Seeds of Technological Change

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DARPA's Mission

Breakthrough Technologies for National Security

Precision Guidance & Navigation

Communications/Networking **IR Night Vision**

Stealth **Radar Arrays** **UAVs**

1960s	1970s	1980s	1990s	2000s	2010s

Microelectronics: VLSI, CAD, manufacturing, IR, RF, MEMS

ARPAnet/Internet

Information Technology: timesharing, client/server, graphics, GUI, RISC, speech recognition

Materials Science: semiconductors, superalloys, carbon fibers, composites, thermoelectrics, ceramics

DARPA's role: pivotal early investments that change what's possible

Factors Shaping DARPA Investments Today

Wide range of national security challenges: evolving nation states, shifting networks

Powerful, globally available technologies set a fast pace

Military systems' cost, pace, and inflexibility limit our operational capabilities

DARPA Technical Offices

BTO
BIOLOGICAL TECHNOLOGY OFFICE

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

DSO
DEFENSE SCIENCE OFFICE

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

I2O
INFORMATION INNOVATION OFFICE

- Empower the Human within the Information Ecosystem
- Guarantee Trustworthy Computing and Information

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

System Focus Areas:
- Ground
- Maritime
- Air
- Space

Crosscutting Themes:
- Agile development
- Cooperative Autonomy
- Unmanned Systems
- Power and Propulsion

A New Generation of Breakthrough Technologies for National Security

Rethinking Complex Military Systems	
Electromagnetic Spectrum Dominance	Fully & dynamically control the EM spectrum for communications, sensing, imaging
Position, Navigation, and Timing Beyond GPS	Deliver accuracy without dangerous reliance on GPS and enable new coherent effects
Air Superiority in Contested Environments	Architect sustainable, cost-effective air superiority over a peer adversary in 2030+
Hypersonics Capability	Prevent peer adversary sanctuary or strategic surprise
Robust Space	Establish confidence in all aspects of space operations despite new threats
Undersea Capabilities	Provide scalable effects from the undersea sanctuary
Overmatch Squad	Expand reach, situational awareness, and maneuver for strategic overmatch
Defense Against Terrorism	Create new counters for new mass terror threats
Information at Massive Scale	
Cyber Capability	Wield cyber as a military capability with confidence in our own cybersecurity
Big Data	Extract new capabilities from the data explosion and map behavior patterns at scale
Biology as Technology	
Brain Function Research	Drive and harness fundamental advances in understanding brain function
Engineering Biology	Create new classes of materials that are unattainable through today's chemistry
Outpacing Infectious Disease	Design rapid, specific diagnostics and therapeutics
New Foundations for Technological Surprise	

These focus areas are part of a broad and diverse portfolio of DARPA investments
Focus areas change over time as some succeed and graduate and others fail, and as DARPA identifies new challenges and opportunities

How we think: The Heilmeier Catechism

Important questions to consider when approaching DARPA with ideas:

- What are you trying to do? (no jargon!)
- How does this get done today?
- What is new about your approach?
- If you succeed, what difference do you think it will make?
- How long do you think it will take?
- Can your work transition (to the DoD or others)?
- How much will it cost?

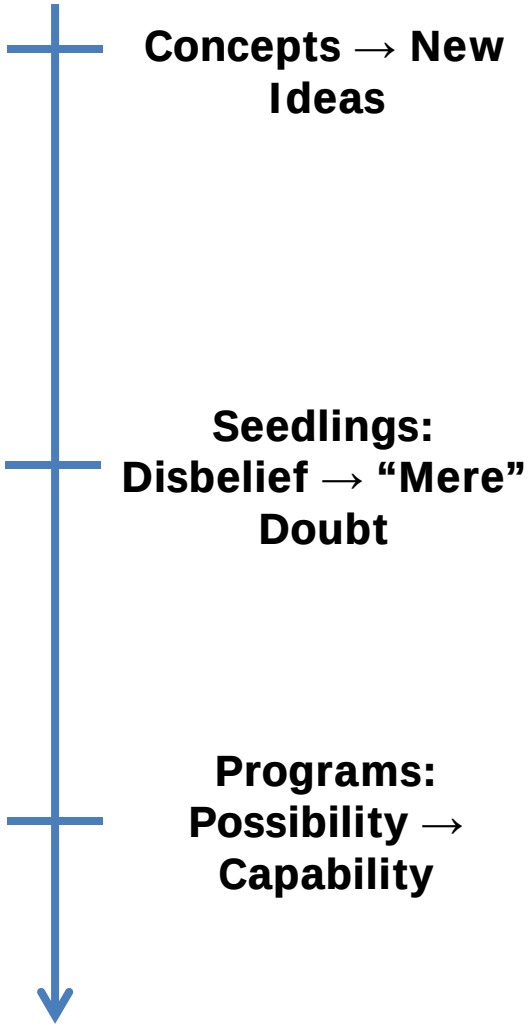
Three Ways to Engage with DARPA

Talk to a Program Manager (PM)

