

RBC-Factory

Christopher J. Bettinger, PhD



Proposer's Day

January 7, 2025



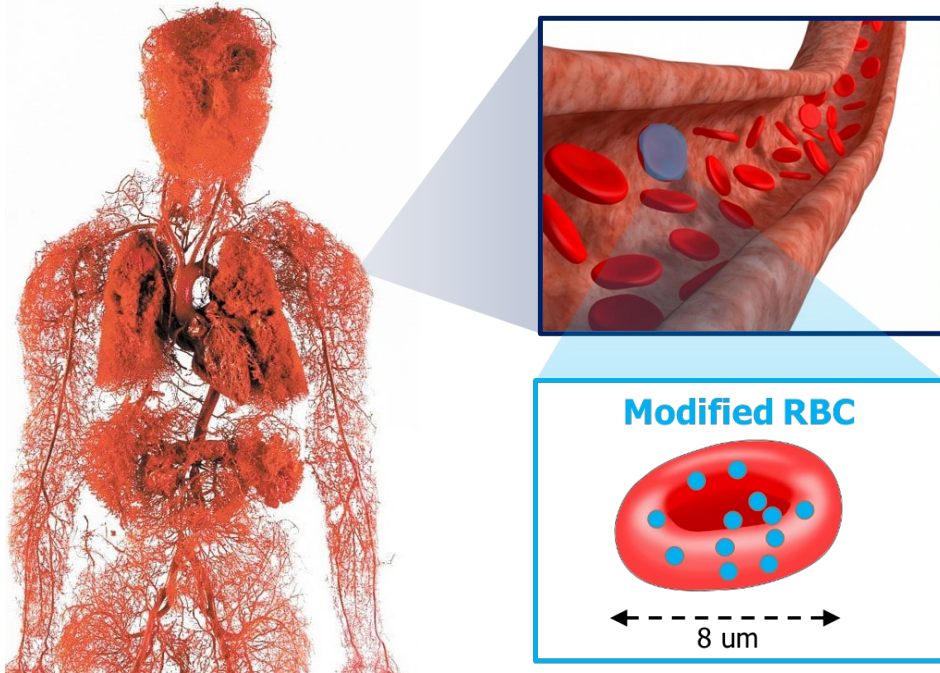


DoD Problem: Dangerous environments degrade performance and endanger warfighter health



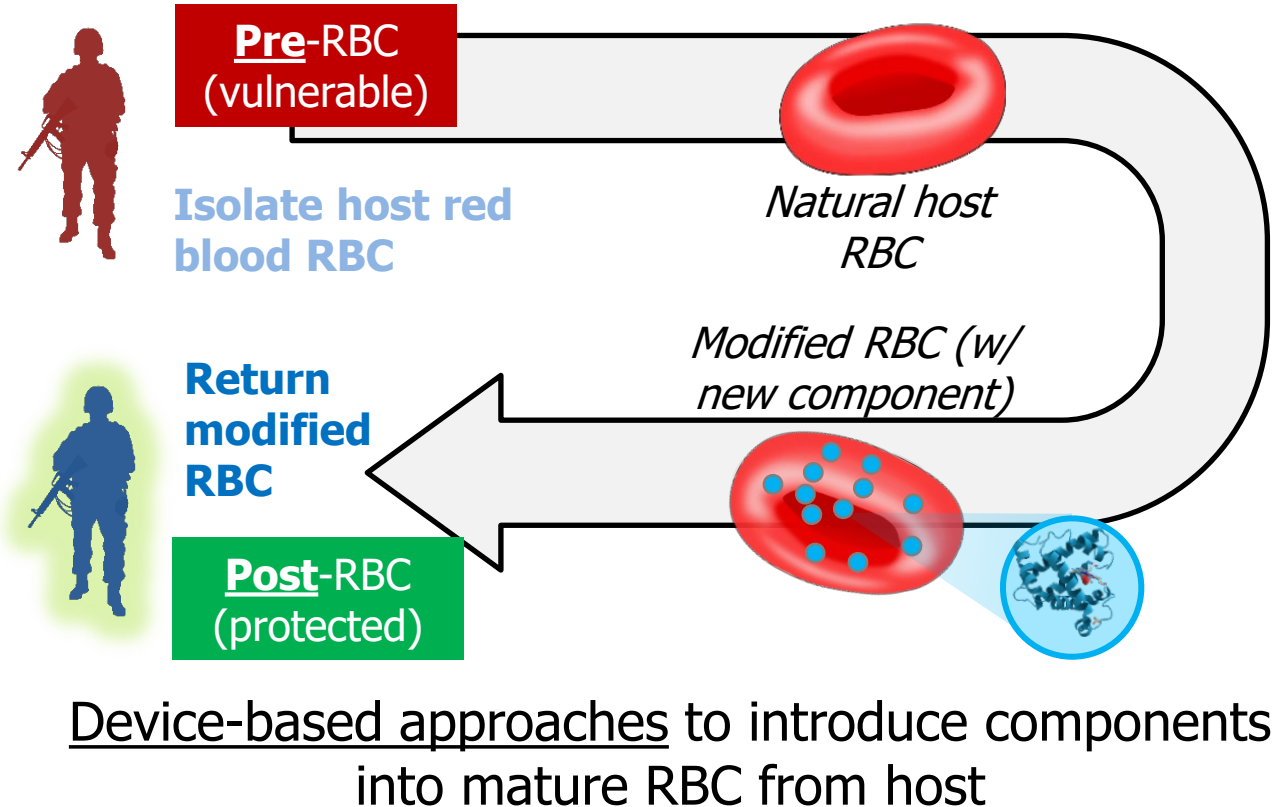
Rationale: Red blood cells (RBCs) are ideal carriers of countermeasures

RBC are abundant & persistent



The blood has ~1.5L of RBC & RBC circulate for ~120 days

Concept: Modify Host RBC



Vision: Establish the physical and biochemical limits of cargos which can be inserted into RBC via non-genetic means

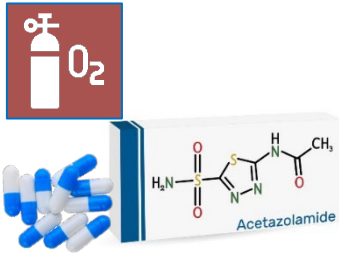
SoA: Pharmaceutical interventions (Rx) or donning personal protective equipment (PPE)

Prophylaxes or Treatments (Rx)

Hypoxia

Malaria

Extreme Cold



Diamox

Malarone

Off Label Rx

Changes tissue pH

Anti-malaria med.

Experimental only

- Only reduces symptoms
- Adherence?

