

**IARPA Advanced Materials and Fabrication for Coherent
Superconducting Qubits Program**

Broad Agency Announcement
W911NF-08-R-0011

Answers to common questions are offered here. Greater detail is offered where the BAA may not be explicit. Where any questions may remain, the BAA is the overriding source for any guidance.

1. QUESTION: We do not have a qubit measurement capability. What do we do?

ANSWER: There are three options. First, the work may be proposed as a Level I activity as described by the BAA, which does not require qubit measurements. Secondly, a Level II proposal may be submitted as described by the BAA; where materials and theory groups combine forces with an additional team component possessing qubit measurement capability. The third option also applies to a Level II proposal. IARPA is considering establishing qubit measurement capabilities at a government laboratory and/or an FFRDC that would be available to performers whose work is selected to be funded by the program. The envisaged qubit measurement capability would include: 1) standardized environment and procedures; 2) standardized qubit architectures and interfaces to facilitate and insure representative comparisons of materials developments within and across separate groups; 3) qualifying device electronics screening for fabrication defects that preclude qubit measurement; and 4) qubit characterization and measurement including T_1 , T_2 , splitting density, etc. **Teams who “wish to take advantage of government-provided qubit measurement capability” should indicate this in their proposals.**

2. QUESTION: Will stand-alone theory efforts be supported?

ANSWER: No. As addressed in the BAA.

3. QUESTION: Will theory efforts be supported which are not directly tied to any single experimental activity but which interact with one or more experimentalists?

ANSWER: The BAA describes in detail the program goals and objectives, the achievement of the associated metrics and waypoints require experimental demonstrations. A theory effort, which only includes interactions with experimental groups, is unlikely to meet these requirements.

4. QUESTION: Can individual researchers be part of more than one proposal?

ANSWER: Duplicate research from multiple proposals will not be funded under the BAA. Roles and responsibilities of individuals proposing research under multiple proposals will be considered in the evaluation process.

5. QUESTION: Can institutions submit more than one proposal?

ANSWER: Yes, but redundancy should be avoided and efficiencies of scale should not be overlooked. Institutions need to decide whether to propose perhaps larger, concerted, and more comprehensive efforts compared to separate, disjointed efforts. Further, issues with the same individuals on multiple proposals should be taken into account as described above.

6. QUESTION: Will our feedback on the white paper be detailed or simply a go / no-go response?

ANSWER: The feedback will include a summary of the comments from the evaluation panel that would be useful to make a full proposal more responsive to the BAA.

7. QUESTION: Will the deadlines be extended?

ANSWER: The BAA has been amended, wherein the deadlines have been extended. See the amended BAA.

8. QUESTION: How is proprietary information handled and protected?

ANSWER: As described in the BAA, individuals who will read and help evaluate the proposals will have signed a Non-Disclosure-Agreement (NDA) with the government. In addition, the BAA outlines how to mark proprietary

information.

9. QUESTION: Can equipment costs be included in the budget?

ANSWER: Yes. Equipment costs specific and relevant to the tasks proposed will be considered.

10. QUESTION: How many awards are expected?

ANSWER: There is no pre-determined number of awards. The final number depends on the proposals recommended for funding by the evaluation panel and available funds for the BAA.

11. QUESTION: How much money per award?

ANSWER: There is no pre-determined maximum budget per award.

12. QUESTION: Does IARPA really have the money?

ANSWER: The program approach, goals, and projected funding have been formally reviewed in great detail and approved by the Director, IARPA, to proceed through the BAA phase. Actual availability of funds is dependent on the quality of proposals received as well as the out-year government budget process. Continuance of funding in the out-years depends, as described in the BAA, on performance against objectives as well as available funding.

13. QUESTION: Could an FFRDC be contracted to provide other services like a foundry?

ANSWER: No.

14. QUESTION: Will foreign proposals be at a disadvantage relative to US proposals?

ANSWER: No.

15. QUESTION: Will proposals that meet government interests be given a priority?

ANSWER: Proposal evaluation criteria have been described in the BAA. As stated in the BAA, "Award recommendations may be made for those proposals determined to offer the best overall value to the Government, all factors considered."

16. QUESTION: Is the program limited to a certain type of qubit?

ANSWER: The BAA solicits proposals to meet the goals of the IARPA Coherent Superconducting Qubit Program. Within that qubit there are no limitations placed on geometrical or architectural variations thereof.

17. QUESTION: Could someone put in a proposal to provide foundry services?

ANSWER: As the BAA describes, research topics of interest to this BAA do not include stand-alone foundry services.

