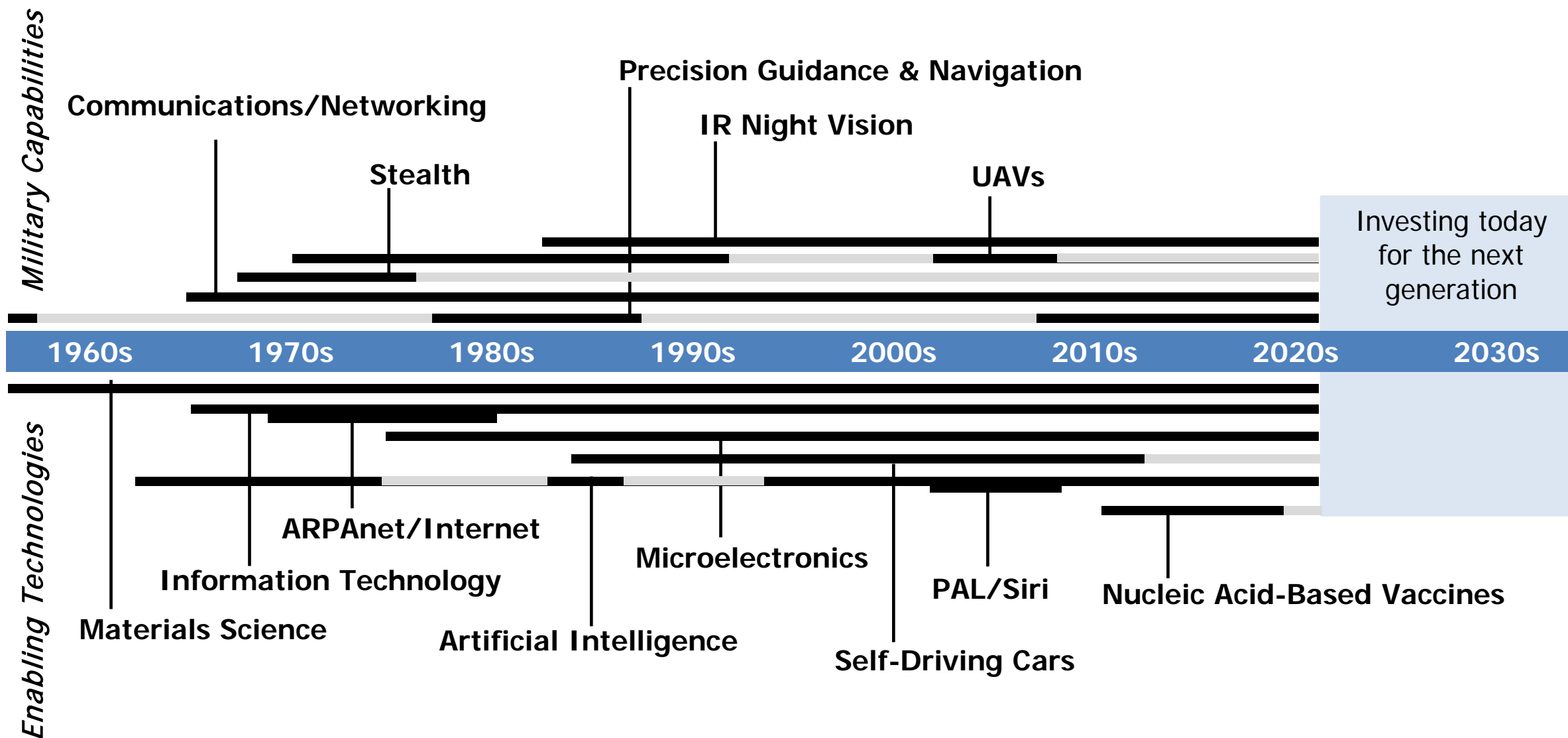

February 7, 1958

"The purpose of this directive is to provide within the Department of Defense an agency for the direction and performance of certain advanced research and development projects."