- Side effects^a: dizziness & depression

- N/A

Personal Protective Equipment (PPE)

Hypoxia

Mosquitos

Arctic



O₂ masks

DEET

CTAPS

Delivers 100% O₂

Mosquito spray

Cold operations

- Consumable
- Cumbersome
- Logistical burden

- Transient
- Partially effective
- Potentially toxic

- Bulky & heavy
- Reduces operator performance

Problem: These methods have poor efficacy and burden the warfighter (physical & cognitive)

SoA – State of the Art; PPE – Personal protective equipment; Rx – Therapeutic; DEET – N,N-diethyl-meta-toluamide; CTAPS – Cold temperature and arctic protection systems

a – 10% of the population exhibits significant side effects

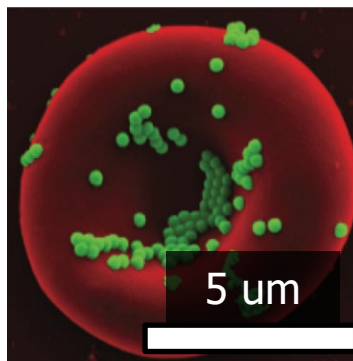
BLUF: Proteins can be attached to RBC surfaces...but they reduce circulation time & can detach

Surface modification of RBC^a

Cell “Backpacks”

- Can stably attach colloids at scale
- Flexible material compositions

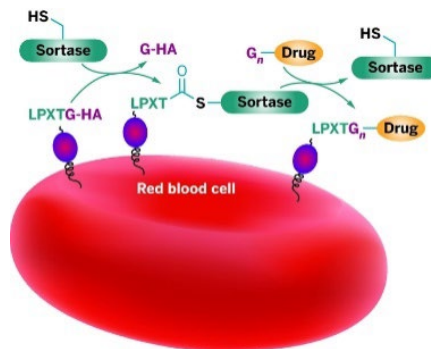
J. S. Brenner, et al. *Annu Rev Biomed Eng* **2021**



Enzymatic conjugation

- Uses enzymes to conjugate proteins & peptides on cells using chemistry

J. Shi, et al. *Proc Nat Acad Sci USA* **2014**



Key Limitations with SoA

1. **Circulation time is reduced** by >80% (~1-2 weeks)
2. **Component can detach** from the surface (shear forces or enzymes)
3. **Limited amounts** of new component can be attached
4. **Processes are not scalable** in a compelling or economically viable manner

RBC – Red blood cells; SoA – State of the Art

^a – Innovations attributed to Blood Pharming DARPA program

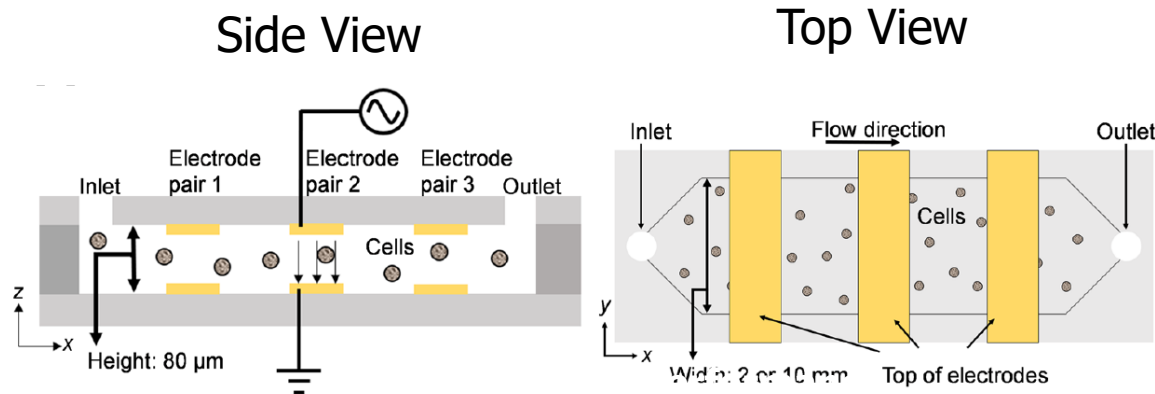
PUBLIC RELEASE

DISTRIBUTION A: Approved for public release, distribution unlimited.

BLUF: Proteins and other biologically active components can be integrated with RBC

Electrical Pore Generation

Concept: Use electric fields to temporarily permeabilize cells and introduce components



Craighead, et al. *Scientific Reports* **2023**; Craighead, et al. *Biomedical Microdevices* **2024**

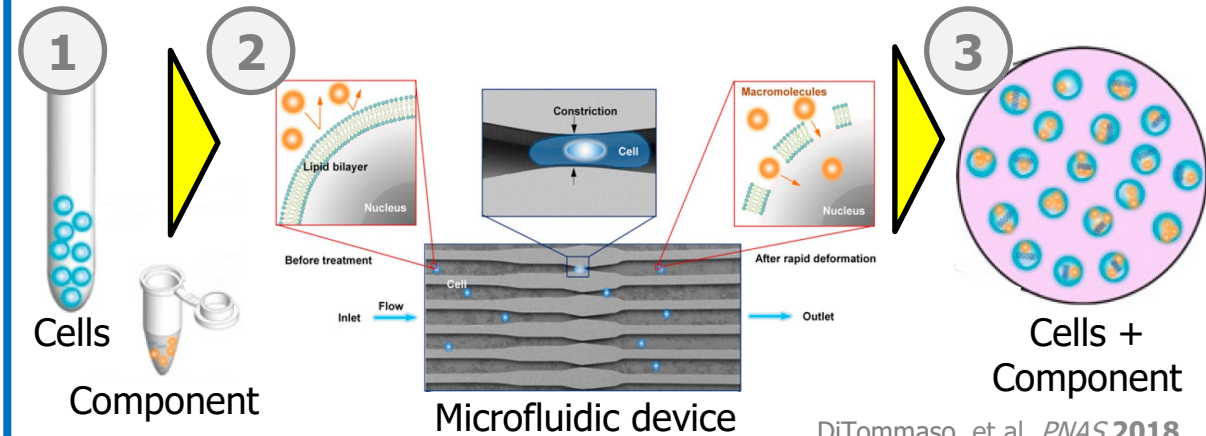
Recent Achievements

- >98% viability (vs. controls)
- >95% transfer efficiency^a
- Can process 256 million cells/min^{a,b}



Mechanical Pore Generation

Concept: Use microfluidics to permeabilize cell membranes & introduce new components



Recent Achievements

- >80% viability
- Can process 1.2 million cells/min^b
- Limited impact on cell behavior^c

