



**Broad Agency Announcement
COmpact Front-end Filters at the ElEment-level
(COFFEE) Program, Technical Area 2 (TA2)**

MICROSYSTEMS TECHNOLOGY OFFICE

HR001124S0027

May 07, 2024

This publication constitutes a Broad Agency Announcement (BAA) as contemplated in Federal Acquisition Regulation (FAR) 6.102(d)(2) and 35.016 and 2 CFR § 200.203. Any resultant award negotiations will follow all pertinent law and regulation, and any negotiations and/or awards for procurement contracts will use procedures under FAR 15.4, Contract Pricing, as specified in the BAA.

OVERVIEW INFORMATION:

- **Federal Agency Name** – Defense Advanced Research Projects Agency (DARPA), Microsystems Technology Office
- **Funding Opportunity Title** – COmpact Front-end Filters at the EIElement-level (COFFEE) Program, Technical Area 2 (TA2)
 - This BAA solicits research proposals that address TA2 of the COFFEE program.
- **Announcement Type** – Initial Announcement
- **Funding Opportunity Number** – HR001124S0027
- **Assistance Listing Number:** Not applicable
- **Dates/Time - All Times are Eastern Time Zone (ET)**
 - Posting Date: May 07, 2024
 - Proposers Day: May 08, 2024
 - Proposal Abstract Due Date: June 04, 2024, at 4:00 p.m.
 - Question Submittal Closed: July 12, 2024, at 4:00 p.m.
 - Proposal Due Date: August 02, 2024 at 4:00 PM
- **Anticipated individual awards** – Multiple awards are anticipated.
- **Types of instruments that may be awarded** – Procurement contract, cooperative agreement, Other Transaction agreements.
- **NAICS Code:** 541715
- **Agency contact**
 - Technical point of contact: Dr. Todd Bauer, Program Manager

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Section I: Funding Opportunity Description

The Defense Advanced Research Projects Agency (DARPA) is soliciting innovative proposals that demonstrate integration of technology developed in the COmpact Front-end Filters at the EIEment-level (COFFEE) program. Proposed research should investigate innovative approaches that enable revolutionary advances in science, devices, or systems. Specifically excluded is research that primarily results in evolutionary improvements to the existing state of practice.

A. Background

The drive toward wideband, digital-at-every-element, active electronically scanned arrays (AESAs) has increased AESA capabilities but left them vulnerable to interferers. To mitigate the impact of interferers, DARPA set out to develop compact, high-performance radio frequency (RF) filter technology through the COFFEE program, Broad Agency Announcement [HR001121S0031](#) (BAA1).

Recent spectrum allocations for FutureG and satellite communications (SATCOM), among others, create new commercial opportunities but risk signal interference with incumbent Department of Defense (DoD) systems. Notably, these new spectrum allocations are in the frequency range addressed by COFFEE RF filters. Thus, breakthroughs in RF filter technologies made in COFFEE now have the potential to radically address the challenges of signal interference across the DoD and in many commercial applications. COFFEE Technical Area 2 (TA2) seeks to demonstrate the newly expanded potential of COFFEE technology.

B. Program Description

COFFEE TA2 will capitalize on the breakthroughs in RF filter size and performance made during the COFFEE program by integrating COFFEE filters into exemplars that demonstrate interference suppression. Such exemplars must:

- Include COFFEE filters that will continue to meet performance metrics after integration with switches and external components
- Cover all or parts of 2 to 18 GHz frequency range of the COFFEE program
 - Proposals are encouraged to incorporate frequencies above 8 GHz, which is the focus of TA1 Phase 2 in BAA1
 - Proposals that incorporate frequencies above 18 GHz will be considered with sufficient justification comprised of technical evidence and application impact
- Necessitate the compact size and performance of COFFEE filters as per the COFFEE TA1 Phase 2 metrics in BAA1
- Demonstrate manufacturability
- Demonstrate a high degree of disruption potential that departs from current practices in filter design and manufacture

COFFEE TA2 is open to a range of applications and definitions of disruptive potential. Some examples include: a radical change to an industry or market, broad societal and/or DoD impact, new or greatly accelerated breakthrough capabilities, discovery of a new field of scientific inquiry, and performance well beyond stated metrics. Proposers should clearly show how they

will achieve the disruptive potential of COFFEE technology through their exemplar filters and how the effort supports a transition strategy after the COFFEE program has concluded.

