# **BEST: BioElectronics to Sense and Treat**

Industry Day February 19, 2025

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#### **DoD Problem**: In Large Scale Combat Operations, wound infections will overwhelm care capabilities. As a result, many wounded will not return to operations, will suffer poor outcomes, will die



#### Infected vs. Non-Infected Wounds:

- Derails healing (debilitating, multiple complications)
- Requires orders of magnitude more resources to treat (provider workload, materials, logistics, \$\$\$)

Program Vision: Smart trauma bandages that eliminate wound infections



## **Caregiver Multiplier**

# Forward-Deployable Self-Contained Automatically, Continually:

• **Predict** if a wound will heal on its own

#### • Prescribe, Deliver, Regulate treatments that:

- prevent infection
- resolve infections
- account for variations in host response

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DoD Need to Prevent and Treat Wound Infections

Infected vs. Non-Infected Wounds: Derails healing (debilitating, multiple complications) Requires orders of magnitude more resources to treat (provider workload, materials, logistics, \$\$\$)

"Extremity trauma is the most common battlefield injury, resulting in a high frequency of combat-related extremity wound infections. [...] these infections are associated with substantial morbidity and may impact wounded warriors long after initial hospitalization."

Petfield, et al, 2022 MILITARY MEDICINE, 187, S2:25

"Infectious complications after combat trauma can be disastrous, resulting in amputation, loss of function, or death. Particular attention to infection control is required to <u>avoid preventable infections</u>."

Yun, et al., 2017 Curr Trauma Rep 3:315–323



## Infected vs. Non-Infected Wounds: Derails healing (debilitating, multiple complications) Requires orders of magnitude more resources to treat (provider workload, materials, logistics, \$\$\$)

"The management of these [wound] infections may be complex, requiring **prolonged hospital stays** and use of combinations of multiple antibiotics. Current antimicrobial treatment options are limited and **during prolonged antibiotic therapy, soldiers are potentially exposed to multi-organ toxic effects.** These toxic effects, as well as treatment failure are common, leading to increased morbidity and mortality in these patients. The total resources for inpatient treatment and **multiple re-hospitalizations associated with infection can run into the millions of dollars and puts a significant additional burden on medical professionals and the patient**."

Masini, B. D. et al., 2011 Rehospitalization After Combat Injury. Journal of Trauma and Acute Care Surgery 71



DoD Need to Prevent and Treat Wound Infections



#### Perfect Storm

Need <u>forward deployable prevention and treatment</u> capabilities for as soon as possible after injury

- More & faster return to operations
- Better outcomes
- Reduce downstream impact to OCONUS and CONUS health care systems

OEF: Operation Enduring Freedom OIF: Operation Iraqi Freedom A2/AD: Anti-access/area denial MDRO: Multidrug-resistant organisms antibiotic



## BEST Vision and Goals

The BEST program seeks to address the DoD need for improved wound infection management technologies by developing **bioelectronic systems** that are

- wearable
- automated

that can

- predict and prevent a wound infection before it can occur
- eliminate an infection that has already taken hold



## BEST Vision and Goals

The BEST program seeks to address the DoD need for improved wound infection management technologies by developing **bioelectronic systems** that are

- wearable
- automated

that can

- predict and prevent a wound infection before it can occur
- eliminate an infection that has already taken hold

Because wound infections initiate at the time of injury and can take hold before medical evacuation in combat conditions, these technologies need to be designed for use on the **battlefield** to have the greatest impact.



To achieve this vision BEST performers will develop novel smart bandages comprised of wound **SENSOR** and **TREATMENT** modules

# **SENSORS: high-resolution** and provide **real-time**, **continual monitoring of wounds** based on, for example, assessments of the microbial community and/or host signatures in the wound bed.



To achieve this vision BEST performers will develop novel smart bandages comprised of wound **SENSOR** and **TREATMENT** modules

**SENSORS: high-resolution** and provide **real-time**, **continual monitoring of wounds** based on, for example, assessments of the microbial community and/or host signatures in the wound bed.

Data from these **SENSORS** will be used to **predict if a wound will fail to heal due to infection, determine the presence and state of infection,** and **regulate** the **administration of targeted treatments by closedloop control** to prevent a predicted infection or to resolve an existing infection so that the wound heals.



To achieve this vision BEST performers will develop novel smart bandages comprised of wound **SENSOR** and **TREATMENT** modules

**TREATMENTS**: will utilize **novel approaches** to **eliminate microbial virulence and/or infection** *as well as* include the option to deliver **established, narrow-spectrum antibiotic drugs** as a risk mitigation.



BEST Vision and Goals – Closed-Loop Control

By the end of the program, the **SENSOR** and **TREATMENT** modules will be combined into a **CLOSED-LOOP DEVICE** that

- is low size, weight, and power (SWaP)
- can provide rapid predictions and precise treatments
- can be deployed at all roles of military medical care including the battlefield.



