

DARPA

SBIR 15.3 DIRECT TO PHASE II
PROPOSAL INSTRUCTIONS

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DARPA DIRECT TO PHASE II (DP2) PROPOSAL INSTRUCTIONS

TABLE OF CONTENTS

IMPORTANT NOTE REGARDING THESE INSTRUCTIONS.....	1
1.0 INTRODUCTION	1
Direct to Phase II (DP2).....	1
System Requirements.....	2
3.0 DEFINITIONS.....	2
3.4 Export Control	2
3.5 Foreign National	3
4.0 PROPOSAL FUNDAMENTALS	3
4.6 Classified Proposals.....	3
4.7/4.8 Human and/or Animal Use	3
4.10 Debriefing.....	4
Notification of Proposal Receipt.....	5
Notification of Proposal Status	5
4.11 Solicitation Protests	5
4.14 DP2 Award Information	5
4.15 Questions/Information	6
Communication with DARPA Program Managers (PM)	6
4.22 Discretionary Technical Assistance (DTA)	6
7.0 DP2 PHASE II PROPOSAL	7
7.1 Introduction	7
7.2 Proposal Provisions.....	7
7.4 Commercialization Strategy.....	7
DP2 PROPOSAL INSTRUCTIONS	9
Appendix Format	12
Modifications or Withdrawal of Proposals	13
DP2 PROPOSAL CHECKLIST	13
8.0 PHASE II EVALUATION CRITERIA.....	14
Advocacy Letters	15
Limitations on Funding.....	15
11.0 CONTRACTUAL CONSIDERATIONS	15
External Certification Authority (ECA).....	15
Security Requirements	15
Payment Schedule.....	15
11.4 Patents	16
11.5 Intellectual Property Representations	16
11.1 (r) Publication Approval (Public Release)	16
11.7 Phase II Reports.....	16
12.0 DARPA SBIR 15.3 TOPIC INDEX.....	16
DARPA SBIR 15.3 TOPIC DESCRIPTIONS	17

IMPORTANT NOTE REGARDING THESE INSTRUCTIONS

THESE INSTRUCTIONS ONLY APPLY TO PROPOSALS SUBMITTED IN RESPONSE TO DARPA 15.3 DIRECT TO PHASE II TOPICS. Please contact our office if you require Phase II Instructions or Direct to Phase II instructions for another solicitation.

Offerors responding to DARPA topics listed in Section 12.0 of this solicitation must follow all the instructions provided in the DoD Program Solicitation AND the supplementary DARPA instructions contained in this section. The section/paragraph numbering in these instructions is intended to correspond with the section/paragraph numbering of the 15.3 DoD Program Solicitation (<http://www.acq.osd.mil/osbp/sbir/index.shtml>).

1.0 INTRODUCTION

DARPA's mission is to prevent technological surprise for the United States and to create technological surprise for its adversaries. The DARPA SBIR Program is designed to provide small, high-tech businesses and academic institutions the opportunity to propose radical, innovative, high-risk approaches to address existing and emerging national security threats; thereby supporting DARPA's overall strategy to bridge the gap between fundamental discoveries and the provision of new military capabilities.

The responsibility for implementing DARPA's Small Business Innovation Research (SBIR) Program rests with the Small Business Programs Office.

DEFENSE ADVANCED RESEARCH PROJECTS AGENCY

Attention: DIRO/SBPO

675 North Randolph Street

Arlington, VA 22203-2114

sbir@darpa.mil

http://www.darpa.mil/Opportunities/SBIR_STTR/SBIR_STTR.aspx

Direct to Phase II (DP2)

15 U.S.C. §638(cc), as amended by NDAA FY2012, Sec. 5106, PILOT TO ALLOW PHASE FLEXIBILITY, allows the DoD to make an award to a small business concern under Phase II of the SBIR program with respect to a project, without regard to whether the small business concern was provided an award under Phase I of an SBIR program with respect to such project.

DARPA is conducting a "Direct to Phase II" pilot implementation of this authority for this 15.3 SBIR solicitation only and does not guarantee the pilot will be offered in future solicitations. Each eligible topic will indicate what documentation is required to determine if Phase I feasibility has been met and the technical requirements for a Direct to Phase II proposal.

ELIGIBILITY

Not all DARPA topics are eligible for a DP2 award. Offerors should read the topic requirements carefully. DP2 topics may accept Phase I and Direct to Phase II proposals or Direct to Phase II proposals only. DARPA reserves the right to not make any awards under the Direct to Phase II pilot. All other instructions remain in effect. Direct to Phase II proposals must follow the DARPA Direct to Phase II Solicitation Instructions.

REQUIREMENTS

Offerors interested in submitting a DP2 proposal in response to an eligible topic must provide documentation to substantiate that the scientific and technical merit and feasibility described in the Phase I section of the topic has been met and describes the potential commercial applications. Documentation should include all relevant information including, but not limited to: technical reports, test data, prototype designs/models, and performance goals/results. Work submitted within the feasibility documentation must have been substantially performed by the offeror and/or the principal investigator (PI).

DARPA will not evaluate the offeror's related Phase II proposal if it determines that the offeror has failed to demonstrate that technical merit and feasibility has been established or the offeror has failed to demonstrate that work submitted in the feasibility documentation was substantially performed by the offeror and/or the principal investigator (PI).

DP2 proposals **MUST NOT** be related to or logically extend from any prior or ongoing federally funded SBIR or STTR work. Offerors interested in submitting a Phase II proposal to DARPA based upon prior or ongoing SBIR or STTR work should contact sbir@darpa.mil for instructions.

DEADLINE FOR 15.3 DP2 PROPOSALS: 6:00 AM (ET) on October 28, 2015.

System Requirements

Use of the DARPA SBIR/STTR Information Portal (SSIP) is MANDATORY. The registered Corporate Official (CO) **MUST** authenticate into the SSIP (via the DARPA Extranet) to retrieve the source selection decision notice, to request debriefings, and to upload reports (awarded contracts only). DARPA SBPO will automatically create an extranet account for new users and send the SSIP URL, authentication credentials, and login instructions AFTER the 15.3 source selection period has closed. DARPA extranet accounts will **ONLY** be created for the individual named as the CO on the Proposal Cover Sheet. Offerors may not request accounts for additional users at this time.

DARPA contractors who are not eligible to receive a Common Access Card (CAC) are required to obtain a digital certificate from an approved External Certification Authority (ECA) vendor.

- If the SBC has or will register for multiple ECAs, one of the registered ECA e-mail addresses **MUST** match the CO e-mail address (listed on the Proposal Cover Sheet).
- Additional information will be sent to small business concerns (SBCs) selected for contract award

WARNING: The Corporate Official (CO) e-mail address (from the Proposal Cover Sheet) will be used to create a DARPA Extranet account. The same e-mail **MUST** also be used for ECA registration. Updates to Corporate Official e-mail after proposal submission may cause significant delays to communication retrieval and contract negotiation (if selected). Additional information in section 4.0.

3.0 DEFINITIONS

3.4 Export Control

The following will apply to all projects with military or dual-use applications that develop beyond fundamental research (basic and applied research ordinarily published and shared broadly within the scientific community):

- (1) The Contractor shall comply with all U. S. export control laws and regulations, including the International Traffic in Arms Regulations (ITAR), 22 CFR Parts 120 through 130, and the Export Administration Regulations (EAR), 15 CFR Parts 730 through 799, in the performance of this contract. In the absence of available license exemptions/exceptions, the Contractor shall be responsible for obtaining the appropriate

licenses or other approvals, if required, for exports of (including deemed exports) hardware, technical data, and software, or for the provision of technical assistance.

- (2) The Contractor shall be responsible for obtaining export licenses, if required, before utilizing foreign persons in the performance of this contract, including instances where the work is to be performed on-site at any Government installation (whether in or outside the United States), where the foreign person will have access to export-controlled technologies, including technical data or software.
- (3) The Contractor shall be responsible for all regulatory record keeping requirements associated with the use of licenses and license exemptions/exceptions.
- (4) The Contractor shall be responsible for ensuring that the provisions of this clause apply to its subcontractors.

