

SINTRA Q&A

Round 1, IARPA-BAA-22-02

1. **Will you be answering the questions that were submitted after Proposer's Day but before the BAA release?**
 - Answer: No. The BAA has been formally released on SAM.gov. The BAA overrides information contained in the Proposer's Day slides. Only questions received in response to the BAA and submitted in accordance with the BAA instructions will be answered. Note: The Q&A period will be reopened and extended after release of BAA Amendment 001. IARPA will accept questions until October 21 @ 5:00pm EST sent to the email listed in the BAA.
2. **Since scientists from FFRDCs cannot participate as performers in IARPA projects but only as T&E, can these FFRDC scientists submit to this BAA as part of a consortium if they have joint appointments to such consortium?**
 - Answer: FFRDCs are generally not eligible to submit proposals or participate as team members of other eligible entities. We would need to review the details of the consortium arrangement and the role and affiliations of individual participants in order to make firm Eligibility and OCI determinations. Please reference BAA sections 3.A, Eligible Applicants, and 3.A.1 Organizational Conflicts of Interest (OCI).
3. RESERVED
4. RESERVED
5. **Will a purely ground based sensing approach be out of scope?**
 - Answer: No
6. **Will a purely machine learning proposal without sensing/collecting new data be out of scope?**
 - Answer: Please refer to the BAA metrics on revisit rate for persistent monitoring of the debris population.
7. **Is it within scope to consider multiple ground sensing stations, possibly coordinating with each other, collating measurements from different spectra/sensors?**
 - Answer: Yes
8. **Please clarify if a budget is required for Volume 1? Under Section 3: Detailed Proposal Information (pg. 24) there is a section titled "Cost, schedule, milestones" that lists the details that would normally be included in a budget, but in multiple places throughout the document it is noted that a full cost proposal is not required unless requested by the contracting officer which would be for Volume 2.**
 - Answer: You are correct. The Technical and Management proposal, Volume 1, requires some budget information to allow IARPA to assess the offeror's understanding of the program as well as Resource Realism and Budget Constraints (See BAA Section 5.A). A full cost proposal is not required unless your proposal is selected for negotiation (See BAA Section 4.B.2 and 5.C). Please note that if proposed costs submitted in Volume 2 - Cost Proposal are substantially different than the estimates provided in Volume 1 -

Technical and Management Proposal, then a contract may not be awarded (See section 5.C).

9. Quantum of Budget? Rough Order?

- Answer: IARPA can't provide a specific ROM as each proposed solution is unique. Historically, a threshold for IARPA programs has been \$50M-\$100M, with each program having multiple performers. Individual performer contracts (base and option) typically do not exceed \$25M. These are not hard figures. Keep in mind that IARPA will seek to maximize the likelihood of meeting program objectives within program budget constraints. This may involve awarding one or more contracts.

10. Regarding teaming: How many university partners/subs can we have? We have identified university partners as well as corporate partners.

- Answer: There are no restrictions on the number of teaming partners but offerors need to ensure an effective work plan. See BAA Sections 1.B and 5.A.

11. Inclusion of foreigners: We are in discussions with an international expert. Would that be permissible in a non-key role?

- Answer: Please reference the BAA section 3.A for specific details on Eligible Applicants and foreign entities. Also consider BAA Section 6.B.6, Export Controls, as some non-US persons could be restricted from working on certain technologies. There will be an Export control clause similar to this provision in all awarded contracts.

12. Who should we contact to get more information (technical specifications) of the GFI high resolution ionosphere data?

- Answer: From 2012 to present, the HFGeo program has sponsored numerous publications and presentations. IARPA is cited in each paper/presentation:
 - i. Radio Science and presentations at conferences sponsored by The International Union of Radio Science
 - ii. Presentations at the Ionospheric Effects Symposium
 - iii. AGU Conference Presentations
 - iv. Allerton Antenna Applications Symposium

13. Please define the following metrics, as several seem to implicitly assume a detection architecture:

a. debris detection: time from debris creation to detection assuming an "always on" architecture or duration of observation required to detect a single debris object?

- Answer: the time from debris creation to detection

b. coverage: is this coverage obtained from a single sensor or from the whole architecture, (the units seem to assume a ground-based sensor)?