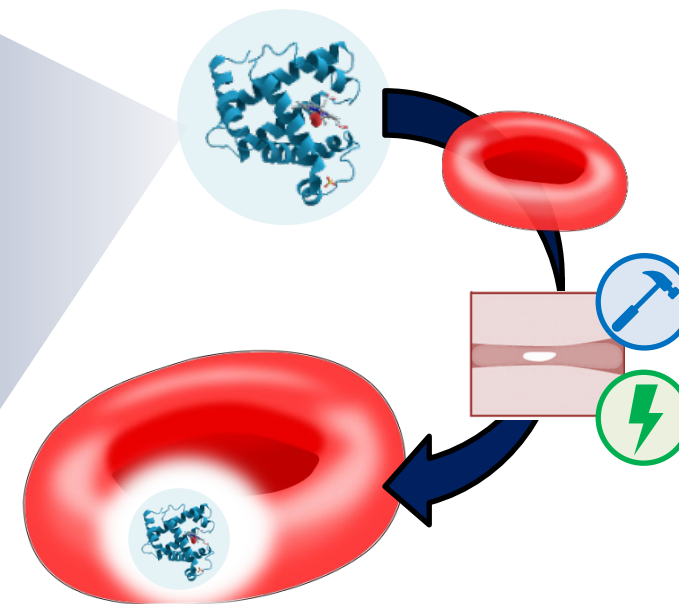
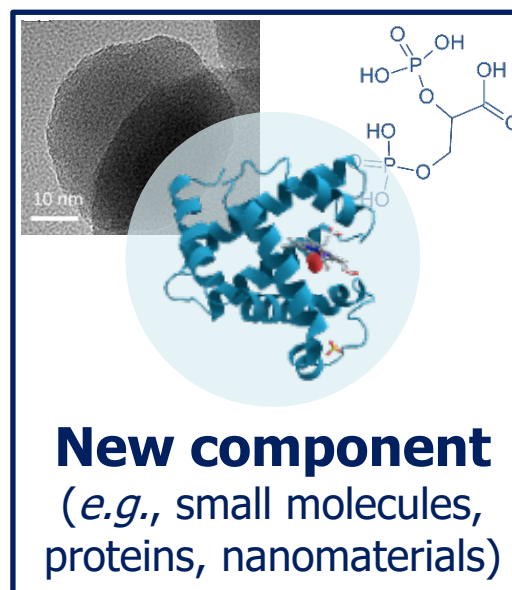


Open Scientific Questions & Key Technical Challenges

1. **How much** of the new component can we integrate into an RBC?
2. **What types** of new components can we integrate?
3. **How fast** can we integrate new components into RBC?
4. **What effect** does component integration have on RBC properties & physiology?

RBC – Red blood cells

Performer Problem Set & Design Space



- Stably integrate any protein, peptide, material into RBC
- Integrate enough component and process at scale
- Minimize impact on RBC structure & function



BLUF: The following parameters (and ranges) comprehensively describe the physical & chemical characteristics of molecules and materials to be inserted into RBC

Molecules

(compounds, proteins, & polymers)

Parameter (factor)	Symbol	Range	Units	# logs
Hydrodynamic radius	rH	[0.1, 100]	nanometers	3
Mass-to-charge ratio	m/z	$\pm[10^2, 10^4]$	kg/Coulomb	2
Molecular weight	Mw	$[10^2, 10^6]$	grams/mole	4
Hydrophobicity	$\ln[P]_{ow}$	[-1, 5]	{ }	6

Materials

(particles, nanomaterials & colloids)

Parameter (factor)	Symbol	Range	Units	# logs
Hydrodynamic radius	rH	[0.1, 100]	nanometers	3
Surface energy	g	[30, 600]	mJ/m ²	1
Mass-to-charge ratio	m/z	$\pm[10^2, 10^4]$	kg/Coulomb	2
Mass density	r	[0.1, 10]	grams/cm ³	2

RBC – Red blood cell; $\ln[P]_{ow}$ – Log of the partition coefficient between 1-octanol and water; kg – kilograms; mJ – milli-Joules

BLUF: Fractional factorization will analyze all component properties in 18 experiments*

* Taguchi L9 array can survey 4 factors across 3 levels each (low/hi end of range + 1 intermediate value) in 9 experiments

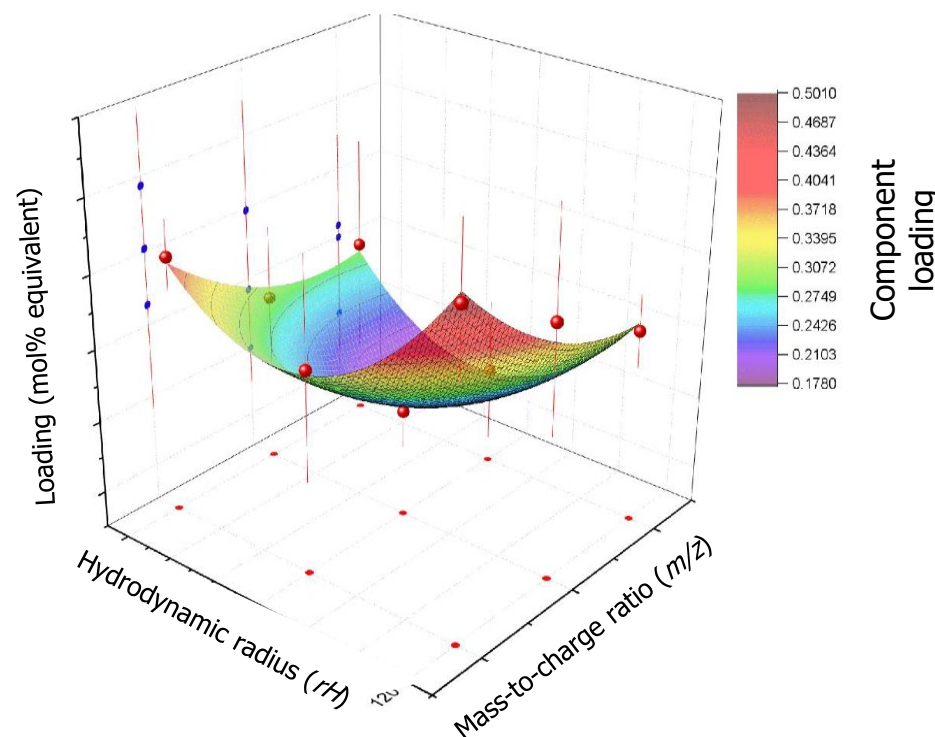
- This exercise will be repeated across (a) molecules and (b) materials (18 experiments total)
- This experimental burden is reasonable given the scope/scale of the RBC Factory timeline

DOE Input – Taguchi L9 array

Experiment Number	Column 1	Column 2	Column 3	Column 4
1	1	1	1	1
2	1	2	2	2
3	1	3	3	3
4	2	1	2	3
5	2	2	3	1
6	2	3	1	2
7	3	1	3	2
8	3	2	1	3
9	3	3	2	1

Wet lab experiments

Output – RBC loading vs. parameter



- Columns denote different factors (e.g., MW , rH)
- Three levels are represented as "1, 2, or 3"

DOE – Design of experiments; MW – Molecular weight; rH – Hydrodynamic radius



Key scientific questions that inform metrics

1. How much of the new component can we integrate into RBC?
2. What are the limitations on physical properties^a of components?
3. Can modified RBC be produced at scale?
4. Can modified RBC be biologically equivalent to host RBC?

