Proposal Track Overview
Spectrum Collaboration Challenge (SC2)
www.SpectrumCollaborationChallenge.com

DARPA-BAA-16-47
Collaborative Intelligent Radio Networks
(Proposal Track)
Competitors Information Day

August 10, 2016

Michael Blackstone
Contracting Officer
DARPA Contracts Management Office
Plenty of good information is made available to potential proposers to help clarify program goals/objectives and proposal preparation instructions.

However:

- Only the information/instructions in the BAA counts.
- Proposals will only be evaluated in accordance with the instructions provided in the BAA.
- Any response provided by the Government in the FAQ that’s different than what is provided in the BAA will be effected by an amendment to the BAA.  
  • Such responses will make note of an impending BAA amendment.

Only a duly authorized Contracting Officer may obligate the Government.
BAA Process - Overview

• Broad Agency Announcement (BAA) has been released utilizing the procedures stipulated at FAR 35.016.
  – BAA’s may be used by agencies to fulfill their requirements for scientific study and experimentation directed toward advancing the state-of-the-art or increasing knowledge or understanding (Science and Technology) rather than focusing on a specific system or hardware solution.
    • Science and Technology (S&T) is what DARPA does.

• Per FAR 35.016 -
  - The BAA, together with any supporting documents, shall—
    - Describe the agency’s research interest (program or broad research interests);
    - Describe the criteria for selecting the proposals, their relative importance, and the method of evaluation;
    - Specify the period of time during which proposals submitted in response to the BAA will be accepted; and
    - Contain instructions for the preparation and submission of proposals.

• Per FAR 35.016 -
  - Proposals received as a result of the BAA shall be evaluated in accordance with evaluation criteria specified therein through a peer or scientific review process.
  - Proposals need not be evaluated against each other since they are not submitted in accordance with a common work statement.
  - The primary basis for selecting proposals for acceptance shall be technical, importance to agency programs, and fund availability. Cost realism and reasonableness shall also be considered to the extent appropriate.

- - That’s it, as far as the regulations go - -

Email questions to sc2@darpa.mil
Distribution A. Approved for public release
BAA Process - Overview

- **BAA allows for a variety of technical solutions and award instrument types.**
  - The BAA defines the problem set, the proposer defines the solution (and SOW).
  - Allows for multiple award instrument types (depending on the nature of research).

- **DARPA Scientific Review Process.**
  - Proposals are evaluated on individual merit and relevance as it relates to the stated research goals/objectives rather than against one another (there is no common statement of work).
  - Selections will be made to proposers whose proposals are determined to be most advantageous to the Government, all factors considered, including potential contributions to research program and availability of funding (multiple awards anticipated).

  ➢ Government may select for negotiation all, some, or none of the proposals received.

  ➢ Government may accept proposals in their entirety or select only portions thereof.

  ➢ Government may elect to establish portions of proposal as options.
BAA Details

- BAA **does not** include an Abstract phase.

- **6.2 (applied) funding is anticipated.**
  
  - **6.2: Universities - Fundamental Research, no publication restrictions apply.**
    - One exception is non-university subcontractors.
  
  - **6.2: Other than Universities - Non-Fundamental/Restricted Research, publication restrictions apply.**
    - The one exception is university subcontractors.

BAA notes that Gov’t expects program goals may be met by proposers intending to perform fundamental research. Primes must justify any work to be performed by other than a university that is being claimed as fundamental.
**Important Dates:**

- **Posting Date** – 19 July 2016
- **Proposal Due Date** – 2 September 2016 (1pm EDT)
  
  ➢ *Late is Late: “Proposals received after this deadline will not be reviewed.”*

- **FAQ Question Due Date** – 22 August 2016 (1pm EDT)

- **Estimated Period of Performance Start** – 24 January 2017
BAA Details

Proposal Track Program Structure (overview):

<table>
<thead>
<tr>
<th>Technical Area</th>
<th>Phases</th>
<th># of Awards</th>
<th>Award Ceiling</th>
<th>Award Instrument</th>
<th>Cash Prizes</th>
</tr>
</thead>
<tbody>
<tr>
<td>BAA constitutes a single technical area (SC2 Competitor)</td>
<td>Ph 1 - 12 mo  Ph 2 – 12 mo  Ph 3 – 12 mo (No options- single CLIN)</td>
<td>Multiple</td>
<td>Ph 1 - $500K  Ph 2 - $750K  Ph 3 - $750K Total: $2M</td>
<td>Firm Fixed Price (FFP) Procurement Contract</td>
<td>SC2 Championship Event Only  1st Place: $2M  2nd Place: $1M  3rd Place: $750K</td>
</tr>
</tbody>
</table>

- A proposal seeking an amount greater than the stipulated award ceiling (by phase or in total) will be deemed non-compliant with the BAA.