Please visit http://www.pmdtc.state.gov/regulations_laws/itar.html for more detailed information regarding ITAR/EAR requirements.

3.5 Foreign National

Foreign Nationals (also known as Foreign Persons) means any person who is NOT:

- a. a citizen or national of the United States; or
- b. a lawful permanent resident; or
- c. a protected individual as defined by 8 U.S.C. § 1324b

ALL offerors proposing to use foreign nationals MUST follow Section 5.4. c. (8) of the DoD Program Solicitation and disclose this information regardless of whether the topic is subject to ITAR restrictions. There are two ways to obtain U.S. citizenship: by birth or by naturalization. Additional information regarding U.S. citizenship is available at http://travel.state.gov/law/citizenship/citizenship_782.html. Definitions for “lawful permanent resident” and “protected individual” are available under section 3.5 of the DoD instructions.

4.0 PROPOSAL FUNDAMENTALS

4.6 Classified Proposals

DARPA topics are unclassified; however, the subject matter may be considered to be a “critical technology” and therefore subject to Export Control Restrictions. See Export Control requirements in Section 3.3.

4.7/4.8 Human and/or Animal Use

Your topic may have been identified by the program manager as research involving Human and/or Animal Use. In accordance with DoD policy, human and/or animal subjects in research conducted or supported by DARPA shall be protected. Although these protocols were most likely not needed to carry out the Phase I, significant lead time is required to prepare the documentation and obtain approval in order to avoid delay of the DP2 award. Please visit <http://www.darpa.mil/WorkArea/DownloadAsset.aspx?id=2147486611> to review the Human Use PowerPoint presentation to understand what is required to comply with human protocols and <http://www.darpa.mil/WorkArea/DownloadAsset.aspx?id=2147486040> to review the Animal Use PowerPoint presentation to understand what is required to comply with animal protocols. Offerors proposing research involving human and/or animal use are encouraged to separate these tasks in the Technical Volume and Cost Volume in order to avoid potential delay of contract award.

- a. **Human Use:** All research involving human subjects, to include use of human biological specimens and human data, selected for funding must comply with the federal regulations for human subject protection. Further, research involving human subjects that is conducted or supported by the DoD must comply with 32 CFR 219, *Protection of Human Subjects*

- b. DoD Directive 3216.02, *Protection of Human Subjects and Adherence to Ethical Standards in DoD-Supported Research* (<http://www.dtic.mil/whs/directives/corres/pdf/321602p.pdf>).
- o Institutions awarded funding for research involving human subjects must provide documentation of a current Assurance of Compliance with Federal regulations for human subject protection, for example a Department of Health and Human Services, Office of Human Research Protection Federal Wide Assurance (<http://www.hhs.gov/ohrp>). All institutions engaged in human subject research, to include subcontractors, must also have a valid Assurance. In addition, personnel involved in human subjects research must provide documentation of completing appropriate training for the protection of human subjects.
 - o For all proposed research that will involve human subjects in the first year or phase of the project, the institution must provide evidence of or a plan for review by an Institutional Review Board (IRB) upon final proposal submission to DARPA. The IRB conducting the review must be the IRB identified on the institution's Assurance. The protocol, separate from the proposal, must include a detailed description of the research plan, study population, risks and benefits of study participation, recruitment and consent process, data collection, and data analysis. Consult the designated IRB for guidance on writing the protocol. The informed consent document must comply with federal regulations (32 CFR 219.116). A valid Assurance along with evidence of appropriate training for all investigators should accompany the protocol for review by the IRB.
 - o In addition to a local IRB approval, a headquarters-level human subjects regulatory review and approval is required for all research conducted or supported by the DoD. The Army, Navy or Air Force office responsible for managing the award can provide guidance and information about their component's headquarters-level review process. Note that confirmation of a current Assurance and appropriate human subjects protection training is required before headquarters-level approval can be issued.
 - o The amount of time required to complete the IRB review/approval process may vary depending on the complexity of the research and/or the level of risk to study participants. Ample time should be allotted to complete the approval process. The IRB approval process can last between one to three months, followed by a DoD review that could last between three to six months. No DoD/DARPA funding can be used towards human subject research until ALL approvals are granted.
- c. **Animal Use:** Any Recipient performing research, experimentation, or testing involving the use of animals shall comply with the rules on animal acquisition, transport, care, handling and use in: (i) 9 CFR parts 1-4, Department of Agriculture rules that implement the Laboratory Animal Welfare Act of 1966, as amended, (7 U.S.C. 2131-2159); (ii) the guidelines described in National Institutes of Health Publication No. 86-23, "Guide for the Care and Use of Laboratory Animals"; (iii) DoD Directive 3216.01, "Use of Laboratory Animals in DoD Program."
- o For submissions containing animal use, proposals should briefly describe plans for Institutional Animal Care and Use Committee (IACUC) review and approval. Animal studies in the program will be expected to comply with the PHS Policy on Humane Care and Use of Laboratory Animals, available at <http://grants.nih.gov/grants/olaw/olaw.htm>.
 - o All Recipients must receive approval by a DoD certified veterinarian, in addition to an IACUC approval. No animal studies may be conducted using DoD/DARPA funding until the USAMRMC Animal Care and Use Review Office (ACURO) or other appropriate DoD veterinary office(s) grant approval. As a part of this secondary review process, the Recipient will be required to complete and submit an ACURO Animal Use Appendix, which may be found at https://mrmc-www.army.mil/index.cfm?pageid=Research_Protections.acuro&rn=1.

4.10 Debriefing

DARPA will provide a debriefing to the offeror in accordance with Federal Acquisition Regulation (FAR) 15.505. The source selection decision notice (reference 4.15 Notification of Proposal Status) contains instructions for requesting a proposal debriefing. Please also refer to section 4.10 of the DoD Program Solicitation.

Notification of Proposal Receipt

Within 5 business days after the solicitation closing, the individual named as the “Corporate Official” on the Proposal Cover Sheet will receive a separate e-mail from sbir@darpa.mil acknowledging receipt for each proposal received. Please make note of the topic number and proposal number for your records. The CO should add this address to their address book and whitelist to ensure all communications are received.

Notification of Proposal Status

The source selection decision notice will be available no later than 90 days after the solicitation close date for DP2 offerors. The individual named as the “Corporate Official” (CO) on the Proposal Cover Sheet will receive an email for each proposal submitted, from sbir@darpa.mil with instructions for retrieving their official notification from the SSIP. Please read each notification carefully and note the proposal number and topic number referenced. The CO must retrieve the letter from the SSIP 30 days from the date the e-mail is sent. After 30 days the CO must make a written request to sbir@darpa.mil for the source selection decision notice. The request must explain why the offeror was unable to retrieve the source selection decision notice from the SSIP within the original 30 day notification period. Selections are posted at <https://sbir.defensebusiness.org/>.

Refer to section 1.0 (System Requirements) for information regarding CO registration and DARPA extranet account creation.

4.11 Solicitation Protests

Interested parties may have the right to protest this solicitation by filing directly with the agency by serving the Contracting Officer (listed below) with the protest, or by filing with the Government Accountability Office (GAO). If the protest is filed with the GAO, a copy of the protest shall be received in the office designated below within one day of filing with the GAO. The protesting firm shall obtain written and dated acknowledgment of receipt of the protest.

Agency protests regarding the solicitation should be submitted to:

SBIR/STTR Solicitation Contracting Officer
WHS/Acquisition Directorate
1155 Defense Pentagon
Washington, DC 20301-1155
E-mail: jonathan.l.becker2.civ@mail.mil

Agency protests regarding the source selection decision should be submitted to:

DARPA
Contracts Management Office (CMO)
675 N. Randolph Street
Arlington, VA 22203
E-mail: scott.ulrey@darpa.mil and sbir@darpa.mil

4.14 DP2 Award Information

- a. **Number of DP2 Awards.** DARPA reserves the right to select and fund only those proposals considered to be of superior quality and highly relevant to the DARPA mission. As a result, DARPA may fund multiple proposals in a topic area, or it may not fund any proposals in a topic area.
- b. **Type of Funding Agreement.** DARPA DP2 awards are typically Cost-Plus-Fixed-Fee contracts.
 - Offerors that choose to collaborate with a University must highlight the research activities that are being performed by the University and verify that the work is FUNDAMENTAL RESEARCH.