- Answer: coverage from the entire proposed architecture, from ground and/or space-based sensors

14. Will there be a downselect in performers between Phases I and II?

- Answer: There is no formal downselect. Exercise of the Option Periods shall depend upon performance during Phase 1 - Base Period and subsequent Option Periods, if any, as well as program goals, the availability of funding, and IARPA priorities. Exercising of Phase 2 – Option Period is at the sole discretion of the Government.
- 15. Can the space sensor size threshold be increased to at least 22,500 cm³, through Task Area 2, Year 2 (TA2Y2). We do not understand the basis or necessity for the imposition of the volumetric limitation and feel that it artificially limits the potential solution space.**
- Answer: The Volume requirements for phase one of the program have been removed but offerors will need to demonstrate the path to achieve the volume constraints in phase two of the program to ensure the technology will have viable transition to IC partners.
- 16. Can the government provide clarity on what GFE data will be provided? a. What phenomenologies? b. How much of the sky? c. At what frequency?**
- Answer: The T&E Team will continuously develop SINTRA Research Sets (SRS) and SINTRA Test Sets (STS) databases throughout the program, curating the databases they develop to meet evaluation goals. The specifics of these collections will be determined by the T&E Team during the program.
- 17. Does IARPA foresee the GFE data being sufficient for the entire requested capability, or will this be only a starting point to train models and demonstrate proof of concept?**
- Answer: As indicated in the previous section, the Government will provide limited datasets (SRS) to Performers for system development. Each Performer is required to plan and carry out debris dataset development efforts.
- 18. Can IARPA list any specific data providers that are anticipated to be contributing to the default data set?**
- Answer: MIT/LL will include observations from the Lincoln Space Surveillance Complex.
- 19. Can you provide a list of data types expected to be available to researchers through the existing datasets for this research (e.g., color images, radar observations, etc.)? Is there any type of observation data that falls out of scope for this BAA and cannot be considered for research purposes?**
- Answer: The data types provided by the T&E team will be determined during the program. Each performer is expected to conduct their own debris dataset development efforts. There are no observation types that fall out of scope.
- 20. Is the design of "low-cost" sensors expected from all teams that are applying? Can a solution propose no new sensors at all, or is this a requirement of the BAA?**
- Answer: New sensors are not a requirement.
- 21. Is the design of "low-cost" sensors referring to only ground-based sensors?**
- Answer: IARPA is removing the term “low-cost” sensor from the BAA. Please see Question #22.

22. **Can you provide an estimate of cost for what you are referring to as a "low-cost" sensor?**
- Answer: IARPA is removing the term "low-cost" sensor from the BAA. What we are trying to articulate is that this is NOT a satellite acquisition program nor is it a constellation of satellites acquisition program. The SINTRA program is targeted at a detection system for the detection, tracking, and characterization of space debris.
23. **Regarding the SINTRA Researcher Collections (SRC), can you provide more details about what is expected from a team? Is a team expected to aggregate, annotate, curate data from existing databases and provide them as a refined dataset? Or is an SRC referring to the collection of new data through possible new sensors? On the same topic, is there a specific expected format for the requested data collection plan?**
- Answer: Performers may curate existing data and/or collect new data. The data format requirements will be provided by the T&E team at program kickoff.
24. **Are the target metrics (Table 1) to be considered as threshold requirements, or are these objective and/or subject to change? For example, detecting a 0.1 cm target is quite challenging. Will you still consider proposals that achieve results for debris slightly larger than that?**
- Answer: Offerors must propose a capability to detect, track, and characterize debris 0.1 to 10 cm in size.
25. **"During Task Area 1 Year 2 (TA1Y2), the program metrics will extend to debris 0.1 – 40 cm in size, from LEO to Geosynchronous Orbit (GEO)." Is 0.1 cm the metric for LEO and 40 cm the metric for GEO in TA1Y2?**
- Answer: The program will focus on debris 0.1 – 40 cm in all orbits about the Earth, from LEO to GEO.
26. **In what dimension is the debris size specified? Is it the diameter, radius, length of the longest dimension, etc.?**
- Answer: The debris size metric has been updated to debris diameter.
27. **Please clarify the calculation of false alarm rate. Is it calculated only using initial detections?**
- Answer: The false alarm rate is based on initial detections.
28. **With regard to the datasets that will be provided, can the Government say more about what they contain? The BAA mentions that data would include debris object "size, shape, mass, density, and surface charge, and orbital regimes of varying altitude and inclination." Would datasets also include information about the partially-ionized plasma environment of the objects, or the density and distribution of such objects in a debris cloud?**
- Answer: The data types provided by the T&E team will be determined during the program. Each performer is expected to conduct their own debris dataset development efforts.