- A proposal seeking an award instrument type other than a FFP procurement contract will be deemed non-compliant with the BAA.

Non-compliant = proposal will not be reviewed
## BAA Details

### Proposal Track Payable Milestones/Deliverables:

<table>
<thead>
<tr>
<th>Phase 1</th>
<th>Phase 2</th>
<th>Phase 3</th>
</tr>
</thead>
<tbody>
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<td>15 March 2017</td>
<td>14 March 2018</td>
<td>20 March 2019</td>
</tr>
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<td>15%</td>
<td>15%</td>
</tr>
<tr>
<td>Colosseum Integration</td>
<td>Mid-Term Status Report</td>
<td>Mid-Term Status Report</td>
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<tr>
<td>17 May 2017</td>
<td>13 June 2018</td>
<td>12 June 2019</td>
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<td>15 August 2018</td>
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<td>Site Visit &amp; Demo</td>
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<td>10%</td>
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</tr>
</tbody>
</table>

Email questions to [sc2@darpa.mil](mailto:sc2@darpa.mil)

Distribution A. Approved for public release
Eligibility Issues

- All interested/qualified sources may respond subject to the parameters outlined in BAA.

Any entity (individual, business, academic institution) selected for award under DARPA-BAA-16-48 (Competition Architecture) is ineligible to participate in the Spectrum Collaboration Challenge as either an Open Track or Proposal Track team (awarded under DARPA-BAA-16-47).

- Foreign participants/resources may participate to the extent allowed by applicable Security Regulations, Export Control Laws, Non-Disclosure Agreements, etc. (No classified proposals anticipated).

- Real and/or Perceived Conflicts of Interest:
  - Identify any conflict/s.
  - If any are identified, a mitigation plan must be included.
Eligibility Issues

**FFRDCs and Government entities:**
- Are not prohibited by the BAA from proposing.
- Are, however, subject to applicable direct competition limitations.
- Are, however, required to demonstrate eligibility (*sponsor letter*).

- The burden to prove eligibility for all such team members rests with the proposer.
- All elements of a proposal (tech and cost, prime and subs) must be included in the prime’s submission in order to be reviewed.
Proposal Submission

Proposals are due 2 September 2016 (1:00 PM EDT)

- Late is Late!
- Proposals received after the due date/time will not be reviewed.

So - why am I repeating this? Because there is typically 1 team who fails to heed this warning and their proposal is deemed non-compliant (not reviewed).

All proposals must be submitted via the DARPA BAA Website (https://baa.darpa.mil).

- You must click the “Finalize Full Proposal” button.
- If you don’t then your proposal has not been submitted for review.

Collaborative efforts and teaming encouraged; however, teams are to be wholly separate entities that do not share members, financial interests, or technical approaches/solutions.

Individuals cannot be members of multiple teams.
Proposal Preparation
(Volume I - Technical & Management)

- Page Limitations: 15 pages (Section II)

- Section II - Detailed Proposal Information:
  - Table of Contents
  - Technical Plan*
  - Statement of Work (by phase)*
  - Management Plan
  - Facilities
  - Executive Summary & Innovative Claims
  - Ongoing Research
  - Personnel
  - Teaming Arrangements

*Nonstandard language included – read carefully & follow instructions.

- Make sure to include every proposal topic - the point is to ensure the Gov’t fully understands what you are proposing.

- Make sure to review “Funding Opportunity Description” for additional proposal preparation information/instructions of a technical nature.
Proposal Preparation
(Volume II - Cost Proposal)

- No Page Limit.

**Those Seeking a Contract (FAR/DFARS)**

- Certified Cost and Pricing Information (required if over $750,000 – prime and subs)
  - Exception (DoD Waiver) for nonprofit organizations, including educational institutions.
  - Exception (DoD Pilot Program through 2020) for small businesses and non-traditional defense contractors if less than $7.5M.
  - No exception for FFRDC’s (if selected, rates/factors reviewed by sponsor CO).
    - Primes **must** provide sub analysis (per FAR Part 15).
    - Provide **all** that is stipulated in the BAA and FAR Part 15 (Table 15-2).
    - Proposal Adequacy Checklist (DFARS 252.215-7009) is **required**.