- Offerors are strongly encouraged to implement a government acceptable cost accounting system during the Phase I project to avoid delay in receiving a DP2 award. Phase II contractors MUST have an acceptable system to record and control costs, including procedures for job costing and time record keeping. Items such as overhead and G&A rates WILL require logical supporting documentation during the DCAA review process. Visit www.dcaa.mil and download the “Information for Contractors” guide for more information.
 - Offerors that are unable to obtain a positive DCAA review of their accounting system may on a case-by-case basis, at the discretion of the Contracting Officer, be awarded a Firm Fixed Price Phase II contract or an Other Transaction (OT).
 - More information on Other Transactions is available at:
[http://www.darpa.mil/Opportunities/Contract_Management/Other Transactions and Technology Investment Agreements.aspx](http://www.darpa.mil/Opportunities/Contract_Management/Other_Transactions_and_Technology_Investment_Agreements.aspx).
- c. **Average Dollar Value.** The maximum value of a DARPA DP2 award is \$1,510,000.
- d. **Timing.** The DoD goal for DP2 award is within 180 calendar days from the proposal receipt deadline. Phase II contract award may be delayed if the offeror does not have an adequate accounting system or fails to include sufficient documentation to support its cost proposal.

4.15 Questions/Information

(1) Contact the **DARPA SBIR/STTR Help Desk** via email (sbir@darpa.mil) regarding general questions about these instructions, DP2 proposal preparation and other DARPA SBIR/STTR program-related areas.

(2) Contact the **DoD SBIR/STTR Help Desk** regarding questions about the DoD SBIR/STTR Proposal Submission System. Help Desk hours are 9:00 a.m. to 6:00 p.m. ET, Monday through Friday:

- Phone: 1-800-348-0787
- E-mail Submission: sbirhelp@bytecubed.com

Communication with DARPA Program Managers (PM)

Offerors participating in the DP2 process may only communicate with PMs during the pre-solicitation period, published at <http://www.acq.osd.mil/osbp/sbir/index.shtml> and on SITIS once the solicitation has opened. Information regarding SITIS is available directly from <https://sbir.defensebusiness.org/>.

4.22 Discretionary Technical Assistance (DTA)

Offerors that are interested in proposing use of a vendor for technical assistance must complete the following:

1. Indicate in question 17, of the Proposal Cover Sheet, that you request DTA and input proposed cost of DTA (in space provided).
2. Provide a one-page description of the vendor you will use and the technical assistance you will receive. The description should be included as the LAST page of the Technical Volume. This description will not count against the 40-page limit of the Technical Volume and will NOT be evaluated.
3. Enter the total proposed DTA cost under the “Discretionary Technical Assistance” line along with a detailed cost breakdown under “Explanatory material relating to the cost proposal” via the online cost proposal. The proposed amount may not exceed \$5,000 per year and a total of \$10,000 per Phase II contract.

DTA requests must be explained in detail with the cost estimate. The cost cannot be subject to any profit or fee by the requesting firm. In addition, the DTA provider may not be the requesting firm itself, an affiliate or investor of the requesting firm, or a subcontractor or consultant of the requesting firm otherwise required as part of the paid portion of the research effort (e.g., research partner). Approval of technical assistance is not guaranteed and is subject to review of the Contracting Officer. Please see section 4.22 of the DoD Program Solicitation instructions for additional information.

7.0 DP2 PHASE II PROPOSAL

7.1 Introduction

DoD SBIR/STTR Proposal Submission System (<https://sbir.defensebusiness.org/>) is designed to reduce the time and cost required to prepare a formal proposal. Carefully review the guidance on allowable content.

A complete DP2 proposal consists of four volumes:

Volume 1: Proposal Cover Sheet

Volume 2: Technical Volume

PART ONE: Feasibility Documentation (75 page maximum)

PART TWO: Technical Proposal (40 page maximum)

APPENDICES (20 page maximum – will NOT be evaluated)

Volume 3: Cost Volume

Volume 4: Company Commercialization Report

7.2 Proposal Provisions

Phase II Option

DARPA has implemented the use of a Phase II Option that may be exercised at the DARPA Program Manager's discretion to continue funding Phase II activities that will further mature the technology for insertion into a larger DARPA Program, DoD Acquisition Program, other Federal agency, or commercialization into the private sector. The statement of work for the Phase II Option MUST be included with the Phase II Technical Volume and should describe Phase II activities, over a 12 month period, that may lead to the successful demonstration of a product or technology. The statement of work for the option counts toward the 40-page limit for the Phase II Technical Volume. If selected, the government may elect not to include the option in the negotiated contract.

7.4 Commercialization Strategy

DARPA is equally interested in dual use commercialization of SBIR project results to the U.S. military, the private sector market, or both, and expects explicit discussion of key activities to achieve this result in the commercialization strategy part of the proposal. The discussion should include identification of the problem, need, or requirement relevant to a Department of Defense application and/or a private sector application that the SBIR project results would address; a description of how wide-spread and significant the problem, need, or requirement is; and identification of the potential DoD end-users, Federal customers, and/or private sector customers who would likely use the technology.

Technology commercialization and transition from Research and Development activities to fielded systems within the DoD is challenging. Include transition and commercialization activities conducted during Phase I, and how the preliminary transition path or paths may evolve during the Phase II project. That plan should include the Technology Readiness Level (TRL) achieved at the end of the Phase I. The plan should include anticipated business model and potential private sector and federal partners the company has identified to support transition and commercialization activities. In addition, key proposed milestones anticipated during Phase II such as: prototype development, laboratory and systems testing, integration, testing in operational environment, and demonstrations.

At a minimum, your commercialization strategy must address the following five questions:

- (1) What is the first product that this technology will go into?
- (2) Who will be the customers, and what is the estimated market size?

- (3) How much money will be needed to bring the technology to market, and how will that money be raised?
- (4) Does the company contain marketing expertise and, if not, how will that expertise be brought into the company?
- (5) Who are the offeror's competitors, and what is the price and/or quality advantage over those competitors?

The commercialization strategy must also include a schedule showing the anticipated quantitative commercialization results from the Phase II project at one year after the start of Phase II, at the completion of Phase II, and after the completion of Phase II (i.e., amount of additional investment, sales revenue, etc.). After Phase II award, the company is required to report actual sales and investment data in its Company Commercialization Report (see Section 7.5.e) at least annually.