It is anticipated that COFFEE filters will need to be integrated into systems along with external components such as switches, controls, interconnects, interposers, tuning elements, etc. These components risk degrading system performance and increasing overall filter component size beyond what is integrable into a system. COFFEE TA2 is open to a range of architectures that overcome these challenges. However, TA2 is not intended to develop fundamental filter technology. TA2 should apply filter technology currently under development that meets COFFEE's TA1 metrics in BAA1. The technical risks of individual approaches should be highlighted along with mitigation strategies as well as recent innovations that enable success.

Solutions that use domestic manufacturing capabilities to achieve program goals are preferred, as DARPA seeks to strengthen domestic access to differentiating technologies. Exemplars that combine COFFEE filters with technology from other DARPA programs will also be considered if necessary to realize disruption. Proposers should note that COFFEE technologies that exceed program metrics may be subject to export control regulation. Refer to the Controlled Unclassified Information (CUI) Guide, provided as Attachment G to this BAA, to determine how data and hardware will be safeguarded during the program.

For additional details, please see the previous COFFEE program BAA [HR001121S0031](#).

C. Program Structure

COFFEE TA2 is a single-phase (18-month) effort that will validate all Technical Challenges of COFFEE BAA1 by integrating 2–18 GHz (or a subset of) filters with as-needed external components (e.g., switches, controls, interconnects, interposer, etc.) into a filter tile. TA2 will culminate with the delivery of integrated filter tiles that meet the performance metrics and constraints shown in Tables 1 and 2 (below). This will demonstrate the potential for scalable manufacturing and interference suppression.

It is anticipated that proposers will project from demonstration-level metrics to system-level performance and significant impact to system capabilities. Proposers are encouraged to suggest and justify metrics particular to their demonstration beyond those listed in Tables 1 and 2 below. However, proposers must provide evidence that their fundamental filter technology meets the metrics and constraints of TA1 in BAA1.

Table 1. COFFEE TA2 Demonstration Metrics

TA2 Metrics [§]		Notes*
Filter Center Frequencies, f_c (GHz)	2–18	1
Maximum Filter Insertion Loss, dB	< 2	2
Maximum Filter Architecture Insertion Loss, dB	< 3	2
Instantaneous Bandwidth, % of f_c	> 5%	2,3
Out-of-Band Rejection, dBc	> 30	4
Selectivity, dBc	> 20	5
In-band power handling, dBm	> 30	6
In-band / Out-of-band IIP3, dBm	> 10 / 40	7
Maximum frequency variability, % of nominal	0.5%	8
Maximum Filter Area, mm ²	< 69/ N	9

- 1) A demonstration that covers a subset of this range is acceptable depending on the target application. Demonstrations may specify additional frequencies beyond this range if relevant to the application.
- 2) Insertion loss is defined as the greatest loss at any frequency falling within the instantaneous bandwidth.
- 3) Instantaneous fractional bandwidth is constrained to < 8% f_c .
- 4) Out-of-band rejection is measured at five instantaneous bandwidths from center frequency.
- 5) Selectivity is measured at one instantaneous bandwidth from center frequency.
- 6) In-band power handling metric denotes maximum input power with 20% duty cycle. Power handling will be gauged on measurable deterioration in filter insertion loss and bandwidth following a 1-hour burn-in.
- 7) The input third-order intercept point (IIP3) is measured using two tones in the passband/stopband, respectively.
- 8) Maximum center frequency variability demonstrated over at least eight filter parts.
- 9) Area of an individual filter, including tuning elements, if applicable, where N is the number of filters required to cover the 2–18 GHz bandwidth for the instantaneous bandwidth and given filter tuning range capability. Demonstrations that cover a subset of this frequency range should provide a performer defined area metric with justification. Note that area is calculated from the two longest dimensions of the filter. Please see Table 2 for further details required in area calculations.