Pivotal early investments that change what's possible

Military Capabilities

Communications/Networking

Precision Guidance & Navigation

IR Night Vision

Stealth

UAVs

Investing today for the next generation

| 1960s | 1970s | 1980s | 1990s | 2000s | 2010s | 2020s | 2030s |

Enabling Technologies

ARPAnet/Internet

Information Technology

Microelectronics

PAL/Siri

Nucleic Acid-Based Vaccines

Materials Science

Artificial Intelligence

Self-Driving Cars

PEOPLE

- Exceptional technologists
- Limited tenure
- Autonomy

PROCESSES

- No in-house labs
- Metrics-based
- Programs have end-dates

CULTURE

- Drive for off-scale impact
- Risk tolerant
- Honor in public service

DARPA's culture persists and the agency delivers

- **Create breakthrough, paradigm-shifting solutions.**

- **Accept and manage significant technology risk.**

- **Disrupt or massively accelerate technology roadmaps.**

DARPA Technical Offices

BTO
### BIOLOGICAL TECHNOLOGIES OFFICE

- Biological Complexity at Scale
- Neurotechnologies
- Engineering Biology
- Restore, Maintain and Improve Warfighter Abilities

DSO
DEFENSE SCIENCES OFFICE

- Math, Modeling & Design
- Physical Systems
- Human-Machine Systems
- Social Systems

I2O
INFORMATION INNOVATION OFFICE

- Proficient artificial intelligence
- Advantage in cyber operations
- Confidence in the information domain
- Resilient, adaptable, and secure systems

MTO
MICROSYSTEMS TECHNOLOGY OFFICE

- Electromagnetic Spectrum
- Tactical Information Extraction
- Globalization

STO
STRATEGIC TECHNOLOGY OFFICE

- System of Systems (SoS)
- Battle Management/ Command and Control (BMC2)
- Communications and Networks (C&N)
- Electronic Warfare (EW)
- Intelligence Surveillance, and Reconnaissance (ISR)
- Positioning, Navigation, and Timing (PNT)

TTO
TACTICAL TECHNOLOGY OFFICE

- Redefine possible across maritime, ground, air and space Domains
- Create solutions that disaggregate, disperse, diversify, disrupt and create doubt
- Demonstrate platforms, systems, and technologies at credible scale

1. What are we trying to do?

2. How is it done today and who does it? What are the limitations of the present approaches?

3. What is new about our approach, and why do we think we can be successful at this time?

4. If we succeed, what difference do we think it will make?

5. How long do we think it will take, and what are our mid-term and final exams? How much will it cost?
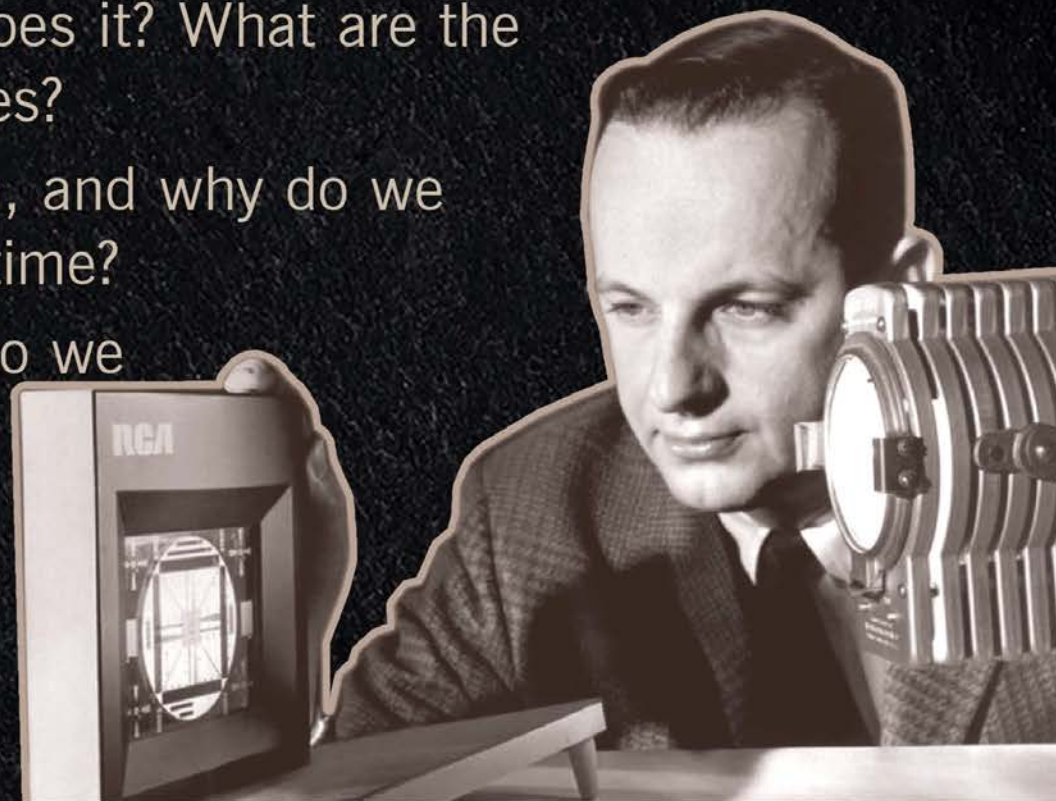
George Heilmeier
DARPA Director 1975-1977