In addition, each Phase II proposal must contain a five-page commercialization strategy as part of the Technical Volume, addressing the following questions:

- (1) Product Description/System Application – Identify the Commercial product(s) and/or DoD system(s) or system(s) under development or potential new systems that this technology will be/or has the potential to be integrated into.
- (2) Advocacy Letters** – Feedback received from potential Commercial and/or DoD customers and other end-users regarding their interest in the technology to support their capability gaps.
- (3) Letters of Intent/Commitment** – Relationships established, feedback received, support and commitment for the technology with one or more of the following: Commercial customer, DoD PM/PEO, a Defense Prime, or vendor/supplier to the Primes and/or other vendors/suppliers identified as having a potential role in the integration of the technology into fielded systems/products or those under development.
- (4) Business Models/Procurement Mechanisms/Vehicles – Business models, procurement mechanisms, vehicles and, as relevant, commercial channels, and/or licensing/teaming agreements you plan to employ to sell into your targeted markets.
 - a. What is the business model you plan to adopt to generate revenue from your innovation?
 - b. Describe the procurement mechanisms, vehicles and channels you plan to employ to reach the targeted markets/customers.
 - c. If you plan to pursue a licensing model, what is your plan to identify potential licensees?
- (5) Market/Customer Sets/Value Proposition – Describe the market and customer sets you propose to target, their size, and their key reasons they would consider procuring the technology.
- (6) What is the current size of the broad market you plan to enter and the “niche” market opportunity you are addressing?
- (7) What are the growth trends for the market and the key trends in the industry that you are planning to target?
 - a. What features of your technology will allow you to provide a compelling value proposition?
 - b. Have you validated the significance of these features and if not, how do you plan to validate?
- (8) Competition Assessment – Describe the competition in these markets/customer sets and your anticipated advantage (e.g., function, performance, price, quality, etc.)
- (9) Funding Requirements – List your targeted funding sources (e.g., federal, state and local, private (internal, loan, angel, venture capital, etc.) and your proposed plan and schedule to secure this funding. Provide anticipated funding requirements both during and after Phase II required to:
 - mature the technology
 - as required, mature the manufacturing processes
 - test and evaluate the technology
 - receive required certifications
 - secure patents, or other protections of intellectual property
 - manufacture the technology to bring the technology to market for use in operational environments
 - market/sell technology to targeted customers

- (10) Sales Projections – Provide a schedule that outlines your anticipated sales projections and indicate when you anticipate breaking even.
- (11) Expertise/Qualifications of Team/Company Readiness - Describe the expertise and qualifications of your management, marketing/business development and technical team that will support the transition of the technology from the prototype to the commercial market and into operational environments. Has this team previously taken similar products/services to market? If the present team does not have this needed expertise, how do you intend to obtain it? What is the financial history and health of your company (e.g., availability of cash, profitability, revenue growth, etc.)?

**Please note: In accordance with section 3-209 of DOD 5500.7-R, Joint Ethics Regulation, letters from government personnel will NOT be considered during the evaluation process.

DP2 PROPOSAL INSTRUCTIONS

Each DP2 proposal must be submitted through the DoD SBIR/STTR Submission Web site by the solicitation deadline.

1. After authenticating, choose “Phase II Proposal Preparation”
2. When asked to choose a Phase I proposal number, choose Z001

a. Proposal Cover Sheet (Volume One)

On the DoD SBIR/STTR Submission Web site, (<https://sbir.defensebusiness.org/>), prepare the Proposal Cover Sheet. The Cover Sheet must include a brief technical abstract, of no more than 200 words, that describes the proposed R&D project with a discussion of anticipated benefits and potential commercial applications. Do not include proprietary or classified information in the Proposal Cover Sheet. If your proposal is selected for award, the technical abstract and discussion of anticipated benefits will be publicly released on the Internet. Once the Cover Sheet is saved, the system will assign a proposal number. You may edit the Cover Sheet as often as necessary until you submit your proposal.

b. Technical Volume (Volume Two)

- The Technical Volume upload must include two parts. Label the Feasibility Documentation “PART ONE: Feasibility Documentation.” Part Two of the Technical Volume should be labeled “PART TWO: Technical Proposal.
- Number all pages of your Technical Volume consecutively. Use no type smaller than 10-point on standard 8-1/2" x 11" paper with one inch margins. The header on each page of the Technical Volume should contain your company name, topic number, and proposal number assigned by the DoD SBIR/STTR Submission Web site when the Cover Sheet was created. The header may be included in the one-inch margin.
- The Technical Volume should cover the following items in the order given below.

VOLUME TWO - PART ONE: Feasibility Documentation

- Provide documentation to substantiate that the scientific and technical merit and feasibility described in the Phase I section of the topic has been met and describes the potential commercial applications. Documentation should include all relevant information including, but not limited to: technical reports, test data, prototype designs/models, and performance goals/results.

- Maximum page length for feasibility documentation is 75 pages. If you have references, include a reference list or works cited list as the last page of the feasibility documentation. This will count towards the page limit.
- Work submitted within the feasibility documentation must have been substantially performed by the offeror and/or the principal investigator (PI).
- If technology in the feasibility documentation is subject to IP, the offeror must have IP rights. Refer to section 11.5 of these DARPA instructions for additional information.
- Include a one page summary on Commercialization Potential addressing the following:
 - i. Does the company contain marketing expertise and, if not, how will that expertise be brought into the company?
 - ii. Describe the potential for commercial (Government or private sector) application and the benefits expected to accrue from this commercialization.
- DO NOT INCLUDE marketing material. Marketing material will NOT be evaluated and WILL be redacted.

VOLUME TWO - PART TWO: Technical Proposal

- (1) **Significance of the Problem.** Define the specific technical problem or opportunity addressed and its importance.
- (2) **Phase II Technical Objectives.** Enumerate the specific objectives of the Phase II work, and describe the technical approach and methods to be used in meeting these objectives.
 - a) Phase II Statement of Work. The statement of work should provide an explicit, detailed description of the Phase II approach, indicate what is planned, how and where the work will be carried out, a schedule of major events and the final product to be delivered. The methods planned to achieve each objective or task should be discussed explicitly and in detail. This section should be a substantial portion of the total proposal.
 - b) Human/Animal Use: Offerors proposing research involving human and/or animal use are encouraged to separate these tasks in the technical proposal and cost proposal in order to avoid potential delay of contract award.
 - c) Phase II OPTION Statement of Work. The statement of work should provide an explicit, detailed description of the activities planned during the Phase II Option, if exercised. Include how and where the work will be carried out, a schedule of major events and the final product to be delivered. The methods planned to achieve each objective or task should be discussed explicitly and in detail.
- (3) **Related Work.** Describe significant activities directly related to the proposed effort, including any conducted by the principal investigator, the offeror, consultants or others. Describe how these activities interface with the proposed project and discuss any planned coordination with outside sources. The proposal must persuade reviewers of the offeror's awareness of the state of the art in the specific topic. Describe previous work not directly related to the proposed effort but similar. Provide the following: (1) short description, (2) client for which work was performed (including individual to be contacted and phone number) and (3) date of completion.
- (4) **Relationship with Future Research or Research and Development.**
 - i. State the anticipated results of the proposed approach if the project is successful.
 - ii. Discuss the significance of the Phase II effort in providing a foundation for Phase III research and development or commercialization effort.
- (5) **Commercialization Strategy.** Each DP2 proposal must contain a five-page commercialization strategy as part of the Technical Volume describing the offeror's strategy for commercializing this technology in DoD, other Federal Agencies and/or private sector markets. Provide specific

information on the market need the technology will address and the size of the market. See section 7.4 for required strategy elements.

- (6) **Key Personnel.** Identify key personnel who will be involved in the Phase II effort including information on directly related education and experience. A concise resume of the principal investigator, including a list of relevant publications (if any), must be included. All resumes count toward the page limitation. Identify any foreign nationals you expect to be involved on this project, country of origin and level of involvement.
- (7) **Facilities/Equipment.** Describe available instrumentation and physical facilities necessary to carry out the Phase II effort. Items of equipment to be purchased (as detailed in the cost proposal) shall be justified under this section. Also state whether or not the facilities where the proposed work will be performed meet environmental laws and regulations of federal, state (name) and local Governments for, but not limited to, the following groupings: airborne emissions, waterborne effluents, external radiation levels, outdoor noise, solid and bulk waste disposal practices and handling and storage of toxic and hazardous materials.
- (8) **Subcontractors/Consultants.** Involvement of a university or other subcontractors or consultants in the project may be appropriate. If such involvement is intended, it should be described in detail and identified in the Cost Volume. A minimum of one-half of the research and/or analytical work in Phase II, as measured by direct and indirect costs, must be carried out by the offeror, unless otherwise approved in writing by the Contracting Officer. No portion of an SBIR award may be subcontracted back to any Federal government agency, including Federally Funded Research and Development Centers (FFRDCs). SBA may issue a case-by-case waiver to this provision after review of the DoD component's written justification that includes the following information: (a) an explanation of why the SBIR research project requires the use of the Federal facility or personnel, including data that verifies the absence of non-federal facilities or personnel capable of supporting the research effort; (b) why the Agency will not and cannot fund the use of the Federal facility or personnel for the SBIR project with non-SBIR money; and (c) the concurrence of the small business concern's chief business official to use the Federal facility or personnel. Award is contingent on the sponsoring agency obtaining a waiver.
- (9) **Prior, Current or Pending Support of Similar Proposals or Awards.** Warning -- While it is permissible, with proposal notification, to submit identical proposals or proposals containing a significant amount of essentially equivalent work for consideration under numerous federal program solicitations, it is unlawful to enter into contracts or grants requiring essentially equivalent effort. If there is any question concerning this, it must be disclosed to the soliciting agency or agencies before award.

c. Cost Volume (Volume 3)

Offerors are REQUIRED to use the online Cost Volume (<https://sbir.defensebusiness.org/>) for the Phase II and Phase II Option costs. Additional details and explanations regarding the Cost Volume may be uploaded as an appendix to the Technical Volume. The Cost Volume (and supporting documentation) DOES NOT count toward the 40-page limit of the Technical Volume. Phase II awards and options are subject to the availability of funds.