- 29. With regard to each Performer having the opportunity to conduct two separate two-week experiments per Program Phase at the Naval Research Laboratory (NRL) Space Physics Simulation Chamber (SPSC):**
- a. Can the Government provide additional technical details on this resource? Specifically, what types of measurements are possible?**
 - Answer: An overview of the NRL SPSC is provided on the IARPA SINTRA Page, under Proposer’s Day Lightning Talks. Offerors are encouraged to contact NRL to learn more about the SPSC.
 - b. Do performer teams need to budget for NRL researchers’ time or any other costs associated with the use of the SPSC?**
 - Answer: IARPA will provide two separate two-week experiments per Program Phase at no additional cost to the Performer. This testing is a Government-provided service. The offeror will need to cover any necessary travel costs in their proposal
- 30. Table 1 in the BAA includes a coverage metric, which is specified in steradians per kilometer. Can the Government please provide a definition as it applies to the debris detection use case?**
- Answer: A steradian is a solid angle unit. The surface area of a sphere is 4π steradians. The coverage metric is given in steradians per kilometer. Each orbital altitude, given in kilometers, can be represented by a sphere with a surface area of 4π steradians.
- 31. In section 1.A.1 Technical Challenges and Objectives, under TA1, it states that the performer will be assessed against known tracked debris objects 10-40cm in size in LEO. If we are using, for instance, optical sensors, will we be expected to observe those objects? That is, will we need to have an observatory site? Or can these all be satisfied via robust laboratory physical simulations? That is, would measuring with the proposed sensor a physical simulation of the light signal that would be generated by a 10cm object at ~500 km distance moving 7 km/s satisfy the SINTRA criteria, presuming they were successful?**
- Answer: Performers may curate existing data and/or collect new data. Simulated data are acceptable for the Performer’s development efforts.
- 32. And to our knowledge, the only size estimate available for most debris is based on the radar cross-section, which is generally not publicly available and not considered accurate for small debris - how will the true size be determined?**
- Answer: The first year of the program will focus on known tracked objects. During the second year, the program will extend to smaller objects that are not currently tracked. Offerors must propose novel, explainable, techniques to establish accurate detection, tracking, and characterization of currently untracked debris and/or debris clouds to address this goal.
- 33. The overall program objectives state that SINTRA is open to any sensor solutions that achieve the goals of detection, tracking and characterizing debris currently below the trackable threshold of 10cm. The structure and metrics seem aimed at detecting plasma waves/solitons generated by charged debris. They seem less well-suited to, for**

instance, optical detection, radar, etc. More detail about how optical sensors and other modalities could match the program requirements would be useful.

- Answer: SINTRA is open to considering any modality for the detection, tracking, and characterization of space debris.

34. Table 1: Program metrics:

a. "Debris Radius" should probably be "Debris Diameter" or other characteristic length. Most debris characterization uses a diameter or other major-axis dimension.

- Answer: The debris metric has been updated to debris diameter.

b. "Debris speed" only appears to cover LEO. GEO rates are less than half that. And for space-based sensors, the encounter velocity can be anywhere between 0 and 15 km/s.

- Answer: The debris speed has been updated to include GEO and GTO.

c. "Debris Detection (h)" - Is this the amount of time it takes to detect the object? 168 hours is many orbits.

- Answer: Yes, as stated on page 13 of the BAA Debris Detection is the Time to detect new debris after a debris-generating event. The debris detection metric becomes more constrained in the second phase.

d. "Coverage (sr/km)" - This metric needs some explanation and translation to other sensor techniques.

- Answer: The coverage metric focuses on the location of debris about the Earth. Each orbital altitude, given in kilometers, can be represented by a sphere with a surface area of 4π steradians.

e. "revisit rate (h)" - The ones in the earlier phases make sense, but it is hard to imagine a sensor that can cover all of LEO-GEO every 5 minutes nor why one would need to.

- Answer: The revisit rate metric allows time for satellite operators to make decisions regarding potential impact to their satellites.

f. "Sensor Size and Power" - why are these presupposed to be this small? Should that optimization not occur after the basic sensor principles have been established? This seems tuned to a particular solution.

- Answer: The Volume and Power requirements for Phase 1 of the program have been removed. Offerors will need to demonstrate the path to achieve the size and power constraints in phase two of the program to ensure the technology will have viable transition to IC partners.

35. What is the anticipated sensor-to-debris standoff distance expected to be?

- Answer: There is no standoff distance requirement.

36. Debris tracking will require initial and follow-up orbit determination. What level of measurement accuracy do you require and what resulting measurement error and

covariance are allowed? For instance, current space catalog position predictions often have km-scale errors.