DARPA

Create New Options for National Security Leaders

- Defend the Homeland
- Deter Adversaries
- Increase Global Stability

For All Domains

Space • Air • Land • Sea • Subsurface
Virtual • Electromagnetic • Social

YEARS	GOV EMPLOYEES	FY21 BUDGET	ACTIVE PROGRAMS	YEARS OF AVG. PM TENURE
64	185	$3.6B	250+	<5

Example Portfolios

- Assault Breaker II
- Electronics Resurgence Initiative
- "AI Next" Campaign
- Resilient Supply Chains

- Distributed Complex Systems
- Long Range Effects
- Warfighter Protection & Performance
- Cyber

- Gray Warfare
- Climate & Environment
- "In Silico"
- Transition & Business
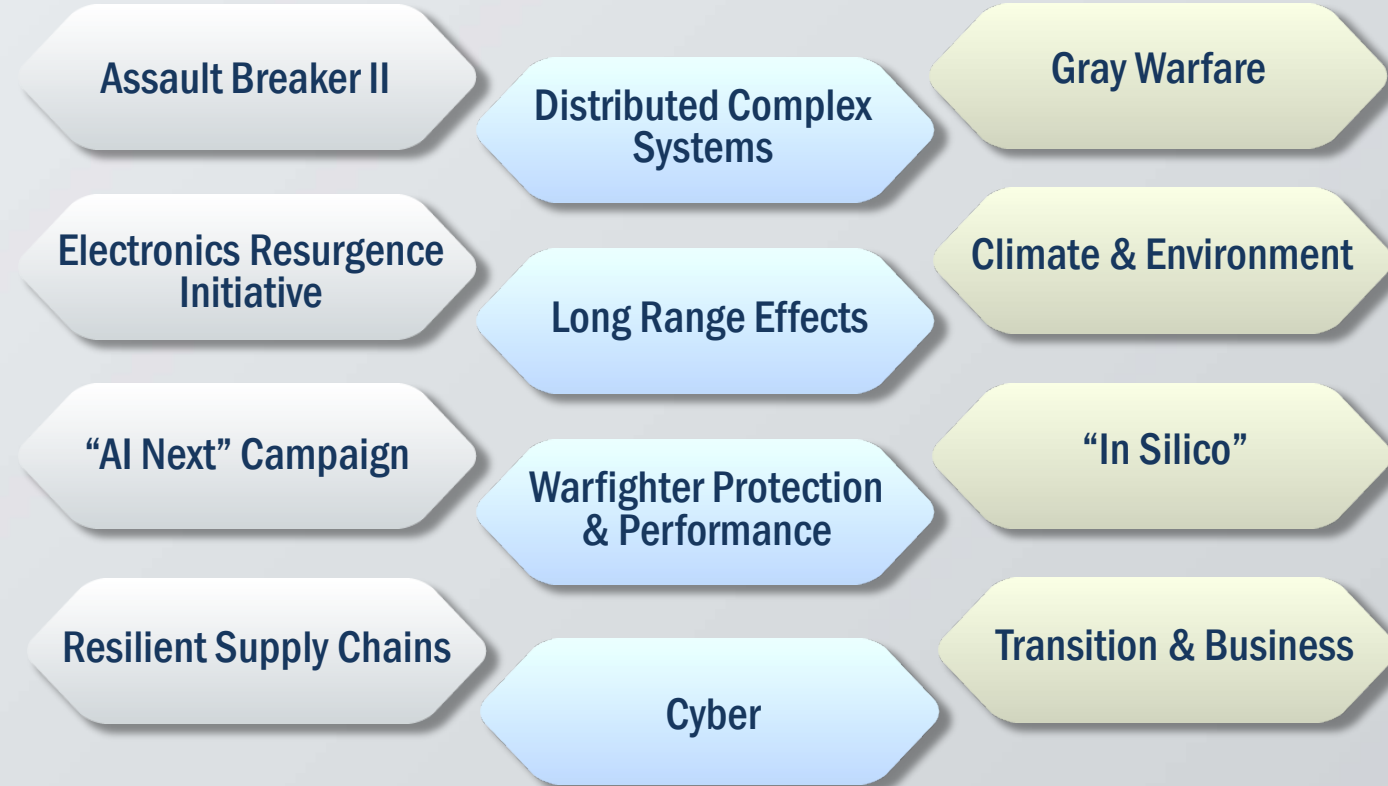
Foundations for Technological Surprise