- Email/phone/face to face throughout the year

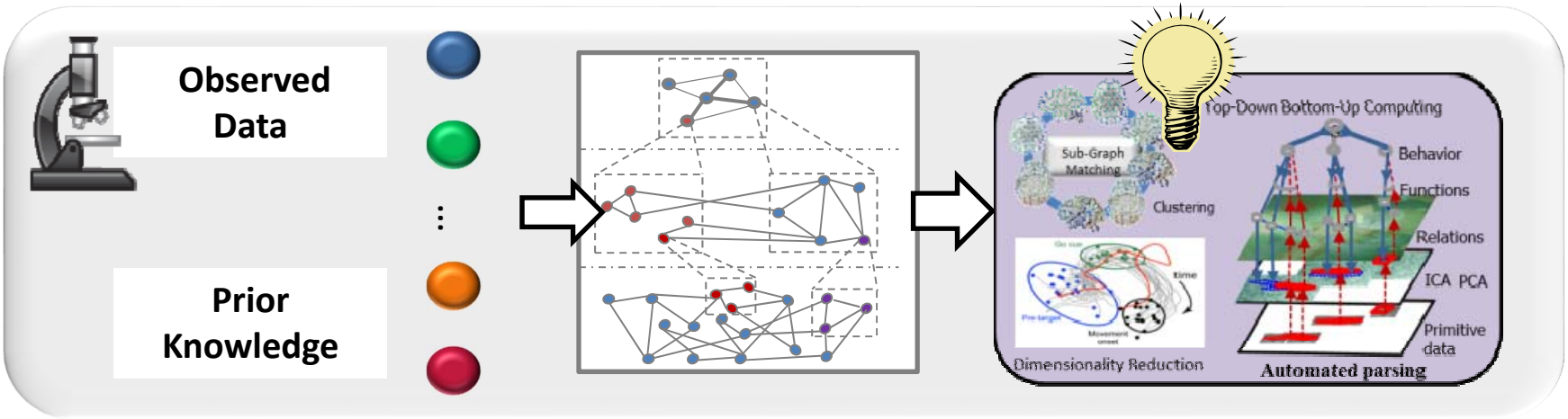
Submit ideas to an Office-Wide BAA (DSO's is BAA-15-39)

Respond to DARPA program BAAs



Example Program: Simplifying Complexity in Scientific Discovery (SIMPLEX)

Knowledge Representation



Datafication **Discovery Tools**

Mathematical framework and tools to represent diverse knowledge and enable rapid discovery and big hypothesis generation

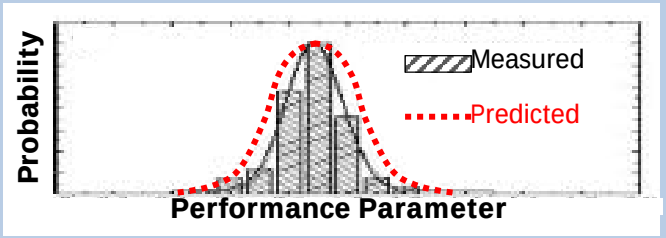
Example Program: Open Manufacturing for Advanced Material Systems (OM)

Rapid Qualification Framework

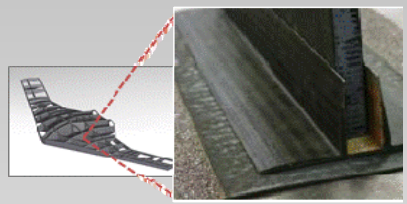
Manufacturing Informatics Methodology

Integrated Robust Computational Process Tools

Predict location-specific probabilistic performance (including tails) of manufactured parts in high fidelity



Focus Technologies



Bonded Composite Structures

Metals Additive Manufacturing

Predictable material properties and reduced qualification time through comprehensive capture, analysis, and control of manufacturing variability

Example Program: SIGMA

Goals:

City- to State-wide Area	Continuous	Intuitive/ Actionable **Automated Algorithms**
High Resolution **~1 meter, 1 Hz**	Low False Alarms	Cost-effective **$400/unit, 10k unit**

Continuous and cost-effective city-scale, network pervasive nuclear WMT detection capability

We look forward to your ideas.

www.darpa.mil

Links...

- DSO Proposers' Day slides: http://www.darpa.mil/attachments/2015DSOProposersDay_Websitefinal.pdf
- E-mail questions about the BAA to DARPA-BAA-15-39@darpa.mil
- FAQs posted under the BAA at http://www.darpa.mil/work-with-us/opportunities (filter by "DSO")
- Find PM bios and program information at https://www.darpa.mil/about-us/offices/dso

Types of BAAs

- Office-wide BAA
  - Encompasses the research focus areas of a DARPA Technical Office

- Program BAA
  - Solicits responses for a specific DARPA research program
  - Much more focused than an office-wide BAA

Seedlings vs. Programs

Seedlings

- Usually submitted through an Office-Wide BAA
- Small short duration (6-9 months) projects
- Move concepts from “disbelief” to “mere doubt”
- May lead to the next generation of program ideas

Programs

- Proposals solicited through specific DARPA program BAAs
- Often multi-year, multi-disciplinary efforts
- Technology development to move from “possibility” to “capability”