[§]Additional metrics may be specified and justified by the proposer based on the application.

*For clarity, see Figure 3 in BAA1.

Table 2. COFFEE TA2 Demonstration Constraints

TA2 Constraints	
Filter Architecture Area, mm ² *	69
Filter Architecture Power Consumption, mW	< 20
Temperature Coefficient of Frequency, ppm/°C	< 100

* Filter architecture area should be calculated based on the size and number of filters and specified external components (e.g. switches, controls, interconnects, tuning elements, etc.). Demonstrations that cover a subset or extension of the 2–18 GHz range should justify an architecture area metric appropriate for the specific use case.

D. Schedule/Milestone

COFFEE TA2 will be an 18-month, single-phase effort estimated to start in Q2FY25 and run in parallel to the COFFEE program’s other ongoing technical areas. A mandatory program kickoff will be held to present technical approaches, discuss technical and programmatic items of concern, and interact with the government team and other program performers. An end-of-phase meeting will be held one month prior to the end of the phase period of performance. This meeting will be used to present demonstrations, progress towards metrics, technical achievements, and transition updates. Progress will be monitored through quarterly teleconferences and occasional site visits by the DARPA program manager and other members of the government team. A summary of the program schedule is presented in Figure 1.

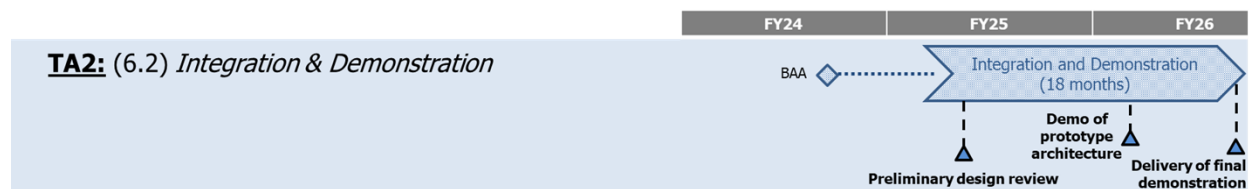


Figure 1. TA2 schedule overview; see text bullets below for specifics

The following program milestones are applicable to TA2:

- A program kickoff meeting to be held at program start
- A preliminary design review of the hardware design, including a detailed analysis of components under development (i.e., materials, structures, fabrication methods, external component requirements, supply chain, etc.), within three months of kickoff
- Demonstration of all technical metrics of the exemplar, approximately one month prior to the end of the period of performance
- Delivery of exemplar for independent verification and validation (IV&V), approximately one month prior to the end of the period of performance at the PM’s discretion

E. Deliverables

Final Report. Upon the completion of the COFFEE TA2, performers must provide to the Government an end-of-phase Final Technical Report that includes:

- a) A description of the demonstration, its principle of operation, and a projection to the system level application
- b) Simulations used to model demonstration performance and projection to system level performance (including source code)
- c) A transition strategy including a roadmap and the demonstration’s role in the strategy
- d) Method of demonstration construction
- e) Component lab test results

The Final Report must include charts and explanations of how well the integrated filter demonstration met, exceeded, or fell short of specified program metrics (as described in Table 1, Table 2, and performer specifications)

Quarterly Progress Reviews and Presentations. All performers must:

- Participate in Quarterly Progress Reviews, either via teleconference or at the performer's site at the discretion of DARPA. A program-wide kickoff will be held at the start of the phase and a review will be held at least once, at a time and place at the Program Manager's discretion.
- Submit briefing materials in PowerPoint format in advance of the Quarterly Progress Reviews.
- Provide plot data in tabular format to the Program Manager upon request.
- Provide detailed spend plans (or detailed program plans for fixed-price award instruments) at program kickoff and in the quarterly technical status reports.