18. QUESTION: Do you expect the theory component of the team to control the experimental component?

ANSWER: A collaborative, teaming approach is envisioned. Observations from experiments may drive theory back to the drawing board. Theory may compel additional experimental work. Neither controls the other, rather each are anticipated and responsible to serve the other for the best interest of the team as a whole. As the BAA describes, theory should attempt to describe all observed phenomena, provide predictive capability and ultimately insight into how to eliminate decoherence mechanisms.

19. QUESTION: What if metrics chosen are not correlated to qubit performance?

ANSWER: As described by the BAA, metrics chosen should be unambiguously correlated to qubit performance. However, any factor whose affect may not have yet been experimentally and definitively characterized in the field but may be reasonably expected to influence qubit performance is assumed an important metric until demonstrated otherwise. e.g., JJ physical quality (barrier film thickness, uniformity, morphology, interface quality, pinholes, stability...).

20. QUESTION: Can an entirely new qubit geometry be proposed that promises greater coherence? e.g., a new construction comprised of multiple JJs.

ANSWER: Yes.

21. QUESTION: What if a team has proven experimental capability generally with superconducting electronics and JJs but not proven capability measuring qubit performance for the kind in question?

ANSWER: As stated in the BAA, the BAA is not soliciting proposals to develop and establish qubit measurement capability. For a Level II proposal, the BAA requires the team to possess proven and established qubit measurement capability; that is, unless the proposal requests "... to take advantage of government-provided qubit measurement capability."

22. QUESTION: What if we are working hard on intrinsic noise sources but it is actually extrinsic sources that are most important and contributing more to decoherence?

ANSWER: The BAA solicits proposals to significantly enhance qubit performance (including T_1 , T_2 , readout fidelity, etc.) through advanced theory, materials, fabrication and geometries. The focus of the CSQ BAA is therefore on intrinsic coherence; eliminating intrinsic sources of decoherence. Extrinsic noise sources are considered inherent to the qubit measurement capability of the team. The BAA clearly indicates the CSQ Program does not solicit proposals to advance qubit measurement capability. The degree to which the team has extant qubit measurement capability will be reflected in how well extrinsic sources are controlled to achieve high-fidelity qubit performance measurements (coherence and fidelity). Should a team determine they do not have access to or are able to team with requisite qubit measurement capability, they may request "government-furnished capability" per guidance above.

23. QUESTION: What if we do not feel we need theory and what if we are not prepared to decide who else to add to the team as a theory component until we get down the road and better understand our needs?

ANSWER: The BAA clearly requests proposals possessing a strong and integral theoretical team component. Goals for the theoretical component are also clearly described in the BAA. The government cannot assess the strength of the team without it having been well-designed and definitively described within the proposal. Further, as described in the BAA the strength of any proposal will depend significantly on input from the theoretical component of the team.

24. QUESTION: For qubit coherence improvement goals of 2x, 5x and 10x, how should we pick what is state-of-art given different qubits and people's "best" reported values?

ANSWER: State-of-art should be best data openly available to the public and considered largely by the community as credible *and* reproducible, and derived from either peer-reviewed publications or openly attended symposium presentations.

25. QUESTION: Regarding materials purity, it may not be possible to get some material like Re with five 9s purity, so how are we supposed to deal with this?

ANSWER: The BAA solicits proposals to understand and eliminate intrinsic sources of decoherence through advanced materials, geometries and fabrication. This includes undertaking or engaging necessary means (e.g. as an added team component) to achieve necessary purity.

26. QUESTION: Regarding traceability, it is not clear that contamination is really an issue that needs to be addressed. Why should we spend so much effort worrying about this before it is proven to be a serious problem?

ANSWER: Assumptions on the role and magnitude of effects from impurities will be considered unsubstantiated without supporting data.

27. QUESTION: Should our budget be constant across all years, since equipment purchases would tend to be front loaded? Is IARPA able to handle a large 1st year load?

ANSWER: Teams should propose budgets required to succeed.

28. QUESTION: Is the budget shown in the BAA the limit?

ANSWER: The five-year budget shown in the BAA has been approved at the Director level of IARPA. Depending on quality of proposals received, an increase in the budget may be considered.

29. QUESTION: Can an FFRDC or government lab be used for support as long as they are not a formal subcontractor in the proposal or mentioned as a team component in the proposal?

ANSWER: The capability of an FFRDC or a Government Lab may not be leveraged in any way as a competitive component of any team funded by this Program.

30. QUESTION: Should issues raised in the feedback given to White Paper submissions be incorporated into the proposal or should they be addressed in a separate document?

ANSWER: Response to feedback should not be separated out from the body of the proposal. Responses should be incorporated in the body of the proposal in the natural progression of discussion.

31. QUESTION: Is the page limit of 2 pages for the Current & Pending Support section for all Senior/Key Personnel?

ANSWER: The page limit of 2 pages for the Current & Pending Support section is for each of the Senior/Key Personnel.