Platform Metrics	Category	Metric	Rationale
	Component Integration	<ul style="list-style-type: none">• 8 picograms of novel component per cell^b• >95% of the component after 40 days <i>in vitro</i>	<ul style="list-style-type: none">• Introduce novel components into RBC at suitable concentrations• Show [RBC+component] is stable
	Cell Fitness & Safety	<ul style="list-style-type: none">• Circulation time: $\pm 10\%^d$• Inflammation & immunity biomarkers^c : $\pm 10\%^d$• Clotting time & hemostasis: $\pm 10\%^d$• Equivalent -omic profile to host RBC ($\alpha = 0.05$)	<ul style="list-style-type: none">• Show modified RBC are equivalent to host RBC
	Scalable Processing	<ul style="list-style-type: none">• Modify $>1 \times 10^9$ cells per minute per device^e	<ul style="list-style-type: none">• Push the limits of throughput to modify RBC at scale^a

RBC – Red blood cell; Hb – Hemoglobin

^a – See slides 6 ^b – Equivalent to >30 wt% existing Hb; ^c – e.g. Tissue necrosis factor-[alpha], C3a, C5a, etc.; ^d – Compared to natural host RBC; ^e – Cell modification module <10 cm x 10 cm x 10 cm;

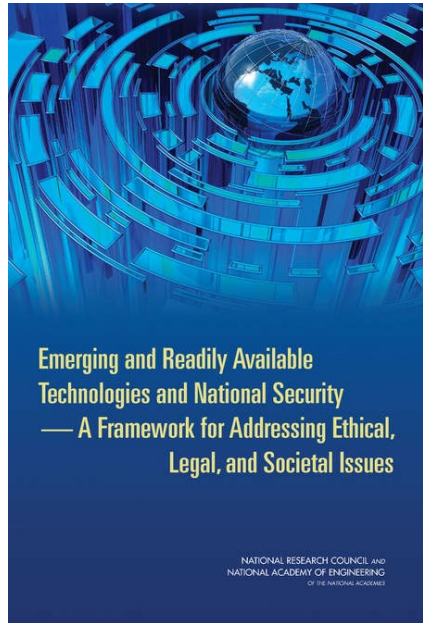


ELSI approach: Biotech countermeasure platforms



Assessing acceptance, adherence and equity impacts

Expert Analysis and Perspectives



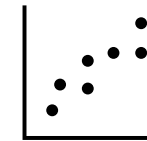
ELSI Experts



Responsible Communications

Active anticipation of perception issues

Platform Impact Assessment



Historical impact assessment



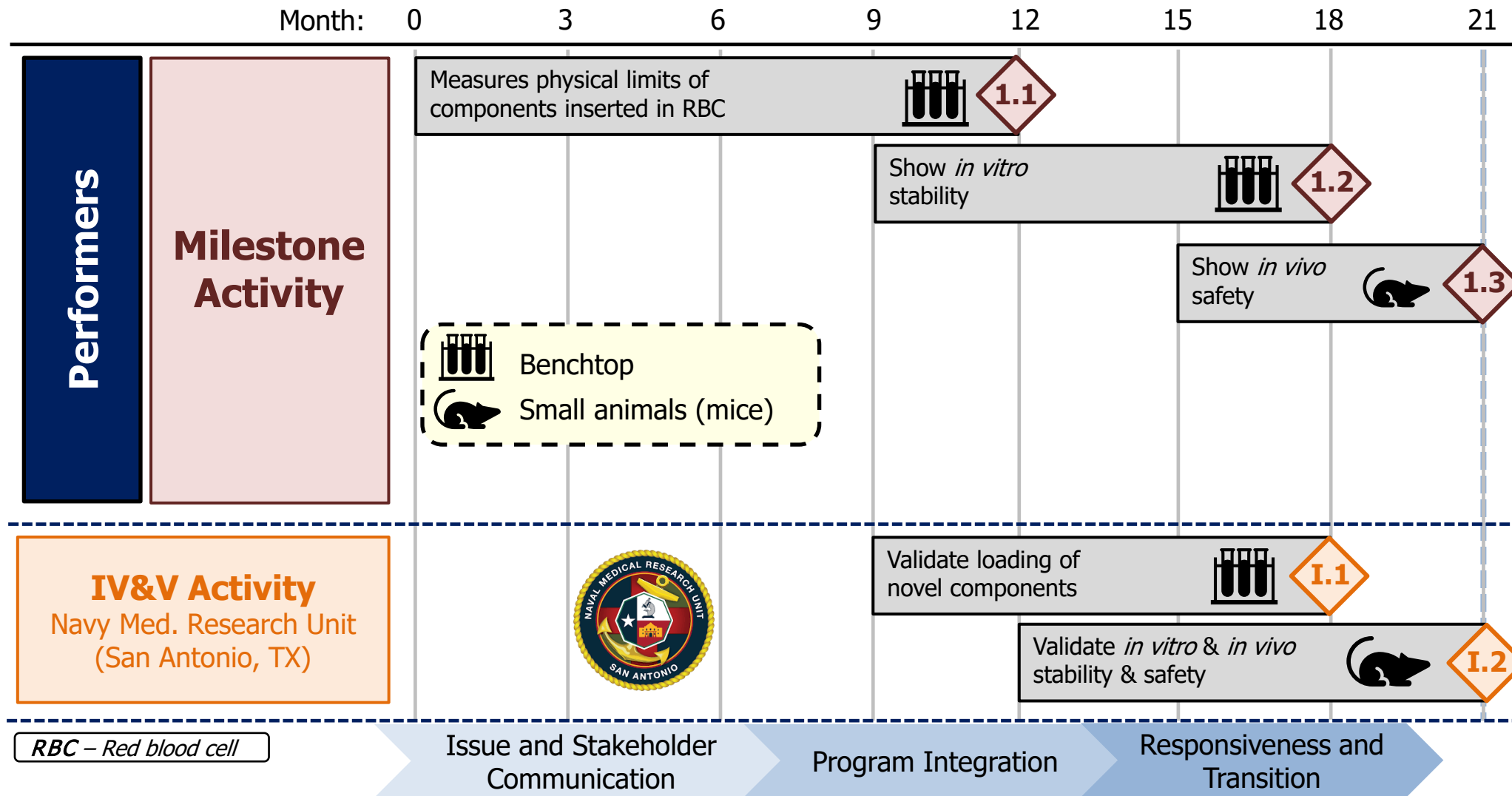
Criteria development



Stakeholder engagement



Impact assessment design





Program Logistics and Tips

Timeline and Contact Information



Open Submissions



PS Released

December 18, 2024



Proposers Day

January 7, 2024



Abstracts Due

January 28, 2025

By Invitation Only



**Invitations to
submit OPPs**

February 11, 2025



OPPs Due

March 11, 2025



**Oral Presentations
in Arlington, VA**

March 18, 2025

Critical Considerations

- The award vehicle will be an Other Transaction for Prototype (OT) with Milestone Payments
- The Oral Presentation Package (OPP) phase is by **DARPA's Invitation ONLY**

Tips for Successful Submission

- **Read the Program Solicitation (PS) carefully**
- Email questions to RBC-Factory@darpa.mil before **January 26, 2025**
- Form complete teams with comprehensive expertise & capabilities
 - Teaming is strongly encouraged
 - Industry expertise desirable
 - Teams are encouraged to have a program coordinator/project manager
 - There is no bias for teams internal to one institution or across multiple institutions, but effective communication and collaboration between teams is key



Proposal Evaluation Criteria

All Criteria Must Be Addressed



Overall Scientific and Technical Merit

Technical approach is **innovative, feasible, achievable, complete and supported by a proposed technical team** that has the expertise and experience to accomplish the proposed tasks



Potential Contribution and Relevance to the DARPA Mission

DARPA's mission is to **make pivotal early technology investments that create or prevent strategic surprise** for U.S. National Security



Cost Realism

Costs are realistic for the technical and management approach and **accurately reflect the technical goals and objectives** of the solicitation.



Schedule Realism

The proposed schedule aggressively pursues performance metrics in the **shortest timeframe and accurately accounts** for that timeframe. The proposed schedule **identifies and mitigates** any potential schedule risk.



Additional Requirements

All Requirements Must Be Addressed



Data sharing

Proposers **must include the description of a plan to share information with DARPA, RBC Factory IV&V teams and U.S. Government stakeholders**

Animal Care and Use Review Office (ACURO)

All United States Department of Defense (DoD) funded research involving laboratory animals **must be reviewed for compliance with Federal and Department of Defense (DoD) Animal Care and Use Review Office (ACURO)** and approved by the Office of Research Protections (ORP).

You will not be allowed to initiate animal work until you receive approval from the Animal Care and Use Review Office (ACURO).

Ethical, Legal, and Societal Implications (ELSI)

Proposers should address potential ethical, legal, and societal implications of the proposed technologies. Program developments will be discussed with a **panel of expert external advisors** with expertise in bioethical issues, including human gene modulation.