- Answer: The debris location metric will be evaluated for each detection.

37. BAA Section 1 FUNDING OPPORTUNITY DESCRIPTION (pg. 2) states that the SINTRA program is “envisioned to be a 48-month effort, beginning approximately May 1, 2023, through April 30, 2026,” but shouldn’t the envisioned concluding date be April 30, 2027?

- Answer: The date has been updated to April 30, 2027. See BAA Amendment 001.

38. BAA Sections 1.A.1 Technical Challenges and Objectives, 1.A.2 Program Phases, 1.F Program Metrics: Table 1: SINTRA Program Target Metrics: (pgs. 5, 12)

a. Can IARPA define what constitutes a “debris cloud”? Is it defined by the number of debris objects that are associated in some manner (e.g., clustering, common drift velocity, common source, motion dynamics, etc.)?

- Answer: The concept of a debris cloud is included in the BAA so that offerors may propose to detect, track, and characterize multiple debris particles. Offerors will determine the threshold at which to track debris clouds instead of individual debris objects.

b. Can IARPA provide information regarding the form, format and quantity of debris and atmospheric data that will be made available by government to successful bidders?

- Answer: The data types provided by the T&E team will be determined during the program. Each performer is expected to conduct their own debris dataset development efforts.

39. BAA Section 1.A.1 Technical Challenges and Objectives: Persistent Monitoring of the Debris Population (TA2): (pg. 5) Can IARPA provide a definition of what is meant by “persistent monitoring”? Does it go beyond the need to maintain custody of debris objects?

- Answer: Persistence is defined by the program metrics with regard to detection rate and revisit rate.

40. BAA Sections 1.A.1 Technical Challenges and Objectives (pg. 5) Is it responsive to propose a debris detection and classification technique that is effective at LEO if it cannot be extended to GEO (e.g., because it depends on much higher ambient plasma densities at LEO)? That is, can distinctly different approaches (sensors/algorithms) be proposed for the LEO and GEO orbital regimes?

- Answer: Yes, a combination of approaches can be proposed to meet program metrics.

41. BAA Section 1.A.2 Program Phases (pg. 6): Where/how can we get more information on the GFI of high-resolution ionosphere data from the IARPA HFGeo Program that will be provided to SINTRA Performers?

- Answer: From 2012 to present, the HFGeo program has sponsored numerous publications and presentations. IARPA is cited in each paper/presentation:

- i. Radio Science and presentations at conferences sponsored by The International Union of Radio Science
 - ii. Presentations at the Ionospheric Effects Symposium
 - iii. AGU Conference Presentations
 - iv. Allerton Antenna Applications Symposium
- 42. BAA Section 1.D.1 Development Data: “Government Research and Test Sets – Datasets collected, annotated, and curated by the T&E Team.” (pg. 8)**
 - a. Can IARPA define/describe “annotated and curated,” so we better understand how the data needs to be ingested into our development environment?**
 - b. We understand that the data (primarily) will originate from the OpenMadrigal website and database. What “annotations” will be included? How will these existing datasets be “curated”?**
 - Answer: Datasets will be curated and annotated to identify where known tracked debris objects pass within the field of view of the collecting sensor. Curation will be conducted to sort by sensor type, and annotations will include the identification of the known tracked debris object.
- 43. BAA Section 1.D.1.1 Government Research and Test Sets. “The Government will release SRS to Performers to facilitate system development.” (pg. 9)**
 - a. When will the SRS data likely be provided to Performers, since understanding probable delivery dates to Performers will help us develop realistic program schedules?**
 - b. When will the form/format of the SRS be described and defined, since understanding formats and data sizes will help us develop ingest and data management processes?**
 - Answer: An initial database will be provided at program kickoff and will be updated throughout the program. The initial database will include collections from the Lincoln Space Surveillance Complex and data from the OpenMadrigal website. Additional data types provided by the T&E team will be determined throughout the program.
- 44. BAA Section 1.D.1.1 Government Research and Test Sets. “The T&E Team will augment the data collected with auxiliary sensors not included in the Madrigal database.” (pg. 9)**
 - a. Can IARPA describe/define/quantify the non-Madrigal sensors and sensor data anticipated to be provided in the SRS?**
 - b. Will the augmented data be provided with the initial SRS delivery to Performers?**
 - Answer: The data types provided by the T&E team will be determined during the program. Each performer is expected to conduct their own debris dataset development efforts.