# Key to success of the BEST program will be technologies that:

- Adapt to variations in the wound microbial community composition
- Adapt to variations in the host's injury and infection response (e.g., compromised immunity due to polytrauma);
- **Continually update** the status of a wound to determine interventions when indicated to fail
- Utilize novel treatments to which microbes cannot develop resistance
- Do not interfere with a wound predicted to heal on its own



BEST Program Objectives – Technical

# **Technical Objective:**

The technical objective of the BEST program is to develop technologies **that meet or exceed the technical metrics and derisk these technologies to TRL-6**\* (system integration and testing).

\*<u>https://medicalcountermeasures.gov/trl/trls-for-medical-devices/</u>



# BEST Program Objectives – Technical

# **Technical Objective:**

The technical objective of the BEST program is to develop technologies **that meet or exceed the technical metrics and derisk these technologies to TRL-6**\* (system integration and testing).

It is crucial that performer teams propose technologies that when fully developed (i.e., TRL-8\*, clinical studies, etc.) by follow-on funding from private and/or Government (non-DARPA) sponsors, are reasonably expected to be **mass produced at non-prohibitive costs, operate in remote and austere environments including battlefields.** 

\*<u>https://medicalcountermeasures.gov/trl/trls-for-medical-devices/</u>



BEST Program Objectives – Technical

In support of the BEST performer technical research efforts, DARPA and members of the Government team will make available to performer teams **datasets generated from combat wounds that include** 

- microbial colonization state (e.g., metagenomic, metatranscriptomic data)
- host wound healing status (e.g., proteomic, metatranscriptomic data)
- wound healing outcome (healed or failed)

In addition, DARPA will utilize **Government combat wound and infection subject matter experts** to engage with performer teams on a regular basis and assess and provide feedback on the technical aspects of the performer team efforts.



**BEST Program Objectives – Transition** 

# **Transition Objective:**

BEST performer teams will be expected to plan for transition of their approaches and devices beyond the DARPA effort.

This will include **developing and executing effective strategies** to prepare for **regulatory**, **clinical**, **and commercialization next steps** with the objective of creating opportunities for advanced development and follow-on funding from private and/or Government sponsors.



BEST Program Objectives – Transition

In support of the BEST transition efforts, DARPA will utilize **Government regulatory and commercialization subject matter experts** to engage with performer teams on a regular basis and assess and provide feedback on the regulatory and commercialization aspects of the performer team efforts.



Proposals must address **all BEST technical** <u>and</u> transition objectives.

Proposer teams should therefore be **multi-disciplinary and highly proficient in many areas** such as but not limited to extremity wounds and wound infections, microbial pathogens and biofilms, immunology, electronics, biosensing, engineering, bioinformatics, machine learning, process control, pharmacokinetics, biomedical sciences, animal and human physiology, medical device regulatory and clinical trial processes, and medical device commercialization pathways.



# **BEST Stakeholders and Potential Transition Partners**





**USAMMDA** 

NSERVE FIGHTING STREET

**USU** 

Uniformed Services University

Lawrence Livermore National Laboratory





**Diabetes and Digestive** and Kidney Diseases

## **BioElectronics to Sense and Treat (BEST)**

#### **Doing Business with DARPA**

#### **Belinda Nwanguma**

Contracting Officer DARPA Contracts Management Office DARPA-PS-25-12

February 19, 2024





# **BEST** – Doing Business with DARPA

- Program Solicitation (PS) posted at SAM.gov.
- Please pay attention to due dates in PS and any special instructions.
- Award Instrument Type Other Transactions (Prototypes).
- Important Dates:
  - Industry Day: February 19, 2025
  - ➢ Posting Date: February 25, 2025
  - Proposal Abstract Due Date: March 25, 2025
  - Full Proposal Due Date: May 6, 2025



#### **Proposal Abstract Tips**

- Abstracts are **strongly recommended.**
- Abstracts are limited to **5** pages and must use the provided template.
- DARPA will review abstracts and provide feedback indicating if there is interest for the proposed work to be submitted as a full proposal ("encouraged") or not ("discouraged").
- Full proposals may be submitted irrespective of comments or feedback received in response to the abstract.

### **Full Proposal Tips**

- Read the Program Solicitation (once published) carefully non-conforming proposals may be rejected without review
- Proposals must address all three (3) focus areas Sense/Treat/Closed-Loop Control
- The use of DARPA-provided attachments is required Summary Slide Template, Volume II (Technical and Management) Instructions and Template, Volume II (Cost) Instructions and Template, DARPA Standard Cost Proposal Spreadsheet, Risk Register, Model OT for Prototype Agreement, Task Description Document (TDD) Template, and Schedule of Milestones and Payments.