Contracting (CMO) and Program Solicitation (PS)

Doing Business with DARPA

RBC-Factory

Doing Business with DARPA

Lydia Richards
Contracting / Grants / Agreements Officer
DARPA Contracts Management Office

January 27, 2025





RBC-Factory (RBC-F) - Doing Business with DARPA

- Program Solicitation (PS) is posted at SAM.gov
- Pay attention to due dates (first page) and special instructions (Section 4)
- Award Instrument Type - Other Transaction (OT) for Prototype Agreement
- Important Dates:
 - Posting Date: December 18, 2024
 - Proposers Day: January 7, 2025
 - Questions Due Date: January 10, 2025, 11:59 PM Eastern Time
 - Abstracts Due Date and Time: January 28, 2025, 12:00 PM Eastern Time
 - Oral Proposal Package (OPP) Due Date and Time: March 11, 2025, 12:00 PM Eastern Time
 - Oral Proposal presentations: March 18, 2025



Other Transaction (OT) Authority

- The Government reserves the right to award an **OT for Prototypes under 10 U.S.C. § 4022**, or make no award at all.
 - Not a Request for Proposal (RFP)- FAR Part 15 does not apply
 - Not a Broad Agency Announcement (BAA)- FAR Part 35 does not apply.
-
- OT Authorities were created to give DOD the flexibility necessary to adopt and incorporate business practices that reflect commercial industry standards and best practices.
 - OTs can help encourage streamlined and cost effective project design and execution.
 - OTs foster building of new relationships and collaboration in innovative arrangements.
 - DARPA's use of an OT is to attract companies, traditional and non-traditional, to effectively negotiate business terms outside the FAR/DFARS based government acquisition process.



Use of OTs for Prototype

- 10 U.S.C 4022 (d) (1) permits DARPA's OT authority to be used only when one of the following conditions are met:
 - (A) There is at least one nontraditional defense contractor or nonprofit research institution participating to a significant extent in the prototype project;
 - (B) All significant participants in the transaction other than the Federal Government are small businesses (15 U.S.C. 638)) or nontraditional defense contractors;
 - (C) At least one third of the total cost of the prototype project is to be paid out of funds provided by sources other than the Federal Government; or
 - (D) The senior procurement executive for the agency determines in writing that exceptional circumstances justify the use of a transaction that provides for innovative business arrangements or structures that would not be feasible or appropriate under a contract, or would provide an opportunity to expand the defense supply base in a manner that would not be practical or feasible under a contract.



"Non-Traditional" Defense Contractor

10 U.S.C 3014 Non-Traditional Definition:

- nontraditional defense contractor, with respect to a procurement or with respect to a transaction authorized under section 4022 of this title, means an entity that is not currently performing and has not performed, for at least the one-year period preceding the solicitation of sources by the Department of Defense for the procurement or transaction, any contract or subcontract for the Department of Defense that is **subject to full coverage under the cost accounting standards** prescribed pursuant to section 1502 of title 41 and the regulations implementing such section. To be considered as participating to a significant extent, the proposal should substantiate that the effort being performed by the nontraditional defense contractor is critical to the technical success of the project
- Participating to a significant extent or Significant Contribution means – The contribution causes a material reduction in the cost or schedule or increase the performance of the prototype. The nontraditional performer is responsible for a key component, technology or process without which the prototype cannot be successfully developed (ie, on the critical path).



Acquisition Strategy

- RBC-Factory is using a modified acquisition approach to lower the administrative burden of entry, reduce program risk, foster competition, and have performing teams get to work quickly.
- Will be soliciting independent abstract submissions for RBC-Factory (21 months).
- A subset of submitted abstracts will be invited to submit Oral Proposal Packages and give oral presentations of their proposals. Selected proposers may be awarded an Other Transaction (OT) for Prototype Agreement. DARPA has approximately \$18.1M total for performer awards and anticipates making multiple awards.