The Phase II Cost Volume must not exceed the maximum dollar amount of \$1,000,000 (24 months) or \$1,010,000 if discretionary technical assistance services are proposed. Offerors proposing a Phase II Option must also submit a Phase II Option Cost Volume, not to exceed \$500,000 (12 months).

Some items in the Cost Breakdown Guidance may not apply to the proposed project. If such is the case, there is no need to provide information on each and every item. What matters is that enough information

be provided to allow DARPA to understand how the offeror plans to use the requested funds if the contract is awarded.

1. List all key personnel by name as well as by number of hours dedicated to the project as direct labor.
2. Special tooling and test equipment and material cost may be included. The inclusion of equipment and material will be carefully reviewed relative to need and appropriateness for the work proposed. The purchase of special tooling and test equipment must, in the opinion of the Contracting Officer, be advantageous to the Government and should be related directly to the specific topic. These may include such items as innovative instrumentation and/or automatic test equipment. Title to property furnished by the Government or acquired with Government funds will be vested with the DoD Component; unless it is determined that transfer of title to the contractor would be more cost effective than recovery of the equipment by the DoD Component.
3. Cost for travel funds must be justified and related to the needs of the project.
4. Cost sharing is permitted for proposals under this solicitation; however, cost sharing is not required nor will it be an evaluation factor in the consideration of a DP2 proposal.
5. The costs for the base and option (if proposed) are clearly separate and identified in the cost volume.

If selected for award, the offeror should be prepared to submit further documentation to the DoD Contracting Officer to substantiate costs (e.g., a brief explanation of cost estimates for equipment, materials, and consultants or subcontractors). For more information about the Cost Volume and accounting standards, see the DCAA publication called "Information for Contractors" available at http://www.dcaa.mil/audit_process_overview.html.

d. Company Commercialization Report (CCR) (Volume 4)

All offerors are required to prepare a CCR through the DoD SBIR/STTR Submission Web Site (<https://sbir.defensebusiness.org/>). List in the CCR, the quantitative commercialization results of the offeror's prior Phase II projects, including the items such as sales revenue, additional investment, as well as other information relative to the offeror's commercialization track record. All prior Phase II projects must be reported, regardless of whether the project has any commercialization to date. The results are compared to the historical averages for the DoD SBIR or STTR Programs to calculate a Commercialization Achievement Index (CAI) value. Only offerors with four or more completed Phase II projects will receive a CAI score; otherwise the CAI is N/A. Offerors with a CAI at the 20th percentile or below may receive no more than half of the evaluation points available for commercial potential criteria. A score of N/A will not affect the offerors ability to be selected for an award.

Offerors may also include at the end of the Report additional, explanatory material (no more than five pages) relating to the offeror's record of commercializing its prior SBIR or STTR projects, such as: commercialization successes (in government and/or private sector markets) that are not fully captured in the quantitative results (e.g. commercialization resulting from the offeror's prior Phase I projects); any mitigating factors that could account for low commercialization; and recent changes in the offeror's organization or personnel designed to increase the offeror's commercialization success. The CCR and additional explanatory material (if any) will not be counted toward the page limit for DP2 proposals.

Appendix Format

An Appendix contains information that is non-essential to understanding of the proposal, but may present information that further clarifies a point without burdening the body of the Technical Volume. An Appendix is optional. Each Appendix should be identified by a Roman numeral in sequence, e.g., Appendix I, Appendix II, etc. Each Appendix should contain different material. The Appendix footer should contain the page number (following the sequence used for the entire proposal) and the Appendix label (ex. Appendix I). Please note, only that

information provided in the Technical Volume (pg. 1-40, including Cover Sheet, Cost Volume and CCR) will be considered by the evaluator. Evaluator review of any Appendix material is optional.

Modifications or Withdrawal of Proposals

Modification

Late modifications of an otherwise scientifically successful proposal, which makes its terms more favorable to the Government, may be considered and may be accepted.

Withdrawal

Proposals may be withdrawn by written notice at any time. Proposals may be withdrawn in person by an offeror or his authorized representative, provided his identity is made known and he signs a receipt for the proposal.

DP2 PROPOSAL CHECKLIST

Complete proposals must contain the following elements. Incomplete proposals will be rejected.

- ___ 1. DP2 is NOT related to or logically extend from prior or ongoing SBIR/STTR work.
- ___ 2. Volume 1: Proposal Cover Sheets
 - ___ a. Completed and checked for accuracy.
 - ___ b. Costs for the base and option (if proposed) are clearly separate and identified on the Proposal Cover Sheet.
- ___ 3. Volume 2: Technical Volume
 - ___ a. Numbered all pages of the proposal consecutively. The Cover Sheets are pages 1 and 2. The Technical Volume begins on page 3.
 - ___ b. Font type is no smaller than 10-point on standard 8½" x 11" paper with one-inch margins. The header on each page of the Technical Volume contains the company name, topic number and proposal number assigned by the DoD SBIR/STTR Submission Web site when the Cover Sheet was created. The header may be included in the one-inch margin.
 - **PART ONE: Feasibility Documentation (75 page maximum)**
 - ___ a. Does not exceed the page limits specified.
 - ___ b. Follows requirements specified in Section 7 (DP2 Proposal Format).
 - **PART TWO: Technical Proposal (40 page maximum)**
 - ___ a. Does not exceed the page limits specified.
 - ___ b. The tasks for the base and option (if proposed) are clearly separate and identified in the Technical Proposal.
 - ___ c. If proposing DTA, one page description submitted in accordance with instructions in section 4.22.
 - ___ d. Follows requirements specified in Section 7 (DP2 Proposal Format).
 - ___ e. Appendices (OPTIONAL) do not exceed the 20 page maximum (appendices will NOT be evaluated).
 - ___ e.1. Appendix contains information that is non-essential to understanding of the proposal, but may present information that further clarifies a point without burdening the body of the Technical Volume.
 - ___ e.2. Each Appendix identified by a Roman numeral in sequence (e.g. Appendix I, Appendix II...). Each Appendix contains different material.
 - ___ e.3. The Appendix footer contains the page number (following the sequence used for the entire proposal) and the Appendix label (ex. Page 78: Appendix I).
- ___ 4. Volume 3: Cost Volume
 - ___ a. Used the online Cost Volume.

- ___ b. Subcontractor, material and travel costs in detail. Used the "Explanatory Material Field" in the DoD Cost Volume worksheet for this information, if necessary.
- ___ c. Costs for the base and option (if proposed) are clearly separate and identified in the Cost Volume.
- ___ d. Base effort does not exceed \$1,000,000 or \$1,010,000 if DTA services are proposed.
- ___ e. Option (if proposed) does not exceed \$500,000.
- ___ f. Included the cost of each ECA to be purchased. Reimbursement is limited to a maximum of three ECAs per company. See section 11.0 for additional information.
- ___ g. If proposing DTA, cost submitted in accordance with instructions in section 4.22 and does not exceed \$5,000 per year (\$10,000 total).