**All Others (Non-profits or schools)**

- Other than certified cost/pricing information is required (FAR Part 15).
- Provide the pricing info requested in the BAA.
Proposal Preparation
(Volume II - Cost Proposal)

All Proposers

- Detailed cost build-ups by phase, task and month.
- Cost build-ups using MS Excel with editable cells that include all formulas.

Cost Accounting System Approval

- Not applicable/necessary for FFP contracts.

Small Business Subcontracting Plan - required if proposal from large business exceeds $700,000.

Subcontractor Proposal(s):

- The prime contractors submission must include, at a minimum, a non-proprietary, subcontractor proposal for each subcontractor.*
- All subcontractors must be able to submit a fully disclosed version of their proposal directly to the Government immediately upon request.

➢*NO ROMS! (otherwise the proposal will be deemed noncompliant)
Government desires Unlimited Rights to data and/or software deliverables.

If asserting less than Unlimited Rights (e.g., Restrictions):
- Provide and justify basis of assertions using the prescribed format.
- Explain how each item will be used to support the proposed research project.
- Explain how the Government will be able to reach its program goals (including transition).

The above Data Rights Cert includes prime and sub info, as applicable.
This information is assessed during evaluations (barriers to transition).
Final/Negotiated Data Rights Cert is made a part of the award instrument (for contracts and OT’s).
Following the proposal preparation instructions assists the evaluation team to clearly understand what is being proposed and supports a timely negotiation.

Proposers are cautioned that evaluation ratings may be lowered and/or proposals rejected if proposal submittal or preparation instructions are not followed.
Evaluation Criteria
(In descending order of importance)

• Overall Scientific and Technical Merit
  – The proposed technical approach is feasible, achievable, complete and supported by a proposed technical team that has the expertise and experience to accomplish the proposed tasks.

• Potential Contribution and Relevance to the DARPA Mission
  – The potential contributions of the proposed effort are relevant to the national technology base.

• Cost & Schedule 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 schedule aggressively pursues performance metrics in the shortest timeframe and accurately accounts for that timeframe.

• Proposer’s Capabilities and/or Related Experience
  – The proposer's prior experience in similar efforts clearly demonstrates an ability to deliver products that meet the proposed technical performance within the proposed budget and schedule.
Communications

Prior to Receipt of Proposals (Solicitation Phase): No restrictions, however Gov’t (PM/PCO) shall not dictate solutions or transfer technology.

- Typically handled through the FAQ.

After Receipt of Proposals/Prior to Selections (Scientific Review Phase): Limited to Contracting Officer or BAA Coordinator (with approval) to address clarifications requested by the review team.

- Proposal cannot be changed in response to clarification requests.

After Selection/Prior to Award (Negotiation Phase): Negotiations are conducted by the Contracting Officer.

- PM and/or COR typically tasked with finalizing the SOW (with PI).
- PM and/or COR typically involved in any technical discussions (i.e., partial selection discussions).

Informal Feedback Sessions (Post Award): May be requested/provided once the selection(s) are made.

- If made on a timely basis (~2 wks after letter), all requests will be accepted.
FAQ

Questions must be submitted in writing to DARPA-BAA-16-47@darpa.mil.
- Send by no later than 22 August 2016 (1pm EDT).
- Avoid including proprietary/sensitive information (mark such info if included).

FAQ will be posted to:
- Filter by Office (select MTO)
- Select “DARPA-BAA-16-47.”

And
- www.SpectrumCollaborationChallenge.com

The BAA, and any amendments thereto, is posted on https://www.fbo.gov/.
- Sometimes possible that the BAA is amended due to question/s received so check back periodically (FAQ will note this if applicable).
Open Track Overview

- Open Track features
  - No need to write a proposal
  - Must complete Entrance Hurdles to participate
  - Team keeps all IP rights
  - Opportunity to win up to $3.5m in prizes
    - $750k in Preliminary Event 1 – up to 10 Open Track winners
    - $750k in Preliminary Event 2 – up to 10 Open Track winners
    - $2m grand prize in SC2 Competition Event

- Steps to participate in Phase 1
  - Initial registration: 1 Nov 2016
  - Full registration: 7 Nov 2016
  - Threshold Hurdles: 18 Nov 2016
  - Ranking Hurdles: 17 Jan 2017

- May enter at any phase
  - Phase 1 or 2 participation is not required to compete for Grand Prize
Open Track Registration