Abstracts

- Abstracts are **REQUIRED**. Proposers must submit an abstract in response to this solicitation to be eligible to participate in the next acquisition step.
- The Government Evaluation Team will review submitted abstracts and invite selected performers to submit an Oral Proposal Package and give an Oral Presentation. Oral Proposal Packages **MAY NOT** be submitted without an invitation from DARPA.
- **Carefully review:** Goals/ metrics, Schedule of Milestones and Payments, required abstract content, evaluation criteria, and templates.
- Monitor SAM.gov for potential PS amendments and Frequently Asked Questions.



Oral Proposal Package / Oral Presentations

- Oral Proposal Packages **MAY NOT** be submitted without an invitation from DARPA.
- To expedite the award process, pay additional attention to the Cost Spreadsheet (Attachment D) and following Model OT for Prototype Agreement attachments:
 - Attachment 1: Task Description Document (Statement of Work for OTs), Describe the work that is being done; can use the Schedule of Milestones as a guide.
 - Attachment 3: Schedule of Milestones and Payments – complete PS Attachment E
 - Attachment 5: Equipment
- Oral Presentations (40 min, 20 min Q&A) are planned to take place in the Washington, DC area. Virtual presentations are possible.
- After the oral presentations, DARPA will make a determination as to which proposers may be asked to participate in the program.
- Carefully read the PS – Proposer Submissions that fail to comply with all requirements of the PS and/or subsequent proposal instructions may be deemed non-conforming and may be removed from consideration.
- Monitor SAM.gov for the final PS posting and potential amendments prior to proposal submission.



Teaming & Eligibility Information

- All responsible sources capable of satisfying the Government's needs may submit a proposal that shall be considered by DARPA.
- Non-U.S. organizations and/or individuals may participate to the extent that such participants comply with any necessary nondisclosure agreements, security regulations, export control laws, and other governing statutes applicable under the circumstances.
- Government agencies/labs & FFRDCs are highly discouraged from proposing against this solicitation as awards to UARCs or FFRDCs will only be made by exception. UARCs and FFRDCs interested in this solicitation, either as a prime or a subcontractor, should contact the Agency Point of Contact (POC) listed in the Overview section prior to the proposal (or abstract) due date to discuss potential participation as part of the government team or eligibility as a technical performer.
- Organizational Conflicts of Interest
 - DARPA policy: Without prior approval or a waiver from DARPA, a contractor cannot simultaneously provide scientific, engineering, technical assistance (SETA) or similar support (A&AS) and also be a technical performer.
 - Must address in your proposal if providing SETA or similar support to any DARPA technical office(s) through an active contract or subcontract.



Proposal Review-Awards Process

- No common Statement of Work – Abstracts and Oral Proposals are evaluated on individual merit and relevance as it relates to the stated research goals/objectives rather than against each other.
- Upon review of Abstracts, the Government may elect to invite all, some, or none of the proposers to submit Oral Proposal Packages.
- Oral Proposals will be evaluated for strengths and weaknesses relative to the criteria published in the PS.
- **The final evaluation criteria and oral proposal instructions will be included with the invitation to present an oral proposal. Evaluation criteria in instructions may very slightly from what is published in the PS.**
- Government anticipates making multiple awards.
- The DARPA contracting office will contact the selected performers and begin the negotiation process.



Competition Sensitive Information

- DARPA policy is to treat all submissions as competition sensitive, and to disclose their contents only for the purpose of evaluation.
 - Restrictive notices notwithstanding, during the evaluation process, submissions may be handled by support contractors for administrative purposes and/or to assist with technical evaluation.
 - All DARPA support contractors performing this role are expressly prohibited from performing DARPA sponsored technical research and are bound by appropriate nondisclosure agreements.
 - Input on technical aspects of the proposals may be solicited by DARPA from non-Government consultants/experts who are strictly bound by the appropriate non-disclosure requirements.



- DARPA reserves the right(s) to:
 - Fund proposals in phases (aka options) for continued work at the end of one or more of the phases
 - Remove proposers from award consideration should the parties fail to reach agreement on award terms, conditions and cost/price
- The DOD can issue follow-on production efforts for projects directly relevant to the capability it wants to acquire or develop.
- The DARPA mission is to get capability into the hands of the warfighter, and we believe an OT is the best vehicle to deliver that mission.

RBC-Factory (RBC-F) Doing Business with DARPA

Program Solicitation (PS) Inbox and Submission

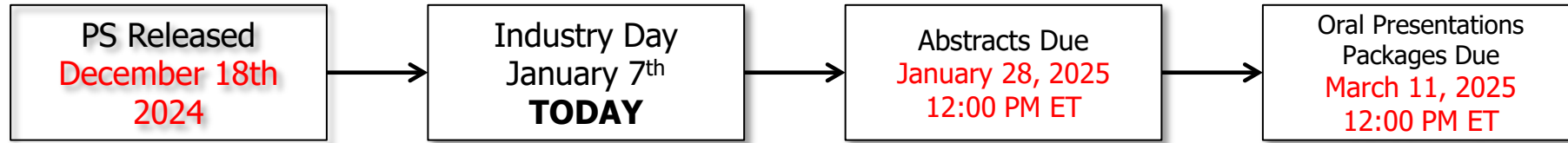
David Swan III
PS Coordinator
DARPA Biological Technologies Office

January 7, 2025





RBC-Factory Program Solicitation (PS) Timeline



TIPS

- Pay close attention to submission **deadlines / times**
 - Abstract submissions are REQUIRED
 - Only abstract proposers invited by DARPA to submit an Oral Proposal Package (OPP) and participate in oral presentations are eligible to provide one
- Formation of complete teams with comprehensive expertise and capabilities is viewed as critical
 - Teaming is strongly encouraged
 - Teams are encouraged to have a project manager/integrator

Take advantage of today's opportunities to meet potential teammates



Program Solicitation (PS) Inbox and Q&A

Direct **ALL** questions and communications to the PS Inbox: RBC-Factory@darpa.mil

Dr. Bettinger, any member of his team, or the PS Inbox **cannot provide feedback or guidance on any aspect of your proposal; they can only clarify the content of the RBC-F PS**

DARPA will update the RBC-F Q&A on a regular basis. The RBC-F Q&A can be found on the DARPA Opportunities web page

<https://www.darpa.mil/research/programs/rbc-factory>

All **questions must be submitted at least 3-5 days prior** to the abstract submission deadline in order to guarantee a response



Example Q&A

Q: Do we have to submit a proposal abstract?