Other negotiated deliverables specific to the objectives of the individual efforts also may be included. These may include registered reports, experimental protocols, publications, data management plan, intermediate and final versions of software libraries, code, and application programming interfaces (APIs), including documentation and user manuals, and/or a comprehensive assemblage of design documents, models, modeling data and results, and model validation data.

Exemplar hardware, as an option, can be considered as a deliverable to the Government should a Government agency express interest in obtaining the hardware for their own study and evaluation.

F. Government Furnished Equipment/Property/Information

No Government Furnished Equipment, Property, or Information will be provided in this effort.

G. Intellectual Property

Any proposed use of intellectual property (patents, proprietary information, etc.) should be clearly identified in the proposal. Identify all intellectual property claims to future results, prototypes, and deliverables. Explain how these claims may limit the Government use of the technology developed under the COFFEE program or development of derivative technologies. For forms to be completed regarding intellectual property, see Attachment C. If there are no intellectual proprietary claims, this should be so stated.

Section II: Evaluation Criteria

- Proposals will be evaluated using the following criteria listed in ***descending order of importance***: Overall Scientific and Technical Merit; Potential Contribution and Relevance to the DARPA Mission; Cost Realism; and Plans and Capability to Accomplish Technology Transition.
 - **Overall Scientific and Technical Merit**: The proposed technical approach is innovative, feasible, achievable, and complete. The proposed technical team has the expertise and experience to accomplish the proposed tasks. Task descriptions and associated technical elements provided are complete and in a logical sequence with all proposed deliverables clearly defined such that a final outcome that achieves the goal can be expected as a result of award. The proposal identifies major technical risks and planned mitigation efforts are clearly defined and feasible.
 - **Potential Contribution and Relevance to the DARPA Mission**: The potential contributions of the proposed effort bolster the national security technology base and support DARPA's mission to make pivotal early technology investments that create or prevent technological surprise. The proposed intellectual property restrictions (if any) will not significantly impact the Government's ability to transition the technology.
 - **Cost Realism**: The proposed costs are realistic for the technical and management approach and accurately reflect the technical goals and objectives of the solicitation. The proposed costs are consistent with the proposer's Statement of Work and reflect a sufficient understanding of the costs and level of effort needed to successfully accomplish the proposed technical approach. The costs for the prime proposer and proposed sub awardees are substantiated by the details provided in the proposal (e.g., the type and number of labor hours proposed per task, the types and quantities of materials, equipment and fabrication costs, travel and any other applicable costs and the basis for the estimates). It is expected that the effort will leverage all available relevant prior research in order to obtain the maximum benefit from the available funding. For efforts with a likelihood of commercial application, appropriate direct cost sharing may be a positive factor in the evaluation. DARPA recognizes that undue emphasis on cost may motivate proposers to offer low-risk ideas with minimum uncertainty and to staff the effort with junior personnel in order to be in a more competitive posture. DARPA discourages such cost strategies.
 - **Plans and Capability to Accomplish Technology Transition**: The proposer clearly demonstrates its capability to transition the technology to the research, industrial, and/or operational military communities in such a way as to enhance U.S. defense. In addition, the evaluation will take into consideration the extent to which the proposed intellectual property (IP) rights structure will potentially impact the Government's ability to transition the technology. Each proposer's commercialization and technology transition strategy must incorporate an initial product development plan including anticipated follow-on funding necessary to mature and manufacture the system at scale. Depending on the performer type (e.g., university, small business, national laboratory, etc.), the

performer may follow a technology licensing path, or create an entirely new company to manufacture and market the technology. Where applicable, technology transition letters of support are encouraged (i.e., written by a follow-on funding source, licensee, and/or white-label manufacturer).