45. **BAA Section 1.F Program Metrics: Table 1: SINTRA Program Target Metrics: (pg. 12) Please provide definitions for each of the metrics contained in the table, including Debris detection, detection rate, coverage, revisit rate and false alarm, debris cloud.**
- Answer: The Definitions have been included in the BAA and are noted here
 - i. Debris detection: Time to detect new debris after a debris-generating event.
 - ii. Debris detection: Percentage of positive detections.
 - iii. Coverage: A steradian is a solid angle unit. The surface area of a sphere is 4π steradians. The coverage metric is given in steradians per kilometer. Each orbital altitude, given in kilometers, can be represented by a sphere with a surface area of 4π steradians.
 - iv. Revisit rate: Time to revisit a previously detected debris object.
 - v. False alarm rate: Percentage of false positive detections
 - vi. Debris cloud: Multiple debris objects. Offerors will determine the threshold at which to define and track debris clouds instead of individual debris objects.
46. **BAA Section 1.G.3.1 Program API (pg. 16): Can IARPA share any information regarding the anticipated SINTRA API before the Phase 1 Kick-off Meeting?**
- Answer: The first version of the SINTRA API will be provided to Performers at the Phase 1 Kick-off Meeting and updated periodically thereafter. The API will define function calls, data structures, and display creation and management for operating and evaluating SINTRA software in a standardized manner. The API will accommodate common Madrigal geospace data formats and human-in-the-loop interactions.
47. **BAA Section 4. B.1.b Section 2: Summary of Proposal E. Project contributors: (pg. 21) Will the eventual contract allow for Second Tier Sub-contractors?**
- Answer: Yes. It is allowed but it should make sense and demonstrate an effective work plan (See Section 5.).
48. **BAA Section 4.B Proposal Format and Content (pg. 20)**
- a. **BAA states “text should be black,” but can text in some of the figures, tables, and charts be in colors other than black?**
 - Answer: Yes.
 - b. **BAA desires Times New Roman font,” but can some of the text in some of the figures and charts be other than Times New Roman?**
 - Answer: Yes. Times New Roman is desired but not required. All content shall be clearly legible with the unaided eye.
 - c. **BAA proposals should be “8-1/2 by 11 inches,” but it does not specify allowable page orientations. We assume most pages should be portrait-oriented pages, but can wide figures, tables, and charts be placed on landscape-oriented pages?**
 - Answer: Pages should be portrait oriented but it is acceptable for figures, tables and charts to be in landscape orientation. “Fold out pages are not permitted.” Also

“...unnecessary use of figures, tables and charts to present information may render the proposal non-compliant.” (See BAA Section 4.B.)

- d. **BAA states proposals should have “1-inch margins from paper edge to text or graphics on all sides,” and on page 21 it says that “all pages should be numbered,” but can the required page number and other identifying text be placed in the 1-inch margins, for example in headers and/or footers? If so, does the page number and other text in those headers and footers have to be Times New Roman 11-point black text, or can it be some other font, size, or color, as long as it is legible?**

- Answer: Yes, the page number and other identifying text such as BAA number can be in the 1 inch margin (header/footer). Text should be black, and desired font size 11-point (10 point for figures, tables and charts). Times New Roman font is desired but not required. All content shall be clearly legible with the unaided eye. (See BAA Section 4.B.)

49. BAA Section 4.B Proposal Format and Content (pg. 21)

- a. **Will IARPA allow the addition of a List of Figures and a List of Tables after the optional Table of Contents that like the Table of Contents, will also not be counted toward the 30-page page-count limit?**

- Answer: This can be included as part of the optional Table of Contents.

- b. **Will IARPA allow the addition of an Attachment 13, List of Acronyms and Abbreviations, that would not be counted toward the 30-page page-count limit?**

- Answer: No. We are not changing our general proposal format at this time.

50. **BAA Section 4.B Volume 1 – Technical & Management Proposal Section 4 – Attachments 11 (pg. 21) states “Research Data Management Plan [RDMP] . . . Template under Appendix A” and a similar reference appears on page 29, but BAA Section 4.B.1.c on page 26 in Section L also requires an RDMP and includes an extensive description of what should be in the plan, so should the RDMP be in Section 3 of the proposal (Detailed Proposal Information) (counted toward the page-count limit), or in Section 4 of the proposal (Attachments) (not counted toward the page-count limit), or both (presented in two different ways)?**

- Answer: The RDMP should be in Section 4 (Attachments) and should follow the instructions in Section 4 and the Template in Appendix A.