## Abstract/Proposal Review-Awards Process

No common Statement of Work – Proposal Abstracts and Full Proposals are evaluated on individual merit and relevance as it relates to the stated research goals/objectives rather than against each other.

- Full proposals are reviewed without regard to feedback given as a result of abstract review. Proposers should note that a favorable response to an abstract is not a guarantee that a full proposal based on the abstract will ultimately be selected for participation in the BEST program.
- Full Proposals are evaluated for strengths and weaknesses relative to the criteria published in the PS, listed in descending
  order of importance:
  - Overall Scientific and Technical Merit
  - Potential Contribution and Relevance to the DARPA Mission
  - Cost and Schedule Realism
- Upon favorable review of a full proposal and subject to the availability of funds, DARPA may choose to negotiate and award an OT for Prototype agreement.
  - Government anticipates making multiple awards.
  - Government reserves the right to select for award all, some (partial selection), or none of the proposals received.
  - The contracting office will contact the selected performers and begin the negotiation process.



# Teaming and Eligibility

# DARPA strongly encourages establishing teams to address all technical areas to ensure the expertise and capabilities necessary to meet program goals.

- You must find your collaborators on your own. Specific content, communications, networking, and team formation
  are the sole responsibility of the proposer teams.
- It is expected that proposals will involve multidisciplinary teams that include expertise from multiple complementary disciplines (e.g., extremity wounds and wound infections, microbial pathogens and biofilms, immunology, electronics, biosensing, engineering, bioinformatics, machine learning, process control, pharmacokinetics, biomedical sciences, animal and human physiology, medical device regulatory and clinical trial processes, and medical device commercialization pathways).
- Your **team must submit a single, integrated proposal** led by a single Principal Investigator/ Manager (Prime contractor) that addresses all program Phases as applicable
- Proposing teams should plan to interact with the Technical and Transition Government Support teams over the course of the BEST program. This team will be composed of Government combat wound and infection, regulatory, and commercialization SMEs.



# Teaming & Eligibility Information

All responsible sources capable of satisfying the Government's needs may submit a proposal that shall be considered by DARPA, so long as the following eligibility requirements are met:

#### Non-U.S. organizations and/or individuals

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 Entities & FFRDCs**: subject to limitations

 These entities 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, in accordance with FAR 9.5, 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



- Multiple awards are possible. The amount of resources made available under this PS will depend on the quality of the proposals received and the availability of funds.
- <u>Award negotiation timelines depend on each institution/organization's responsiveness to the</u> proposal requirements in the PS.
- The contracting office will contact the selected performers and begin the contracting process.

## **BioElectronics to Sense and Treat (BEST)**

#### **Program Solicitation Inbox and Submission**

#### **David Swan III**

BAA Coordinator Biological Technologies Office DARPA-PS-25-12

February 19, 2024



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# BEST Program Solicitation (PS) Timeline



## TIPS

- Pay close attention to submission **<u>deadlines</u>** 
  - Abstract submissions are STRONGLY recommended
  - Proposals will be reviewed without regard to abstract response
- 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



Direct **ALL** questions and communications to the PS Inbox:

BEST@darpa.mil

Dr. Tender, 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 BEST PS.

DARPA will update the BEST FAQs on a regular basis. FAQs can be found on the BEST Program web page

https://www.darpa.mil/research/programs/best-bioelectronics

All **questions must be submitted at least 7-10 days prior** to the abstract submission deadline in order to guarantee a response



## **Q:** Do we have to submit a proposal abstract?

A: Proposers are strongly encouraged, but not required, to submit an abstract in advance of a full proposal to minimize effort and reduce the potential expense of preparing a full proposal that is not well aligned to the BEST program goals.

## **Q: How much funding is available in the BEST program?**

A: DARPA has approximately \$22.8M total for performer awards and anticipates making multiple awards.

## **Q:** Does DARPA anticipate awarding Grants for the BEST program?

A: This PS may result in the award of an OT for Prototype agreement. The Government reserves the right to award an OT for Prototype agreement under 10 U.S.C. § 4022 or make no award at all.



# Submission Specifics

NO submissions via fax/e-mail

NO Human Subjects Research (HSR)

## Start Today ©

- Register for an account at the BAA Portal (<u>https://baa.darpa.mil</u>)
- Clarify any administrative concerns about submission process

Only attach attachments requested in the PS. For example:

- Executive Summary Slide
- Abstract/Proposal Templates
- Budget Spreadsheet
- Model OT
- Risk Register
- Task Description Document
- Schedule of Milestones and Payments



# DARPA BAA Portal

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Once it is published, read the Program Solicitation 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

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

**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 fund it anyway

A proposal abstract is **<u>STRONGLY RECOMMENDED</u>** 



www.darpa.mil