- Unless otherwise specified in this announcement, for additional information on how DARPA reviews and evaluates proposals through the Scientific Review Process, please visit: [Proposer Instructions and General Terms and Conditions](#)

Section III: Submission Information

- This announcement allows for multiple award instrument types to be awarded, to include Procurement Contracts, Cooperative Agreements, and Other Transactions. Some award instrument types have specific cost-sharing requirements. The following websites are incorporated by reference and contain additional information regarding overall proposer instructions, general terms and conditions, and each specific award instrument type.
 - **Proposer Instructions and General Terms and Conditions:** [Proposer Instructions and General Terms and Conditions](#)
 - **Procurement Contracts:** [Proposer Instructions: Procurement Contracts](#)
 - **Assistance (Cooperative Agreements):** [Proposer Instructions: Grants/Cooperative Agreements](#)
 - **Other Transaction agreements:** [Proposer Instructions: Other Transactions](#)
- This announcement contains an abstract phase. Abstracts are strongly encouraged, but not required. Abstracts are due June 4, 2024, at 4:00 p.m. ET, as stated in the Overview section. Additional instructions for abstract submission are contained within **Attachment A**.
- Full proposals are due July 12, 2024, at 4:00 p.m. ET, as stated in the Overview section. **Attachments B, C, D, and E** contain specific instructions and templates and constitute a full proposal submission. Please visit [Proposer Instructions and General Terms and Conditions](#) for specific information regarding submission methods through the Broad Agency Announcement Tool (BAAT).
- **BAA Attachments:**
 - **Attachment A:** Abstract Instructions and Template
 - **Attachment B:** Proposal Summary Slide Template
 - **Attachment C:** Proposal Instructions and Volume I Template (Technical and Management)
 - **Attachment D:** Proposal Instructions and Volume II Template (Cost)
 - **Attachment E** MS Excel™ DARPA Standard Cost Proposal Spreadsheet
 - **Attachment F:** Associate Contractor Agreement (ACA)
 - **Attachment G:** COFFEE Controlled Unclassified Information Guide signed 5.10.2021

Section IV: Special Considerations

- This announcement, stated attachments, and websites incorporated by reference constitute the entire solicitation. In the event of a discrepancy between the announcement, attachments, or websites, the announcement shall take precedence.
- All responsible sources capable of satisfying the Government's needs, including both U.S. and non-U.S. sources, may submit a proposal that shall be considered by DARPA. Historically Black Colleges and Universities, Small Businesses, Small Disadvantaged Businesses and Minority Institutions are encouraged to submit proposals and join others in submitting proposals; however, no portion of this announcement will be set aside for these organizations' participation due to the impracticality of reserving discrete or severable areas of this research for exclusive competition among these entities. 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.
- As of the time of publication of this solicitation, proposal submissions are anticipated to be unclassified and classified. For an abstract or proposal that includes both classified and unclassified information, it is recommended that the abstract or proposal be separated into an unclassified portion and a classified portion. The submission should include as much information as possible in the unclassified portion and use the classified portion ONLY for classified information.
- When an abstract or proposal includes a classified portion, and when able according to security guidelines, we ask that proposers send an e-mail to HR001124S0027@darpa.mil as notification that there is a classified portion to the submission and to request instructions on how to submit the classified portion.
- This program is subject to Attachment **F**: Associate Contractor Agreement.
- This program is subject to Attachment **G**: COFFEE Controlled Unclassified Information (CUI) Guide signed May 10, 2021. All individuals accessing CUI agree to protect CUI in accordance with *DoD Instruction 5200.48 CONTROLLED UNCLASSIFIED INFORMATION (CUI)* and *NIST Special Publication 800-171 Protecting Controlled Unclassified Information in Nonfederal Systems and Organizations*.
- Federally Funded Research and Development Centers (FFRDCs), University Affiliated Research Centers, and Government entities interested in participating in the COFFEE TA2 program or proposing to this BAA should first contact the Agency Point of Contact (POC) listed in the Overview section prior to the Abstract due date to discuss eligibility. Complete information regarding eligibility can be found at [Proposer Instructions and General Terms and Conditions](#).
- As of the date of publication of this solicitation, the Government expects that program goals as described herein may be met by proposed efforts for fundamental research and non-

fundamental research. Some proposed research may present a high likelihood of disclosing performance characteristics of military systems or manufacturing technologies that are unique and critical to defense. Based on the anticipated type of proposer (e.g., university or industry) and the nature of the solicited work, the Government expects that some awards will include restrictions on the resultant research that will require the awardee to seek DARPA permission before publishing any information or results relative to the program. For additional information on fundamental research, please visit [Proposer Instructions and General Terms and Conditions](#).