51. **BAA Section 4.B Volume 1 – Technical & Management Proposal Section 4 – Attachments 12 (pg. 21) states “Privacy Plan, (See Section 1.D.3), no page limit” and a similar reference appears on page 29, but there is no Section 1.D.3 in the BAA nor any section describing a Privacy Plan, so is this Privacy Plan attachment actually required, and if so, is IARPA expecting to see anything in particular in such a plan, or is its composition left up to the Proposer?**

- Answer: The Privacy Plan will not be required for this BAA. This is removed in BAA Amendment 001.

52. **BAA Section 4. B.1.c. Section 3: Detailed Proposal Information K. The names of other federal, state, or local agencies or other parties receiving the proposal and/or funding the proposed effort (pg. 26):**
- a. **What does IARPA mean by the phrase “receiving the proposal”?**
 - Answer: If the Offeror has submitted this proposal to another federal, state, or local agency please provide the information requested in the BAA. For example, if the same proposal is being considered for funding by DARPA, it may impact IARPA’s decision to fund the effort.
 - b. **Can IARPA provide an example of some other organization funding an effort?**
 - Answer: See answer above.
53. **BAA Section 4.B.1.d Section 4: Attachments - Attachment 9 (pg. 29) describes the “Three Chart Summary of the Proposal” attachment in terms of “PowerPoint” and “slides,” but the specified format for the attachment provided in Appendix A.5 on page 47 shows three charts all located on a single page, so should this attachment consist of one page with three charts shown on that page, or should it consist of three pages with an image of one slide on each page, or should the attachment be a separate PowerPoint file submitted in addition to the proposal PDF file, or as a PowerPoint file attached inside of the PDF file with the PowerPoint file icon displayed in the PDF’s Attachments pane, or some combination of the above?**
- Answer: This was meant to be 3 PowerPoint slides. Follow the format for each slide as depicted in Appendix A.5.
54. **General Information, Item 11, and elsewhere: The term “debris signature” is used throughout the document. What is meant by that term in the sentence “...developing novel methods to identify debris signatures?” For instance, would detecting an individual piece of debris and providing its estimated orbital state information constitute identification of that debris’ signature? What features of debris signature identification distinguish that activity from debris detection? What features of debris signature detection (page 6) distinguish that activity from debris detection?**
- Answer: SINTRA is open to the detection of debris and/or debris signatures. Debris signatures are defined as observables that infer the presence of debris.
55. **1.A p. 2 It is stated that “ground-based sensors are not able to track small objects due to the debris’ relatively high angular velocity and must remain in staring mode to count the number of objects passing through their small fields of view.” This is not true. Ground-based optical telescopes routinely track and image objects in low-Earth orbit. These rate-track imaging techniques can and are used to detect comparatively dim objects. The cited document, “NASA Technology Roadmaps: TA 5: Communications, Navigation and Orbital Debris Tracking and Characterization Systems, chapter 5.7 Orbital Debris Tracking and Characterization. NASA, 2015” does not support, or even address this claim. What is the basis upon which this judgement was made? Was this perhaps meant to refer to debris discovery?**
- Answer: Please refer to Reference #7 in the BAA: Limiting Future Collision Risk to Spacecraft. National Academies Press, Nov 2011.

56. **1.A p. 2 "SINTRA will aim to develop ... (c) characterize orbital debris size, density, and mass" In this statement, does the term density refer to the density of a debris field, or individual densities of debris particles? The latter of these could be compute from size and mass measurements of individual particles.**
- Answer: Individual debris particles
57. **1.A p. 2 Does IARPA have a specification on the price of a "low-cost sensor"? A small set of cost categories, even approximate, will be essential for scoping potential solutions. While the total expected value of the BAA is known, the division of effort between research and sensing hardware is a free parameter.**
- Answer: IARPA has removed the term low-cost sensor from the BAA. We are open to any mode offered for the detection, tracking, and characterization of space debris.
58. **1.A p. 4 How does IARPA envision Performers using each other's datasets, given that they are to be provided at the end of each phase? Additionally, how does IARPA intend to adjudicate between contradictory claims of ground truth between Performers? These are almost certain to arise if the Performers pursue unrelated sensing modalities.**
- Answer: IARPA envisions the sharing of datasets across Performers will help ensure that improvement in performance result from the technical approaches rather than from access to a large amount of data. We envision the sharing of the data at the end of each program milestone to inform the work in the next milestone of the program. We are open to sharing of data earlier in the program if that makes sense to the performers. Aspects of evaluation that involve human adjudication or feedback will be performed by the T&E Team.
59. **1.A p. 4 "A robust data collection effort ... for comparing the algorithm performance against ground truth": What is the source of ground truth once proof of concept phase (i.e., known, tracked debris) has passed? If a SINTRA solution is novel and advances the state of the art then, by definition, no external ground truth will exist outside of that solution. (Related: in 1.D.2, generalization to the STS is described – again, by what means will this be constructed for objects which are untrackable?)**
- Answer: The T&E team will collect new datasets at the Lincoln Space Surveillance Complex, which will be provided in the SINTRA database for development and evaluation.
60. **1.A p. 4 Will Performers be permitted to influence or assist the SINTRA T&E team as they “conduct dataset development activities?” For many novel sensing concepts, the mode of collection is important for the Performer's solution.**
- Answer: No, the T&E evaluation will be entirely independent of performer recommendations. However, the T&E teams will be involved in the regular review and evaluation of the performers so they will be informed of the concepts in use to ensure that the datasets are relevant and appropriate for the performers.
61. **1.A.2 The performance evaluation process described in the first two paragraphs of page 6 appears to frame evaluation as an offline procedure executed using a static sequestered dataset. Yet the SINTRA program metrics, particularly those in TA2,**