___ **5. Volume 4: Company Commercialization Report**

- ___ a. Completed and checked for accuracy. Follow requirements specified in section 5.4(e).

___ **6. Submission**

- ___ a. Upload four completed volumes: Volume 1: Proposal Cover Sheet; Volume 2: Technical Volume; Volume 3: Cost Volume; and Volume 4: Company Commercialization Report electronically through the DoD submission site by 6:00 AM (ET) on June 24, 2015.
- ___ b. Review your submission after upload to ensure that all pages have transferred correctly and do not contain unreadable characters. Contact the DoD Help Desk immediately with any problems (see section 4.15).
- ___ c. Submit your proposal before 6:00 AM (ET) on June 24, 2015. DARPA will NOT accept proposals that have NOT been submitted by the solicitation deadline.

8.0 PHASE II EVALUATION CRITERIA

DP2 proposals will be evaluated based on the criteria outlined below. Selections will be based on best value to the Government considering the following factors which are listed in descending order of importance:

- a. The soundness, technical merit, and innovation of the proposed approach and its incremental progress toward topic or subtopic solution.
- b. The qualifications of the proposed principal/key investigators, supporting staff, and consultants. Qualifications include not only the ability to perform the research and development but also the ability to commercialize the results.
- c. The potential for commercial (Government or private sector) application and the benefits expected to accrue from this commercialization.

Evaluators will base their conclusions only on information contained in the proposal. Do not assume that evaluators are acquainted with the offeror or key individuals or any referenced experiments. Relevant supporting data such as journal articles, literature, including Government publications, etc., should be contained or referenced in the proposal and will count toward the page limit. Where technical evaluations are essentially equal in merit, cost to the Government will be considered in determining the successful offeror.

The offeror's attention is directed to the fact that non-Government advisors to the Government may review and provide support in proposal evaluations during source selection. Non-government advisors may have access to the offeror's proposals, may be utilized to review proposals, and may provide comments and recommendations to the Government's decision makers. These advisors will not establish final assessments of risk and will not rate or rank offeror's proposals. They are also expressly prohibited from competing for DARPA SBIR or STTR awards in the SBIR/STTR topics they review and/or provide comments on to the Government. All advisors are required to comply with procurement integrity laws and are required to sign Non-Disclosure Agreement and Rules of Conduct/Conflict of Interest statements. Non-Government technical consultants/experts will not have access to proposals that are labeled by their offerors as "Government Only."

Advocacy Letters

Please note that qualified advocacy letters will count towards the proposal page limit and will be evaluated towards criterion C. Advocacy letters are not required. Consistent with Section 3-209 of DoD 5500.7-R, Joint Ethics Regulation, which as a general rule prohibits endorsement and preferential treatment of a non-federal entity, product, service or enterprise by DoD or DoD employees in their official capacities, letters from government personnel will NOT be considered during the evaluation process.

A qualified advocacy letter is from a relevant commercial procuring organization(s) working with a DoD or other Federal entity, articulating their pull for the technology (i.e., what need the technology supports and why it is important to fund it), and possible commitment to provide additional funding and/or insert the technology in their acquisition/sustainment program. If submitted, the letter should be included as the last page of your technical upload. Advocacy letters which are faxed or e-mailed separately will NOT be considered.

Limitations on Funding

DARPA reserves the right to select and fund only those proposals considered to be of superior quality and highly relevant to the DARPA mission. As a result, DARPA may fund multiple proposals in a topic area, or it may not fund any proposals in a topic area. All awards are subject to the availability of funds.

11.0 CONTRACTUAL CONSIDERATIONS

External Certification Authority (ECA)

Offerors must include, in the Cost Volume, the cost of each ECA proposed to be purchased in order to be reimbursed for the cost of ECAs. Reimbursement is limited to a maximum of three ECAs per company. The cost cannot be subject to any profit or fee by the requesting firm.

Offerors should consider purchasing the ECA subscription to cover the Phase II period of performance, to include the option year. Offerors will only be reimbursed for ECA costs once per subscription. Offerors that previously obtained a DoD-approved ECA may not be reimbursed under any potential SBIR/STTR Phase II contract. Likewise, offerors that are reimbursed for ECAs obtained as a requirement under an SBIR/STTR Phase II contract, may not be reimbursed again for the same ECA purchase under any subsequent government contract. Additional information regarding ECA requirement may be found in section 1.0, System Requirements.

Security Requirements

If a proposed effort is classified or classified information is involved, the offeror must have, or obtain, a security clearance in accordance with the Industry Security Manual for Safeguarding Classified Information (DOD 5220.22M).

Payment Schedule

Payment will be made in accordance with General Provisions FAR 523.216-7, *Allowable Cost and Payments*.

11.4 Patents

Include documentation proving your ownership of or possession of appropriate licensing rights to all patented inventions (or inventions for which a patent application has been filed) that will be utilized under your proposal. If a patent application has been filed for an invention that your proposal utilizes, but the application has not yet been made publicly available and contains proprietary information, you may provide only the patent number, inventor name(s), assignee names (if any), filing date, filing date of any related provisional application, and a summary of the patent title, together with either: (1) a representation that you own the invention, or (2) proof of possession of appropriate licensing rights in the invention. Please see section 11.4 of the DoD Program Solicitation for additional information.

11.5 Intellectual Property Representations

Provide a good faith representation that you either own or possess appropriate licensing rights to all other intellectual property that will be utilized under your proposal. Additionally, proposers shall provide a short summary for each item asserted with less than unlimited rights that describes the nature of the restriction and the intended use of the intellectual property in the conduct of the proposed research. Please see section 11.5 of the DoD Program Solicitation for information regarding technical data rights.

11.1 (r) Publication Approval (Public Release)

National Security Decision Directive (NSDD) 189 established the national policy for controlling the flow of scientific, technical, and engineering information produced in federally funded fundamental research at colleges, universities, and laboratories. The directive defines fundamental research as follows: "Fundamental research" means basic and applied research in science and engineering, the results of which ordinarily are published and shared broadly within the scientific community, as distinguished from proprietary research and from industrial development, design, production, and product utilization, the results of which ordinarily are restricted for proprietary or national security reasons."

It is DARPA's goal to eliminate pre-publication review and other restrictions on fundamental research except in those exceptional cases when it is in the best interest of national security. Please visit http://www.darpa.mil/NewsEvents/Public_Release_Center/Public_Release_Center.aspx for additional information and applicable publication approval procedures.

11.7 Phase II Reports

All DARPA SBIR awardees are required to submit reports in accordance with the Contract Data Requirements List – CDRL and any applicable Contract Line Item Number (CLIN) of the Phase II contract. Reports must be provided to the individuals identified in Exhibit A of the contract.

Reports are uploaded to the DARPA SBIR/STTR Information Portal (SSIP). See section "Retrieval of DARPA SBPO Notifications" on page 4 of these instructions.

12.0 DARPA SBIR 15.3 TOPIC INDEX

These instructions ONLY apply to Direct to Phase II (DP2) proposals. For Phase I, refer to the 15.2 DoD Program Solicitation for Phase I Topics and Proposal Instructions, and the DARPA 15.3 Phase I Instructions (<http://www.acq.osd.mil/osbp/sbir/index.shtml>).

Topic Number	Topic Title	Proposals Types Accepted	
		Phase I	DP2
SB153-001	Soft Bio-Interfaces for Physiological Sensing and Modulation	YES	YES

SB153-002	GHz, Octavespanning Photodetectors for MWIR/LWIR	YES	NO
SB153-003	Tunable Cyber Defensive Security Mechanisms	YES	NO
SB153-004	High-Sample Rate Analog to Digital Converters for Reconfigurable Phased Array Applications	YES	YES
SB153-005	Conformal, Random Access Beam Steering for Broadband Systems	YES	YES
SB153-006	Medium Caliber Projectile Conformal Antenna RF Seeker	YES	NO

DARPA SBIR 15.3 TOPIC DESCRIPTIONS

SB153-001 TITLE: Soft Bio-Interfaces for Physiological Sensing and Modulation

PROPOSALS ACCEPTED: Phase I and DP2. Please see the 15.3 DoD Program Solicitation and the DARPA 15.3 Phase I Instructions for Phase I requirements and proposal instructions.

