

DARPA Robotics Challenge
Questions & Answers

This document is a continuation of the DARPA Robotics Challenge Round 1 and 2 Q&A documents found at the following URL: <https://www.fbo.gov/spg/oda/darpa/cmo/darpa-baa-12-39/listing.html>

CONTRACTS

- C28. REF BAA Page 22, Section 2. Question: The instructions are very clear with regard to submission of grant and cooperative agreement proposals, but it is unclear how you would like us to submit proposal types such as Cost Plus or Fixed Firm Price. Should these types of proposals also be submitted through Grants.gov, or as hard copies?
- A. Submission rules are the same for all types of proposals. From BAA-12-39, page 30: Proposers should submit one (1) original, two (2) hard copies and two (2) CD-ROMs containing the entire proposal as a single Adobe PDF file to the following address:
ATTN: BAA 12-39
675 North Randolph Street
Arlington, VA 22203-2114
Grant or cooperative agreement proposals may only be submitted to DARPA through Grants.gov or in hard-copy. No e-mailed or faxed proposals will be accepted. The deadline for proposal submissions is 4:00pm Eastern Time on Thursday, May 31, 2012. The dates and times indicated are deadlines by which proposals must be received by DARPA or submitted to Grants.gov.
- C29. By what date should I submit the application?
- A. Please see BAA 12-39, page 30: The deadline for proposal submissions is 4:00pm Eastern Time on Thursday, May 31, 2012. The dates and times indicated are deadlines by which proposals must be received by DARPA or submitted to Grants.gov. Proposers are required to submit proposals by the time and date specified in the BAA in order to be considered. Ability to review late submissions remains contingent on availability of funds. Proposers are warned that the likelihood of funding is greatly reduced for proposals submitted after the initial closing date deadline.
- C30. How many members per team?
- A. Team composition is determined by the proposer.
- C31. What documents must we present to participate in the challenge?
- A. If you would like to submit a proposal for track A or track B, please follow the instructions set forth in BAA-12-39. Registration instructions for track C and D will be posted by DARPA at a future date.

- C32. Where should we send the documents?
A. Please follow the instructions in BAA-12-39 and refer to the answer to C34, above.
- C33. With whom do we contact you personally?
A. The program manager for this effort is Dr. Gill Pratt but all questions should be sent to the DARPA Robotics Challenge program email address: DARPA-BAA-12-39@darpa.mil.
- C34. Should an institution support us?
A. It is not necessary that teams receive financial support by an institution, but any cost sharing by an institution or other sponsors should be noted in the proposal
- C35. Does this open the call to the general public?
A. Yes.
- C36. I would like to know how to register for this program. I have registered in the interested vendor list already.
A. Individuals interested in participating in the DARPA Robotics Challenge for track A and/or B should follow the instructions in BAA-12-39. Registration instructions for track C and D will be posted by DARPA in the future.
- C37. What is considered a “human use”? E.g. if we use motion capture data during the research phase to collect data for machine learning, is it considered a human use? Does it depend on whether we use core team to collect the data or invite outside parties? Is apprenticeship learning considered a human use?
A. Research involving human subjects that is conducted or supported by the DoD must comply with 32 CFR 219, *Protection of Human Subjects* (http://www.access.gpo.gov/nara/cfr/waisidx_07/32cfr219_07.html) and 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>).
- C38. If some of the core team member prefer to be paid as self-employed (1099 vs. W-2), do they have to be treated as sub-contractors with all the complicated procedures?
A. The BAA does not place any restrictions on how teams manage team members.
- C39. C39. "Can members of a Track A DRC team receive funding from OSRF to contribute software in the development of the GFE simulator?"
A. No.

PROGRAMMATIC

- P44. Can you clarify what teams are and aren't allowed to build before the CDR? The BAA states that the “final build” will not be allowed until after the CDR. However, our hardware approach involves rapid iteration and multiple incremental builds throughout the program. Is there a dollar limit to spending before the CDR? What other limitations are there on hardware before the CDR?