Biotechnology • Complexity • Chemistry • Data Science
Human-Machine Symbiosis • Interoperability • Machine Learning
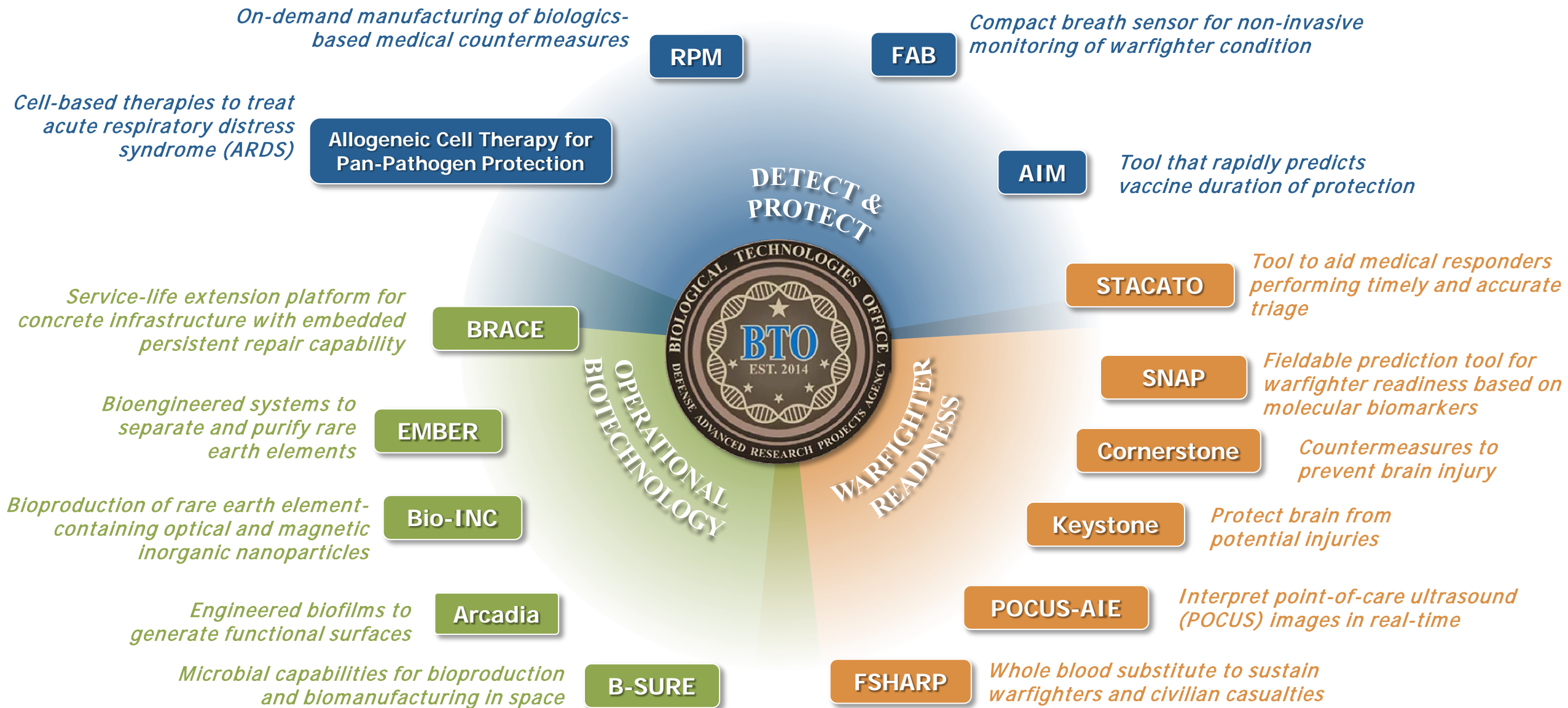Materials • Microelectronics • Quantum • Social Science …