TECHNOLOGY AREA(S): Biomedical, Sensors

OBJECTIVE: Develop and demonstrate clinically-viable bio-interface technologies that have mechanical properties similar to tissue, yet can interface with conventional benchtop and/or implantable electronics to form complete systems for biological sensing and modulation. Areas of interest include implantable interface technologies for neural and other biological tissue, as well as wearable biosensors and interfaces.

DESCRIPTION: There is a critical need for DoD capabilities that would provide breakthrough medical treatments for wounded warriors with post-traumatic stress disorder (PTSD), anxiety, immune system dysfunction and other DoD-relevant health issues. Regulation of neural and other biological functions via interface technologies has become increasingly enticing as a means of clinical treatment [1]. For instance, over the past several decades we have seen the emergence of neural recording and stimulation to restore sensorimotor capability and vagal nerve stimulation technologies for the treatment of epilepsy and depression. While these treatments have achieved moderate success, existing clinically approved technologies offer limited stability and precision, which significantly hinders their clinical translation. Despite recent noteworthy advancements in pre-clinical electrode technologies, existing devices suffer from reliability problems, often associated with tissue damage and/or mechanical failure of the device [2].

Even state-of-the-art interface technologies exert high mechanical strain on surrounding tissues, leading to scarring, persistent bleeding and neuronal damage. Tissue in the peripheral nervous system (PNS) has Young's Modulus of approximately 600 kPa. Traditional electrodes are manufactured using either fine metal wires, such as platinum (168 GPa), or microfabricated from silicon (180 GPa). This six order of magnitude difference in stiffness leads to a number of issues—including tissue damage, surgical attachment and relative motion—which reduce the clinical viability of these technologies. By developing bio-interfaces with kPa-scale stiffness, it would be possible to attach neuromodulation devices to the PNS without incurring these problems. Proposed implantable neural interface devices should be able to penetrate the tough epineurium of a specified nerve (e.g. vagus, ulnar), enter multiple fascicles and accommodate the range of motion that the nerve typically encounters. Wearable technologies should similarly match the mechanical properties of skin and tissue to provide robust, biocompatible solutions for biological interfacing.

This topic seeks to advance the clinical readiness of bio-interface technologies by decreasing the biomechanical mismatch between manufactured devices and biological tissue. The most established approaches in this space use polymeric substrates with embedded conductors [3]. There have been recent advances in materials that may push the Young's Modulus down even further, such as shape memory polymers that soften when inserted into tissue [4]. While these advances are important, all still use substrate materials that have a modulus greater than 10 MPa. Some early demonstrations of biologic materials such as collagen [5] have yielded crude but functional devices with kPa-

scale stiffness properties. Dissolvable carrier substrates [6] have also shown promising results, but depend heavily upon the dissolution rate of the sacrificial material and leave behind tiny but stiff electrodes.

Despite these advances in materials science and device fabrication, there has been little progress towards demonstration of functional devices, much less mechanical testing with ex vivo nerve tissue or in vivo electrophysiological validation. Without this validation, promising new technologies will not be adopted by the neural interface community or medical device manufacturers.

PHASE I: Proposals to this topic should aim to develop and/or demonstrate mechanically compliant yet reliable biological interface devices that are wearable or implantable, enabling direct monitoring or modulation of biological signals in peripheral nerves and organs. Implantable PNS-specific devices should demonstrate an ability to penetrate the epineurium and perineurium of a nerve to insert kPa-scale electrodes into individual fascicles, and to do so at a scale and precision relevant to neuromodulation therapies. These devices should include interconnects to mate with standard benchtop or implantable electrophysiology equipment. Wearable devices should provide reliable measurement of biological signals that are relevant to quantifying health physiology.

Phase I deliverables include:

Proof of concept demonstrating the feasibility of manufacturing and implementing novel soft bio-interface devices. Feasibility may be demonstrated through a variety of models, including tissue phantoms, in vitro, ex vivo, or in vivo studies. The final report must include a quantitative analysis of interface properties and mechanical characteristics. The final report should also contain detailed plans for Phase II.

PHASE II: Work in this SBIR topic should focus upon creating fully functioning interface devices suitable for chronic implantation in vivo. Performers should develop manufacturing and testing procedures to produce and verify the flexible bio-interface assembly. Devices should comprise a set of interconnects, flexible tethering leads and a compliant substrate containing a multitude of interface sites for stimulating and/or sensing neural activity (at fascicular resolution or better) or measuring biomolecules in vivo. The interface assemblies must be safe, effective and chronically stable for long-term use in animals or humans.

Phase II deliverables include:

Demonstrate the reliability and scalability of the manufacturing approach. Proposals should include plans to develop and demonstrate individual compliant devices using batch manufacturing process flows capable of producing hundreds of identical devices. Studies should characterize the morphological and physiological properties of relevant tissue to develop advanced finite element models and validate these against ex vivo experiments with the soft interface technology. Phase II efforts must also demonstrate the lifetime of the devices through Failure Mode and Effects Analysis (FMEA), including mechanical, soak and electrical testing. Finally, the devices must be tested chronically in animal models to validate sensing and modulation capability, as well as cross-talk, impedance and other relevant properties. Tissue samples must undergo histological examination to demonstrate the extent of damage incurred during application or surgical insertion as well as after chronic use.

Direct to Phase II: Existing technologies that target peripheral nerves and have demonstrated capabilities are eligible for Direct to Phase II applications.

PHASE III DUAL USE APPLICATIONS: Highly effective clinical therapies for treating disease and mental health through biocompatible neuromodulation devices.

Highly effective treatments for PTSD, anxiety, immune function, and other DoD-relevant health issues through biocompatible neuromodulation devices.

REFERENCES:

1. Famm et al. (2013), "Drug discovery: A jump-start for electroceuticals," Nature 496 (159-161).
2. Barrese, James C., et al. "Failure mode analysis of silicon-based intracortical microelectrode arrays in non-human primates." Journal of neural engineering 10.6 (2013): 066014.

3. Yoshida, Ken, Thomas Stieglitz, and Shaoyu Qiao. "Bioelectric interfaces for the peripheral nervous system." Engineering in Medicine and Biology Society (EMBC), 2014 36th Annual International Conference of the IEEE. IEEE, 2014.
4. Ware, Taylor, et al. "Fabrication of responsive, softening neural interfaces." Advanced Functional Materials 22.16 (2012): 3470-3479.
5. Chen, Shuodan, and Mark G. Allen. "Extracellular matrix-based materials for neural interfacing." MRS bulletin 37.06 (2012): 606-613.
6. Gilgunn, P. J., et al. "An ultra-compliant, scalable neural probe with molded biodissolvable delivery vehicle." Micro Electro Mechanical Systems (MEMS), 2012 IEEE 25th International Conference on. IEEE, 2012.

KEYWORDS: biology, neuroscience, peripheral nervous system, spinal cord, neuromodulation, nerves, shape memory polymers, silicone, electrode, collagen, elastomer.

SB153-004	TITLE: High-Sample Rate Analog to Digital Converters for Reconfigurable Phased Array Applications
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PROPOSALS ACCEPTED: Phase I and DP2. Please see the 15.3 DoD Program Solicitation and the DARPA 15.3 Phase I Instructions for Phase I requirements and proposal instructions.

TECHNOLOGY AREA(S): Electronics, Sensors

OBJECTIVE: Develop high-sample rate, low power, analog-to-digital converters (ADCs) for elemental digital phased array antennas. By the end of Phase II of the program, the ADCs should have a demonstrated effective number of bits (ENOB) > 6 bits, conversion rate of > 40 Giga samples per second (GS/s), analog bandwidth >20 GHz and power consumption < 500 mW.