- Teams must register through our website:
  www.SpectrumCollaborationChallenge.com

- Registration opens Friday August 12th
  - Two-step process:
    1. Initial online registration
    2. Extended Application

- Teams must be wholly separate entities
- Other eligibility details are contained in the SC2 Rules Document
Open Track Flowchart

Register → Entrance Hurdles 1 → Top ~25 → Phase1 Activities → Prelim. Event 1 → Top 10 → $750K

Register → Entrance Hurdles 2 → Top ~15 → Phase2 Activities → Prelim. Event 2 → Top 10 → $750K

Register → Entrance Hurdles 3 → Top ~15 → Phase3 Activities

SC2 Champ. Event → $2M → $1M → $750K
Open Track Entrance Hurdles

• Entrance Hurdles determine the set of Open Track competitors
  • Software programming problems
  • Cover the SC2 core technical areas: Reconfigurable Radio Design, Radio 
    Environment Understanding, Reasoning, Contextualization, and Collaboration

• Threshold Hurdles
  • Submissions due November 2016
  • Pass/fail – team performance must exceed specified threshold
  • Assesses basic competence in the technical areas

• Ranking Hurdles
  • Submissions due January 2017
  • Open-ended – team performance will be compared to others
  • Much more challenging

• Detailed description and problems for Hurdles to be released 
  1 September 2016
Funding Opportunities for Open Track teams

- Prize awards

- Sponsorship
  - Sponsor trademarks are permitted in team names and materials
  - Sponsors may provide funding, technical tools, computing resources, work space
  - Sponsors may NOT provide staff or consulting if they are not a team member
  - If you have any questions about a sponsorship arrangement, ask DARPA in advance

- National Science Foundation awards
  - US-based universities and colleges only
NSF Support for proposers in DARPA SC2 through the Advanced Wireless Initiative

August 10, 2016
NSF Collaboration with DARPA SC2 Challenge

DARPA Spectrum Collaboration Competition (SC2) Grand Challenge
- [http://spectrumcollaborationchallenge.com/](http://spectrumcollaborationchallenge.com/)
- DARPA-BAA-16-47 for Proposal Track teams
- Open Track teams do not get DARPA contract funds, but are eligible for cash prizes at intermediate stages of SC2 as well as the final event.
- Three stage - each event at the end of year 2017 – 2019, up to 30 teams

NSF will provide support for academic researchers under Open Track
- US based universities and colleges only
- No prior NSF support required
- Only if the team clears the SC2 Stage Entrance Hurdles identified in the Rules Document
- Up to 5 – 6 awards to support 1 – 2 students for a year, starting in January 2017.
Specifics of NSF support for SC2

No restrictions on dissemination or publications
DARPA rules explicitly disallow collusion: e.g., source code cannot be dissemination until after the competition
Voluntary cost-sharing is prohibited, as is normal for NSF.

Clear Entrance Hurdles for current stage – to be announced soon

- Contact NSF PD, Thyaga Nandagopal, in January (of each year of SC2) with:
  - 2-page brief overview of the Collaborative Intelligent Radio (CIR) design, and evidence of passing Entrance Hurdles in January.

- If approved, then submit NSF proposal as either a EAGER, or as a supplement to existing NSF award
  - Awards will be made within 2 months

- Include technical design document, as specified in DARPA-BAA-16-47
  - technical description of Collaborative Intelligent Radio (CIR) design
  - evidence of clearing the Entrance Hurdles for current stage.
Colosseum (Testbed) Overview
Colosseum Introduction

- World’s largest wireless testbed
  - 256 x 256 100 MHz RF channel emulation
  - Capable of being subdivided for running multiple simultaneous scenarios
- 128 Standard Radio Nodes
  - Configured as 2x2 MIMO
  - Compute resources
- Access control and scheduling infrastructure
  - Supports remote access for scrimmages and competitions
- Scoring infrastructure
  - Runs automated scoring algorithms for rewarding optimized collaborative behavior
- Automated match initialization
  - Deployment of performer nodes
  - Configuration of RF environment

https://commons.wikimedia.org/wiki/File:Lightmatter_colosseum.jpg

Unique channel emulation along every TX/RX path
What can Colosseum do as an RF Testbed

• Make the radios believe they are operating in a 1 sq. km open field, a dense urban city, a suburban shopping mall, a desert, or anything in-between
• Multipath and fading effects will be simulated with high-fidelity ray-tracing

http://www.sodesoto.com/sites/328/uploaded/images/OutdoorMall.jpg

Email questions to sc2@darpa.mil
Distribution A. Approved for public release
What can Colosseum do as a Competition Framework