Harnessing Biology to Support the Warfighter

BTO develops capabilities that embrace the unique properties of biology—adaptation, resiliency, complexity—to revolutionize how the United States defends the homeland and prepares and protects its Warfighters

Detection & Diagnostics - Environment

Detection & Diagnostics - Human

Environmental Resilience

Medical Countermeasures

BIOLOGICAL TECHNOLOGIES OFFICE
BTO
EST. 2014
DEFENSE ADVANCED RESEARCH PROJECTS AGENCY

Biomanufacturing & Supply Chain

Warfighter Health & Recovery

Expanded Operationalization

Neural Interfaces

DETECT AND PROTECT

OPERATIONAL BIOTECHNOLOGY

WARFIGHTER READINESS

On-demand manufacturing of biologics-based medical countermeasures — **RPM**

Compact breath sensor for non-invasive monitoring of warfighter condition — **FAB**

Cell-based therapies to treat acute respiratory distress syndrome (ARDS) — **Allogeneic Cell Therapy for Pan-Pathogen Protection**

Tool that rapidly predicts vaccine duration of protection — **AIM**

DETECT & PROTECT

BTO EST. 2014 — BIOLOGICAL TECHNOLOGIES OFFICE — DEFENSE ADVANCED RESEARCH PROJECTS AGENCY

Service-life extension platform for concrete infrastructure with embedded persistent repair capability — **BRACE**

Tool to aid medical responders performing timely and accurate triage — **STACATO**

Bioengineered systems to separate and purify rare earth elements — **EMBER**

Fieldable prediction tool for warfighter readiness based on molecular biomarkers — **SNAP**

OPERATIONAL BIOTECHNOLOGY

WARFIGHTER READINESS

Bioproduction of rare earth element-containing optical and magnetic inorganic nanoparticles — **Bio-INC**

Countermeasures to prevent brain injury — **Cornerstone**

Protect brain from potential injuries — **Keystone**

Engineered biofilms to generate functional surfaces — **Arcadia**

Interpret point-of-care ultrasound (POCUS) images in real-time — **POCUS-AIE**

Microbial capabilities for bioproduction and biomanufacturing in space — **B-SURE**

Whole blood substitute to sustain warfighters and civilian casualties — **FSHARP**

BTO Drives Ethical, Legal, and Social Issue (ELSI) Engagement to Ensure Responsible Technology Development

Goal: Flexible ELSI framework to accommodate changing technical & policy landscape