A: It is important to note that proposers must submit an Abstract in response to this PS to be considered for participation in the RBC-F program. Only abstract proposers invited by DARPA to participate in the oral presentations are eligible to provide one.

Q: Does DARPA anticipate awarding Cooperative Agreements or Procurement Contracts under?

A: No. The Government will review all oral presentations and selected proposers may be awarded an Other Transaction (OT) for Prototype agreement not to exceed \$8M.

Q: Our team intends to utilize an approach that modifies cell surfaces to achieve the RBC-F goals. Would this be of interest to DARPA?

A: No. See Section 1.2.4.B. of DARPA-PS-25-08 for a list including additional technologies that are not of interest and therefore considered out of scope for the RBC-F program.



Read the Program Solicitation (PS) **over and over again, and follow all instructions carefully**

A conforming proposal addresses **all aspects** of the PS

- Pay attention to “**must**”, “**should**”, “**shall**”, and “**all**” in the PS
- Nonconforming abstracts may not be evaluated

DO NOT try to **shoehorn ongoing, but not applicable, work into the PS**

DO NOT submit a **rewritten USDA, NIH, or NSF abstract**

DO NOT propose to do anything that is **not directly relevant to the PS**

DO NOT submit **an irrelevant or incomplete abstract** in the hope we’ll invite it anyway

A proposal abstract is **REQUIRED**



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Opportunities**

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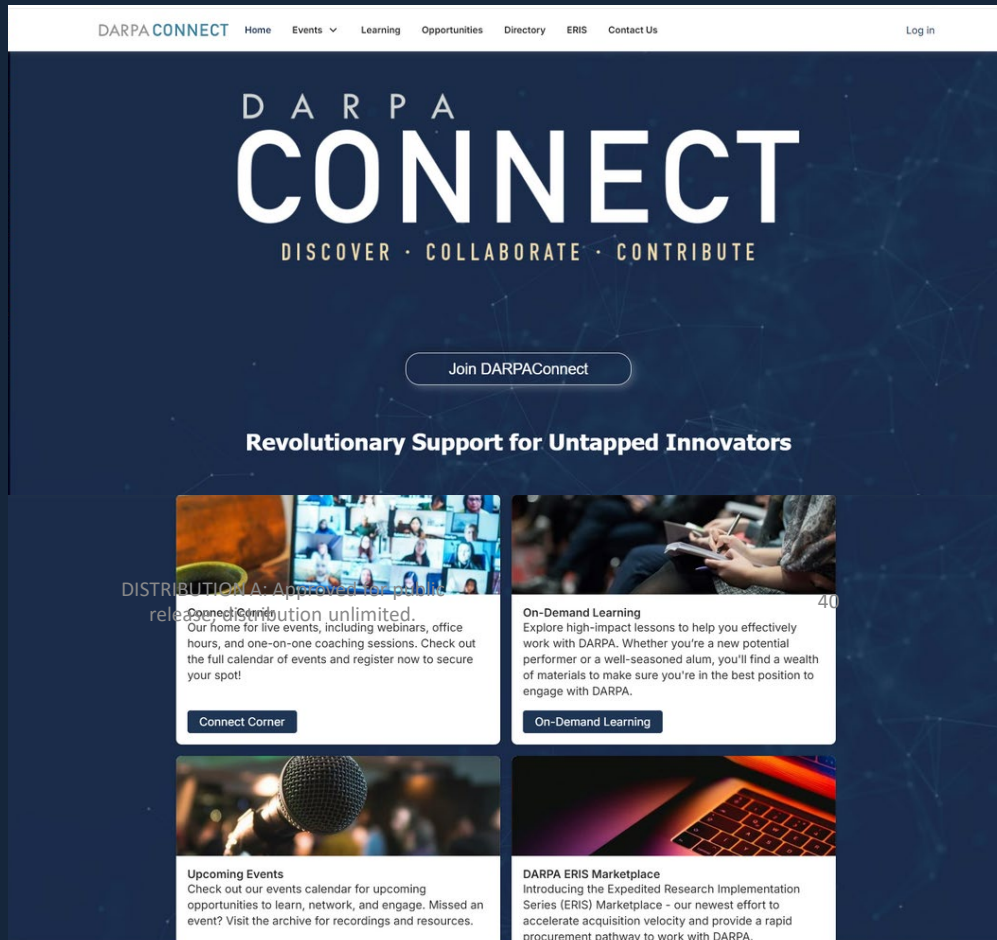
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The screenshot shows the DARPAConnect website homepage. At the top is a navigation bar with links: DARPACONNECT, Home, Events, Learning, Opportunities, Directory, ERIS, Contact Us, and a Log in button. The main header features the text 'DARPA CONNECT' in large white letters, with the tagline 'DISCOVER · COLLABORATE · CONTRIBUTE' below it. A central button reads 'Join DARPAConnect'. Below this is the section 'Revolutionary Support for Untapped Innovators'. The page is divided into four content blocks: 'Connect Corner' (with a video call image and text about live events), 'On-Demand Learning' (with an image of people working and text about lessons), 'Upcoming Events' (with a microphone image and text about the events calendar), and 'DARPA ERIS Marketplace' (with a laptop image and text about the Expedited Research Implementation Series).

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Our home for live events, including webinars, office hours, and one-on-one coaching sessions. Check out the full calendar of events and register now to secure your spot!

On-Demand Learning
Explore high-impact lessons to help you effectively work with DARPA. Whether you're a new potential performer or a well-seasoned alum, you'll find a wealth of materials to make sure you're in the best position to engage with DARPA.

Upcoming Events
Check out our events calendar for upcoming opportunities to learn, network, and engage. Missed an event? Visit the archive for recordings and resources.

DARPA ERIS Marketplace
Introducing the Expedited Research Implementation Series (ERIS) Marketplace - our newest effort to accelerate acquisition velocity and provide a rapid procurement pathway to work with DARPA.