Proposers should indicate in their proposal whether they believe the scope of the research included in their proposal is fundamental or not. While proposers should clearly explain the intended results of their research, the Government shall have sole discretion to determine whether the proposed research shall be considered fundamental and to select the award instrument type. Appropriate language will be included in resultant awards for non-fundamental research to prescribe publication requirements and other restrictions, as appropriate. This language can be found at [Proposer Instructions and General Terms and Conditions](#).

For certain research projects, it may be possible that although the research to be performed by a potential awardee is non-fundamental research, its proposed subawardee's effort may be fundamental research. It is also possible that the research performed by a potential awardee is fundamental research while its proposed subawardee's effort may be non-fundamental research. In all cases, it is the potential awardee's responsibility to explain in its proposal which proposed efforts are fundamental research and why the proposed efforts should be considered fundamental research.

- DARPA's Fundamental Research Risk-Based Security Review Process (formerly CFIP, now FERBS) is an adaptive risk management security program designed to help protect the critical technology and performer intellectual property associated with DARPA's research projects by identifying the possible vectors of undue foreign influence. The DARPA team will create risk assessments of all proposed Senior/Key Personnel selected for negotiation of a fundamental research grant or cooperative agreement award. The SID risk assessment process will be conducted separately from the DARPA scientific review process and adjudicated prior to final award. For additional information on this process, please visit [Proposer Instructions: Grants/Cooperative Agreements](#).
- The APEX Accelerators program, formerly known as the Procurement Technical Assistance Program (PTAP), focuses on building a strong, sustainable, and resilient U.S. supply chains by assisting a wide range of businesses that pursue and perform under contracts with the DoD, other federal agencies, state and local governments and with government prime contractors. See <https://www.apexaccelerators.us/> for more information.

APEX Accelerators helps businesses:

- Complete registration with a wide range of databases necessary for them to participate in the government marketplace (e.g., SAM).

- Identify which agencies and offices may need their products or services and how connect with buying agencies and offices.
 - Determine whether they are ready for government opportunities and how to position themselves to succeed.
 - Navigate solicitations and potential funding opportunities.
 - Receive notifications of government contract opportunities on a regular basis.
 - Network with buying officers, prime contractors, and other businesses.
 - Resolve performance issues and prepare for audit, only if the service is needed, after receiving an award.
- Project Spectrum is a nonprofit effort funded by the DoD Office of Small Business Programs to help educate the Defense Industrial Base (DIB) on compliance. Project Spectrum is vendor-neutral and available to assist businesses with their cybersecurity and compliance needs. Their mission is to improve cybersecurity readiness, resilience, and compliance for small/medium-sized businesses and the federal manufacturing supply chain. Project Spectrum events and programs will enhance awareness of cybersecurity threats within the manufacturing, research and development, as well as knowledge-based services sectors of the industrial base. Project Spectrum will leverage strategic partnerships within and outside of the DoD to accelerate the overall cybersecurity compliance of the DIB.

www.Projectspectrum.io is a web portal that will provide resources such as individualized dashboards, a marketplace, and Pilot Program to help accelerate cybersecurity compliance.

- DARPAConnect offers free resources to potential performers to help them navigate DARPA, including “Understanding DARPA Award Vehicles and Solicitations,” “Making the Most of Proposers Days,” and “Tips for DARPA Proposal Success.” Join DARPAConnect at www.DARPAConnect.us to leverage on-demand learning and networking resources.
- DARPA has streamlined our Broad Agency Announcements and is interested in your feedback on this new format. Please send any comments to DARPA solicitations@darpa.mil.