- Allow multiple teams to timeshare resources of the system to evaluate and debug their radio network designs using a large numbers of radio nodes
- Automate the execution of complex scripted scenarios involving multiple teams
- Visualize and Score the decisions, actions, effects and performance of multiple radio networks interacting in real-time

Email questions to sc2@darpa.mil
http://sdr.osmocom.org/trac/wiki/fosphor
Colosseum Management Functions

- **Resource Manager**
  - Manages resource requests from performers
  - Allocates resources to performers
  - Instantiates appropriate network filters via SDN control protocol

- **Visualizations**
  - Visualizations of the test bed events including users, scoring outcomes, channel environments, etc.
  - 3rd-party module

- **Event Scoring**
  - Set of metrics defined by a scoring algorithm. These are collected from various points within the test bed
  - 3rd-party software module

- **Channel Emulator Manager**
  - Manages channel emulator configuration
  - Collects performance data from emulator

- **Test Event Manager**
  - Controls setup and execution of scrimmages and tests
  - Disables remote access to test bed resources

- **Test Bed Monitor**
  - Collects test bed health data
  - Collects performance metrics
Colosseum Management Functions
Colosseum Hardware Sub-Systems

- **Performer Compute Nodes**
  - Dell R730 server w/ 1 GPU, dual processors, 64GB RAM
  - Ettus x310 with dual RF daughter cards
  - 10G Ethernet interconnect

- **Traffic Generators**
  - Software-based traffic generation solutions (e.g., D-ITG) hosted on a pool of dedicated servers
  - $N$ traffic generation processes forked for each performer node in use

- **Incumbent Systems**
  - DARPA-supplied incumbent radio systems
  - Could support USRP-based incumbent systems

- **Channel Emulator**
  - 128-port 2x2 MIMO RF inter-connect
Colosseum Competitor Sub-Systems

- **VPN Gateway**
  - Limit test bed access to performers, operators, and authorized observers

- **Web Server**
  - Primary access to test bed components
    - Software upload
    - Resource requests
    - Practice execution
  - Resource request front-end for open practice times
  - Test observation mode for scrimmage/test times

- **Database**
  - Stores test event metrics, system and user information
Radio design can take advantage of a heterogeneous processing architecture
Performers will provide installation script for installing their radio node on a standard OS baseline image
  • Baseline OS image will be provided by DARPA

Performers can submit radio configurations for testing against house radios when Colosseum is not in use for scrimmages or tournaments
  • Access will be limited in duration, with jobs scheduled such that no one performer can get exclusive access to Colosseum
  • Performers will have access to a subset of scenario configurations

Performers will have shell access to SRN host computers during testing
  • All external access to SRN host computers will be shut down for scrimmages and tournaments
  • Performers may still download logs at the completion of scrimmages and tournament matches
Schedule
Key Dates Prior to Phase 1 Kickoff

**Upcoming Key Dates**

Aug 10 2016  -  Competitor Information Day
Aug 11 2016  -  Architecture Proposers Day
Aug 22 2016  -  BAA Proposal FAQ Submissions Close
Sep 1 2016   -  Hurdle Problems Posted
Sep 2 2016   -  Proposal Due Date
Nov 1 2016   -  Open Track Team Registration Deadline
Nov 1 2016   -  Threshold Hurdle Submissions Open
Nov 7 2016   -  Open Track Team Extended Applications Due
Nov 22 2016  -  Threshold Hurdle Submissions Close
Dec 1 2016   -  Ranking Round Go/No-Go Announcement
Jan 1 2016   -  Ranking Hurdle Submissions Open
Jan 17 2016  -  Ranking Hurdle Submissions Close
Jan 24 2016  -  Proposal & Open Track Teams Announced
Jan 24 2017  -  Competition Phase 1 start
Teaming
Online Teaming

- DARPA will establish a website with a whitelist access list based on the email addresses from registration
- Directory of profile pages that each team or individual can edit themselves
- List a bio/team approach, what they're looking for, and contact info
- As team forms, update the page appropriately to note changes in availability or team needs
• Proposal Track Teams
  • Proposals due 9/2

• Open Track Teams
  • Find teammates
  • Register on spectrumcollaborationchallenge.com starting 8/12
  • Hurdles released 9/1
  • Hurdle submissions start 11/1

• Questions?
  • Email sc2@darpa.mil