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- Engaging DARPA Program Managers
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- Understanding DARPA Announcements and Contract Vehicles
- Reviewing and Analyzing a DARPA Opportunity
- DARPA SBIR and STTR Program
- Understanding DARPA Security Resources
- Preparing Your DARPA Proposal
- Tying It All Together: Strategies for Success
- Opportunities for Networking



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DARPAConnect Curriculum

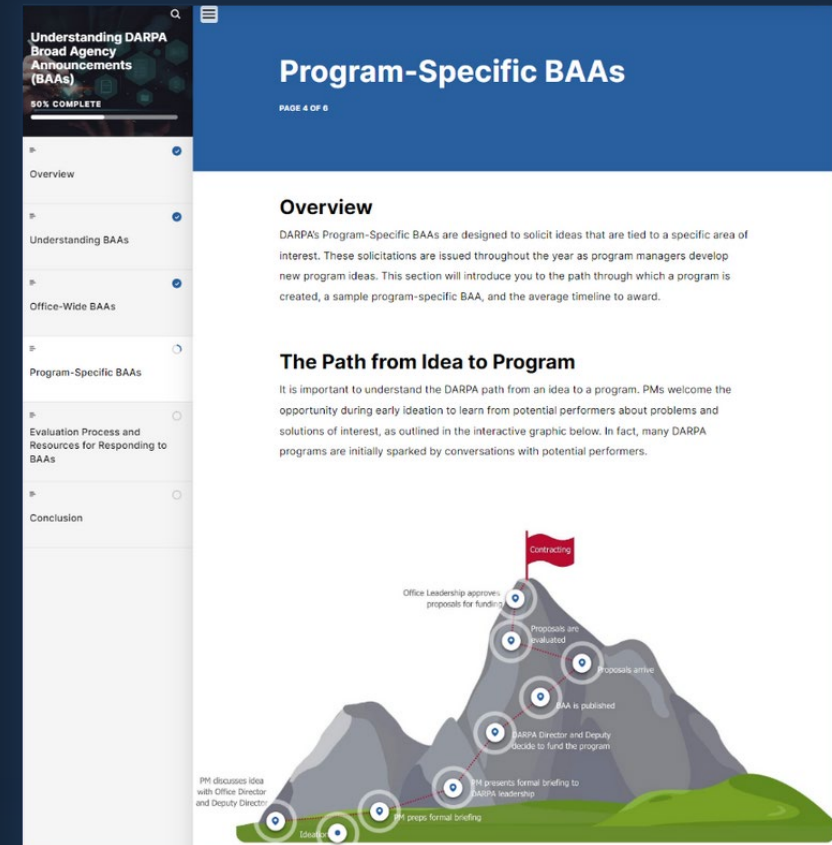
Lessons Include:

- Understanding BAAs
- SBIR/STTR
- DARPA 101
- DARPA Award Vehicles & Solicitations
- Proposal Tips
- Preparing for Proposers Day
- Heilmeier Catechism
- Engaging DARPA Program Managers
- Becoming a PM
- DARPA Innovation Fellows
- Introduction to Security
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Connect Corner

Webinars

Online sessions that offer a unique opportunity to learn about the mechanics of working with DARPA directly from DARPA presenters.



Ask Me Anything

An open forum where participants send in their questions and DARPA presenters answer them in a group setting



One-on-One Coaching

30-minute private session where participants introduce their research interests and explore how they may fit at DARPA



Office Hours

10-minute sessions during which participants ask specific questions about working with DARPA in a private setting



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NAVIGATE THE DARPA ENTERPRISE

We offer a one-stop-shop to
navigate the changes and
opportunities at DARPA



ENGAGE PROGRAM MANAGERS

Identify and engage PMs
whose research interests
⁴⁴
align with your research



SPEAK THE HEILMEIER

Frame your ideas using
DARPA's Heilmeier
Catechism

NOT FOR QUESTIONS SPECIFIC TO AN OPEN BAA.



Thank You.

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Ethical, Legal, and Societal Implications

Intro to ELSI (Ethical, Legal, and Societal Implications)

Kerry Leehan, PhD

*Slides based on Dr. Rebecca Crootof's work
as the DARPA 2024 Visiting ELSI Scholar*

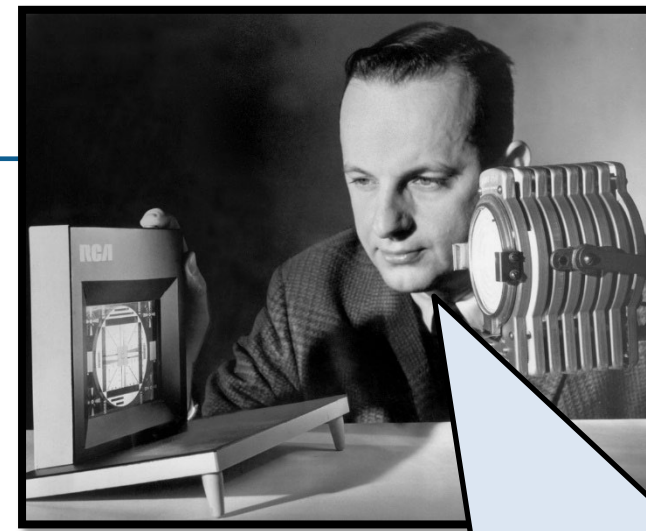
Briefing prepared for RBC-Factory Proposer's Day

January 7, 2025





- What is ELSI?
 - Improving research by identifying unknowns, anticipating consequences, and acting proactively to maximize benefits and minimize risks
- DARPA's "Year of ELSI" goals
 - Make explicit what is already happening implicitly
 - Expand the ways we think about programs and their impacts
 - Internalize the ELSI mindset



What are you trying to do?

How is it done today, and what are the [ethical/legal/social/technological] limits of current practice?

Who cares? If you are successful, what [ethical/legal/social/technological] difference will it make?

What are the risks?



Engagement to ensure safety and equity for military and civilian populations

Expert Analysis & Perspective

ELSI Performer Embeds

Proposers are encouraged to integrate their own experts into their proposed teams to collaborate with DARPA's ELSI experts, including dedicated resources for activities with the DARPA team.

Independent ELSI Group Members

ELSI Group members would not be eligible to propose as an interdisciplinary team member. Group will not be finalized until after teams have been selected for negotiation.



- **What are the benefits and opportunities?**
 - What does it facilitate or enable, alone or in combination with other technologies? In the near term? In the long term?
 - Who enjoys the benefits?
 - What technological/design choices promote the benefits?
- **What are the drawbacks and risks?**
 - What does it facilitate or enable, alone or in combination with other technologies? In the near term? In the long term?
 - How might it be foreseeably misused?
 - Who experiences the risks and harms?
 - What technological/design choices minimize/eliminate the drawbacks?
- **What unknowns are anticipated?**
 - How can program structure and interdisciplinary teams mitigate the risks of unknowns?



- **Be curious!**
 - We're not answering questions today – we're identifying them. And there are undoubtedly more that we didn't identify.
 - Goal is to promote an ELSI mindset for the duration of the program.
- **Determine which (if any) opportunities you want to maximize or risks you want to alleviate via program design decisions.**
- **Determine which (if any) unknowns you want to evaluate during the program lifecycle and consider what data you could collect.**
- **Become more comfortable with stating, explaining, and documenting your design choices in light of ELSI considerations.**

What are *your* takeaways?

Identify 1-3 takeaways from this discussion that will inform your program or design choices going forward.



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