necessitate a responsive system contextualized in a dynamic environment. How will metrics such as the revisit interval (i.e., rate) be evaluated using a static dataset? Is IARPA willing to consider, in part, proposals that include synthetic environment testing?

- Synthetic environment testing can be conducted to support development and evaluation efforts. The T&E evaluation process for Phase 1 will focus on debris detection, tracking, and characterization. For Phase 2, the evaluation process will focus on debris monitoring. The SINTRA database and API will be updated throughout the program to support the evaluation of metrics for each phase
- 62. 1.A.2 If a SINTRA solution satisfies the program metrics, but requires a particular observing cadence, sensing concepts (e.g., phenomenology), or collection strategy, will the Performer be able to place these requirements on "sequestered datasets" such that they are appropriate for the Performer's solution?**
- Answer: Each performer is expected to conduct their own debris dataset development efforts.
- 63. 1.A.2 Revisit interval (i.e., rate) can be minimized via solution efficiency or sensor proliferation, but it could also be maximized by solutions requiring as few revisits as possible to maintain tracking. Minimizing the mean revisit rate across a population of objects does not necessarily maximize persistence, because different objects have different feasible kinematics. Is IARPA open to solutions which do not meet stringent revisit rates (< 0.083 h at the fastest) if those solutions show that their revisit rate provides persistent monitoring?**
- Answer: Offerors must describe how proposed solutions will provide persistent monitoring.
- 64. 1.A.2 Can Performers provide sequestered datasets? For example, containers could be submitted and then performers could deliver data collected after submission for the T&E team to use. This would enable solutions for which the nature of the collection (e.g., cadence) is important to drive algorithm performance.**
- Answer: Each performer is expected to conduct their own debris dataset development efforts.
- 65. 1.A.2 Will Performers be able to influence the SINTRA API or collaborate with the T&E team on its development?**
- Answer: No, the T&E evaluation will be entirely independent of performer recommendations. However, the T&E teams will be involved in the regular review and evaluation of the performers so they will be informed of the concepts in use to ensure that the API is relevant and appropriate for the performers.
- 66. 1.D.1 How will the T&E team handle testing for algorithms designed on development data that may not apply to sequestered data types?**
- Answer: The T&E Team will continuously develop SRS and STS database throughout the program, curating the database they develop to meet evaluation goals. The specifics of these collections will be determined by the T&E Team during the program.