Expert Analysis and Perspective

On Neurotechnology

Review
October 17, 2019
Ethical Challenges of Risk, Informed Consent, and Posttrial Responsibilities in Human Research With Neural Devices
A Review
Saskia Hendriks, MD, PhD[1,2]; Christine Grady, RN, PhD[1]; Khara M. Ramos, PhD[2]; et al

Neuroethics Guiding Principles for the NIH BRAIN Initiative
Henry T. Greely, Christine Grady, Khara M. Ramos, Winston Chiong, James Eberwine, Nita A. Farahany, L. Syd M Johnson, Bradley T. Hyman, Steven E. Hyman, Karen S. Rommelfanger, and Elba E. Serrano
Journal of Neuroscience 12 December 2018, 38 (50) 10586-10588; DOI: https://doi.org/10.1523/JNEUROSCI.2077-18.2018

On Gene Drives

Gene Drives on the Horizon
Advancing Science, Navigating Uncertainty, and Aligning Research with Public Values

Responsible Media Engagement

DARPA DEFENSE ADVANCED RESEARCH PROJECTS AGENCY   ABOUT US / OUR RESEARCH /

Defense Advanced Research Projects Agency > News And Events > Setting a Safe Course for Gene Editing Research

Setting a Safe Course for Gene Editing Research

Safe Genes program aims to build a biosafety and biosecurity toolkit to reduce potential risks and encourage innovation in the field of genome editing

OUTREACH@DARPA.MIL
9/7/2016

Regular ELSI Meetings – Opportunity for Comment on Ongoing Efforts

Issue and Stakeholder Communication → Program Integration → Responsiveness and Transition

New Start Discussion

Ad Hoc Discussion

Event Driven Interaction

Meeting Participation

Ways to engage with DARPA

Opportunity	Audience	Topic Specificity	Timing	Duration
Program Specific Broad Agency Announcement (BAA)	General Research	Narrow	Irregular	Up to 5 years (Multiple phases)
Office-wide BAA	General Research	Broad	Rolling	~1 year
Small Business SBIR/STTR	Small Business	Narrow	Rolling	Up to 3+ years (Multiple phases)
Young Faculty Award	Tenure Track Assistant/Associate Professors	Narrow	Annual	Up to 2+ years
Transition Partner	Gov't/Commercial	Narrow	Program Dependent	Partner Dependent
Program Manager	Academia/Gov't/ Industry	Narrow	Rolling	2-4 years

Visit darpa.mil for more information

Young Faculty Award (YFA)

Identify and engage **rising stars** in junior research positions, emphasizing those without prior DARPA funding, and expose them to DoD needs and DARPA's program development process

The YFA program provides:

- Research funding
- DoD contacts
- Military visits/exercises
- PM Mentor

The YFA program yields:

- Insight into DoD problems
- Novel ideas
- Career development
- Future DARPA performers
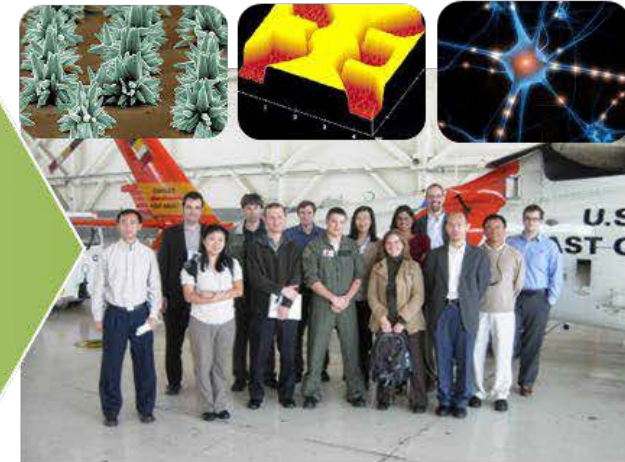
Develop the next generation of academic scientists, engineers, and mathematicians who will focus a significant portion of their career on DoD and National Security issues

www.darpa.mil