- A. For Track A and Track B, Section F (Program Schedule) defines the phase periods, and Section G (Program Funding) defines the funding profiles for each phase. Within these schedule and funding constraints, teams may propose their preferred hardware approach, including rapid iteration and multiple incremental builds. The CDR is used as a forcing function on progress, ensuring that teams have a viable design that is ready for construction by that date.
- P45. The BAA states that the CDR will occur no later than 9 months from program kickoff. Is this date determined by the team, or will DARPA hold all CDRs in the same time period? Can we hold our CDR earlier?
- A. For Track A, DARPA will schedule Critical Design Reviews directly with each team. Teams may request earlier reviews.
- P46. I would like to ask whether the bibliography is included in the page count limit for the "Technical Approach" section in the proposal.
- A. References, if any, should be listed in Section 2.3 (Technical Approach), and do count towards that section's page count limit.
- P47. We understand that the precise vehicle type will not be known or specified until program kickoff. But as we contemplate the problem in order to direct our initial design efforts appropriately, it would be useful to have an idea of what class of vehicle to expect. Will this be some sort of civilian-style SUV with an ordinary driving interface? Or will it be a small front-loader or other type of construction vehicle with control knobs on long stalks? Or something else. And, will the vehicle have a glass windshield, or no windshield?
- A. The vehicle is expected to be a utility vehicle, with a steering wheel, foot pedals, and a windshield. Such vehicles are sometimes called "Utility Task Vehicles" (UTVs), "Recreational Off-road Vehicles" (ROVs) or "Side by Side" vehicles. Proposals should be written assuming this type of vehicle. DARPA may later modify the vehicle type to adjust the difficulty of the challenge.
- P48. Q&A mentions multiple times that the proposal should cover 27 months. At the same time, during these 27 months there will be several independent phases/grants. Could you elaborate? Are we applying simultaneously for Phase 1 Part 1, Phase 1 Part 2, and Phase 2 grants with this proposal, or will everything beyond Phase 1 Part 1 require a separate proposal? If we are applying for the future grants with this proposal, will modifications to the original plan be allowed?
- A. Proposers should submit one proposal covering the duration of the program.
- P49. According to BAA, "proposed research should investigate innovative approaches", and naturally some of these investigations might lead to intractable problems or less optimal solutions, requiring course corrections. We plan multiple areas of research with a lot of pruning down the road. That pruning will affect what has to be done later, including resource re-allocation and hiring. At the same time BAA and Q&As seem to imply a rigid plan for 27 months, built upfront.

Do you have any recommendations on how to structure the proposal if we believe that explorations, pruning and flexibility are important for maximizing the return from this program?

- A. Proposers should propose the approach they believe most likely to succeed within resource limitations. DARPA understands that plans evolve as knowledge grows with experience.

P50. We'd like to include a list of references in the proposal, but the proposal format in BAA does not list such subsection. Could we add an appendix to Section 2 or create Section 2.9 for a reference list? Including a list of references within Section 2.3 (as part of the 8 page limit) would reduce the technical contents significantly.

- A. References, if any, should be listed in Section 2.3 (Technical Approach).

P51. My institution does not permit "military research". Is the DARPA Robotics Challenge "Military Research"? If not, how do I explain this to my institution?

- A. The 2012 US Department of Defense (DoD) Strategic Guidance lists a range of primary missions for the US DoD, from military missions that potentially employ force, to non-military missions that do not. Humanitarian Assistance and Disaster Relief (HADR) is one of the US DoD's non-military primary missions, and provided aid during the Fukushima disaster as well many other disasters. While the results of any research, whether funded by civilian or defense organizations, may be used to advance military technology (and the DARPA Robotics Challenge is no exception), because the DARPA Robotics Challenge is focused on the non-military mission of Disaster Response, it may not meet your institution's definition of "military research". We hope that this explanation will enable your institution to allow you to participate in track A or B, but if your institution will not accept DARPA funding, we encourage you to participate in track C and have your institution talk to us further about this issue, or to secure funding elsewhere and participate in track D. Registration instructions for track C and track D will be posted by DARPA in the future.