DESCRIPTION: The ability to quickly and efficiently convert radio frequency (RF) signals to the digital domain where the underlying information can be processed using digital signal processing is a critical aspect of many DoD electronics systems. A specific example are phased array antenna systems, where high speed analog-to-digital converters (ADCs) enable the RF frequency band selection and RF beam steering to be performed using flexible and adaptive digital signal processing.

Recently, great advances have been made in high sample rate (>10 GS/s), yet energy efficient ADCs [1-3], dramatically improving the well-known Walden figure-of-merit (FOM). Yet, improvements in dynamic range, analog bandwidth and especially power consumption are needed for these converters.

To meet the needs of the DoD, this solicitation seeks high-sample rate ADCs that can meet the specifications of an ENOB greater than 6 bits, conversion rate faster than 40 GS/s, analog bandwidth greater than 20 GHz and power consumption less than 500 mW by the end of Phase II of the program. Designs may use digitally-assisted or other methods to improve performance. Especially of interest are ADC implementations that have beneficial physics based scaling in advanced CMOS technology nodes of 32 nm and below.

PHASE I: Develop, analyze and sufficiently simulate an ADC architecture with a predicted performance of:

- (1) Power < 500 mW
- (2) ENOB > 6b
- (3) Data Rate > 40 GS/s
- (4) Analog Bandwidth > 20 GHz
- (5) FOM < 200 fJ/conversion-step

Required Phase I deliverables will include:

(1) A report detailing the ADC architecture, design and expected performance.

PHASE II: Use Phase I analysis to design, build, and successfully demonstrate the operation of a prototype ADC for Government evaluation with the following specifications:

- (1) Power < 500 mW
- (2) ENOB > 6b
- (3) Data Rate > 40 GS/s
- (4) Analog Bandwidth > 20 GHz
- (5) FOM < 200 fJ/conversion-step

Required Phase II deliverables include:

- (1) Report containing design, simulation, layout files and test results from 2 ADC chips.
- (2) Delivery of 2 packaged ADC chips to the government.
- (3) Any necessary GDS or equivalent layout files to allow the Government to re-fabricate the design.
- (4) A datasheet containing all the information needed for the government to characterize the chip, use the chip in an application or incorporate the data converter design and layout into a larger integrated circuit.

PHASE III DUAL USE APPLICATIONS: In the emerging 5G standard for wireless handsets, phased arrays are expected to supply the spatial filtering needed to massively increase the number of handsets supported by a single base station. Digital phased arrays would further add to the flexibility and number of simultaneous users (handsets) but further increases in ADC sample rate and bandwidth are required for digital phased arrays to emerge at 5G.

Much like the Phase III commercial communications application, high-sample rate ADCs for DoD/Military applications are of great importance. Multiple-input multiple-output (MIMO) radio frequency systems are an effective method for in-theatre communications. These ADCs are a crucial component to breaking through the limitations of current MIMO systems to create MIMO systems supporting a greatly increased number of carriers and thus communications bandwidth.

In order to reach the goals of future communications systems, Phase III ADC metrics are as follows:

1. Power < 500 mW
2. ENOB > 6b
3. Sample > 80 GS/s
4. Analog Bandwidth > 40 GHz

REFERENCES:

1. L. Kull, et. al, "A 90GS/s 8b 667mW 64x Interleaved SAR ADC in 32nm Digital SOI CMOS". ISSCC 2014
2. N. Heath, "IBM opens the door to 400Gbps internet", [Online]. <http://www.zdnet.com/article/ibm-opens-the-door-to-400gbps-internet/>
3. B. Murmann, "ADC Performance Survey 1997-2013," [Online]. <http://www.stanford.edu/~murmman/adcsurvey.html>

KEYWORDS: ADC, A/D, analog-to-digital conversion, data converter, phased array

SB153-005 TITLE: Conformal, Random Access Beam Steering for Broadband Systems

PROPOSALS ACCEPTED: Phase I and DP2. Please see the 15.3 DoD Program Solicitation and the DARPA 15.3 Phase I Instructions for Phase I requirements and proposal instructions.

TECHNOLOGY AREA(S): Air Platform, Sensors

OBJECTIVE: Demonstrate a conformal, thin, broadband and rapid optical beam steering device without gimbals.

DESCRIPTION: There is a critical DoD need for a new class of broadband, random access electro-optic sensors on lightweight, airborne platforms. A conformal, thin, broadband and rapid steering beam steering device would overcome the usual, disadvantages of traditional optical systems and electro-optical devices beam steering devices, which use heavy and power-hungry gimbals and optical components making large mechanical motions. Non mechanical optical beam steering devices have been demonstrated. Most use electrically- controlled optical diffraction to steer the optical beam. These devices operate over a narrow wavelength band, since the diffraction induced steering angle depends sensitively on the wavelength of light. These narrowband devices are not suitable for broadband optical applications.

Most passive electro-optic (EO) systems are broadband. Also there are laser systems, such as femto-second pulsed lasers and supercontinuum lasers that are broadband and will allow broadband light detection and ranging (LIDAR) systems. Providing broadband beam steering for lidar and passive EO systems could enable new LIDAR capabilities using these super continuum lasers, and new passive EO systems capability.

As a baseline this effort will require operation in either the near IR wavelength region or the mid IR wavelength region. The proposed effort should discuss extending this capability to the visible and to either the NIR region or MWIR region, which ever band is not covered by the baseline approach.

Threshold performance objectives are a 10 cm diameter aperture, a 60 degree field of steering in both angular dimensions, > 75% optical transmission efficiency , broadband operation over at least 10 percent bandwidth, beam quality no worse than 3 times diffraction limit, and < 1 msec beam steering time. It is desire able to exceed these goals if possible. It is desirable to keep physical size small, with the beam steerer no deeper than the diameter of the clear aperture beam steering device. A key aspect of the approach is that the beam steering concept must be compatible with conformal windows on aircraft (i.e. windows that conform to the airframe surface). Beam steering approaches should be capable of operating bi-directionally, that is, as optical transmitters and receivers.

PHASE I: Determine feasibility of possible EO beam steering approaches and evaluate their performance. The Phase I effort should result in (1) detailed physical optics simulation of light propagation through the component(s), (2) assessment of the beam steering dynamic behavior and electrical properties, and (3) preliminary evaluation of the expected size, weight, and power consumption of a prototype implementation.

PHASE II: Demonstrate the Phase I concept via laboratory brassboard experiments, and develop a preliminary design of a device for field experiments. In Phase II, a Phase I concept will be reduced to practice and performance validated in a laboratory setting. The experiments conducted should result in empirical and/or analytic knowledge that will be used in the preliminary prototype design effort. The laboratory brassboard may not directly meet the desired threshold objectives, but should at a minimum provide characterization data and demonstrate by analysis that the performance objectives can be met. The preliminary design should focus on a demonstration system which could be utilized in a field experiment and would directly meet the performance objectives. Phase II deliverables include: (1) laboratory brassboard design, (2) report of brassboard experiment results, (3) preliminary design package for field test device.

PHASE III DUAL USE APPLICATIONS: A Phase III system could be applied to a number of commercial applications, including: 1) LIDAR measurements of wind velocities, aerosol characterization, and terrain mapping, 2) compact surveillance systems in security applications. A commercially focused Phase III effort would choose a viable commercial use and build a prototype system optimized for that application.

The DoD currently uses a large number of broadband EO systems, and active EO systems (e.g. LIDAR) are increasingly of interest as well. The use of optical systems such as these is limited by the need for a turret to house the beam director. This protrusion causes aerodynamic drag that limits range and speed of the platform. Additionally, the wake turbulence can limit the useful speed and field-of-regard regime of the sensor systems. A Phase III effort would focus on increasing the TRL level of the technology to a point that is compatible with an airborne demonstration on a relevant military air platform. The effort would include any necessary component technology development, but primarily be a detailed design, integration and test phase. Phase III would include a

final test and evaluation of the beam steerer with both an active EO system and a broadband passive EO sensor.

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