TECHNICAL

T87. What computing resources are available on the mobile robot unit, which we can use to run software that we develop for the system? We assume that some of the processing resources on the mobile unit will be used for stereo vision, motion control, and other computational needs for the mobile unit's subsystems, so our goal is to determine what computing resources remain to run our software.

- A. The GFE Platform will have two on-board processors: One "Robot Computer" and one "User Computer." (Note that both processors are on-board the platform.) It is expected that Track B team software will run on the "User Computer." It is expected that only GFE Platform code will run on the "Robot Computer". The specifications of these two computers will be released no later than program kickoff.

T88. If we pursue Track B, can we plan on augmenting the computing resources on the mobile GFE robot unit, or will we be limited to the computing resources included in the GFE baseline?

- A. Track B teams must run their software on the “User Computer” on-board the GFE Platform, and may not add new computer systems to the GFE Platform. There are no constraints on computer hardware used by the operator control unit, which is to be provided by the team.
- T89. What kind of operator station will be provided for the GFE robot? One of the variables in the challenge will be the degree of human control required. Will we have the ability to customize the software and equipment at the operator station to implement our approach, or will we be limited to an existing operator station configuration?
- A. The GFE Platform does not include an operator station – it must be designed and provided by the teams.
- T90. What type of software interface will the GFE robot expose? For example, I would expect that the GFE robot would provide software that automatically manages leg movement and balance for walking, so we would not have to develop the low level control software to manage each actuator used in walking. However, I expect we might have to manage the low level actuator control for the arms when performing some actions, like steering a vehicle, or operating a valve handle. In developing a plan to address each of the technical capabilities needed to complete the challenge, we need sufficient detail on how the GFE unit will interface with our software, to be able to develop a proposed approach.
- A. The software interface will be specified no later than the Program Kickoff. The GFE will provide some low level behaviors but will not provide some high level behaviors. Proposers should make reasonable assumptions about the interface and indicate in their proposal what those assumptions are.
- T91. Ideally, there would be an interface document, specification, and drawings for the GFE unit, which we can use to develop our proposed approach. However, the BAA gives the impression that the GFE unit is still in development at this time. Can you tell us what documentation is available, and what we need to do to access this documentation? Even a list of requirements for the GFE system would give us a much better basis upon which to develop our proposal.
- A. The interface document, specifications, and drawings will be provided no later than the Program Kickoff. Proposers should make reasonable assumptions and indicate in their proposal what those assumptions are.
- T92. Will the GFE Simulator be able to simulate whatever control functionality is built into the GFE Platform?
- A. Yes.
- T93. With regard to T30, shall we assume that the GFE Simulator will also output simulated camera data, e.g. OpenGL rendering? It would be a waste of time to have to develop computer vision for rendered scenes, given that real-world computer vision tends to be quite different...
- A. It is expected that the GFE Simulator will output simulated camera and other sensor data.

- T94. Will the 3D model used by the GFE Simulator also be available to the control software? If that is the case, the positions/orientations/shapes of stationary objects can be obtained directly from the model, instead of being inferred using synthetic computer vision.
- A. Direct information about the 3D environment in the simulator may not be used, regardless of whether it is exposed. Teams must only use information perceived by modeled sensors.
- T95. The BAA states that a simulation is required at the CDR. What type of simulation is necessary? Should it be equivalent to that provided by the software teams, including complete supervised autonomy? The BAA implies that the purpose of the simulation at this stage is simply to verify the range of motion, force output capabilities, and other kinematic & dynamic capabilities of the robot. Is a simple simulation demonstrating that the robot can physically perform all the required tasks sufficient?
- A. For Track A, the simulation at CDR must implement the control approach, and must demonstrate the robot performing each of the scenario events. The more realistic the simulation, the more convincing the Critical Design Review will be.