- 67. 1.D.1 How will T&E be conducted for characterization algorithms? We understand how many of the program metrics may be measured via comparison with a collection of ground truth metric observations in principle. It is less clear how characterization performance (e.g., size, mass) may be evaluated given that many of these features cannot be known directly.**
- Answer: The first year of the program will focus on known tracked objects. The SRS datasets will include new collections from the radar and optical systems currently used to develop debris models, as detailed at <https://orbitaldebris.jsc.nasa.gov/measurements/>, to validate measurements by proposed systems. The new collections will be dependent on proposed solutions and may be coordinated across multiple sensors to ensure maximum utility to the performers.
 - During the second year, the program will extend to smaller objects that are not currently tracked. Offerors must propose novel, explainable, techniques to establish accurate detection, tracking, and characterization of currently untracked debris and/or debris clouds to address this goal.
- 68. 1.D Can details on T&E datasets (hardware, collection cadence, etc) be provided so Offerors can speak to them in the proposal phase? If not, can proposals suggest or influence the nature of these T&E collections?**
- Answer: The T&E Team will continuously develop SRS and STS database throughout the program, curating the database they develop to meet evaluation goals. The specifics of these collections will be determined by the T&E Team during the program. The T&E teams will be involved in the regular review and evaluation of the performers so they will be informed of the concepts in use to ensure that the datasets are relevant and appropriate for the performers.
- 69. 4.D This section specifies that “facility construction costs are not allowable under this activity.” May Proposers assume that this prohibition does not extend to sensor facilities (i.e., domes, pads)?**
- Answer: IARPA will not pay for the construction of infrastructure needed for facilities. We are only funding R&D activities. Performers are expected to have the necessary facilities to conduct the proposed research activities.
- 70. Table 1 How does SINTRA intend to judge metric achievement for the requirements articulated in Table 1? While we understand that progression through the requirements space over the period of performance is the desired outcome, it is unclear what level of performance is envisioned to constitute success; this impacts proposal scope.**
- Answer: Metrics were established based on feedback from the debris community and satellite operators, to enable improved debris impact risk assessments for operational satellites. Success will be measured throughout the progression of the program to ensure that metrics address improved risk assessments.
- 71. Table 1 How are Performers to interpret the “+/-” column? Are these values meant to be the target variance in an estimator of the relevant metric (i.e., as a characterization task)? Should they be added to the outer bound of the “Range” column for the**

detection and track tasks? As an example, for debris radius, are Performers to detect objects within the “Range” bounds, or measure radii of objects within these bounds?

- Answer: That is correct.

72. Table 1 The debris density metric range is 0-22,000 kg/m³ which includes almost all matter. Are we correct in interpreting this requirement as a characterization objective? That is: to satisfy this requirement, we are expected to estimate the density of an individual debris object. Does this density requirement refer to the density of a single object, or the density of a debris cloud?

- Answer: Debris density applies to individual debris objects.

73. Table 1 In the Proposers Day Q&A session, the debris detection time requirement was described as “The time it takes to detect debris after it is created.” Debris can be created from any object in orbit around the Earth at any time. Thus, satisfaction of the debris detection time requirement entails an approximately 5-minute observation interval for every resident space object, including existing debris. The simultaneous satisfaction of 4 pi steradian of coverage and 5-minute revisit interval independently imply the same level of persistence and coverage. This level of persistence and coverage is not achieved today by the entire commercial SDA industry and USG sensor networks combined, even for objects 40 cm and greater, which are less numerous those targets envisioned under SINTRA.

- Answer: Based on the feedback IARPA received during the RFI workshop and Proposer’s Day, we believe the problem can be solved today.

74. Table 1 May we assume that Space Sensor Size & Space Sensor Power limitations do not apply to ground-based technologies?

- Answer: SWaP only applies to new space-based systems.

75. p. 29, 33-34 What "observable" is expected from "signature simulations and detections" (p. 29)? Is it our proposed raw (or processed) data? Is it a temporal, spectral, and/or polarimetric energy distribution of a given object? The "signature" would seem to be unique to the proposed solution such that T&E validation may also require method[s] for processing it in order to measure accuracy.

- Answer: The SINTRA Program will utilize a standardized Application Programming Interface (API) for all software Deliverables and evaluations. The first version of the SINTRA API will be provided to Performers at the Phase 1 Kick-off Meeting and updated periodically thereafter. The API will define function calls, data structures, and display creation and management for operating and evaluating SINTRA software in a standardized manner. The API will accommodate common Madrigal geospace data formats and human-in-the-loop interactions. All Performer solutions must be compatible with the SINTRA API. Performers have a requirement to provide sufficient documentation and training for T&E partners to adequately evaluate their systems.

76. p. 29-30 Are the government-furnished datasets (p. 30) going to include these "signatures" (p. 29) per object? Anything more than or other than that?

- Answer: The T&E Team will continuously develop the database throughout the program, curating the database they develop to meet evaluation goals. The specifics of these collections will be determined by the T&E Team during the program.
77. **p. 37 May Proposers assume that space-based techniques can be used on existing space-based assets and subsequently, if proven, a future architecture (that would likely require new launch[es]) to solve the metrics proposed as a result?**
- Answer: IARPA will not fund the launch of new satellites to evaluate program metrics. Offerors must address program metrics through use of existing systems or alternate proposed solutions.
78. **7.2 The BAA indicates that Proposals are due on a Federal Holiday. Will the Government be available to confirm receipt on that date?**
- Answer: The due date will be updated. See BAA Amendment 001.
79. **3 A.2 The BAA indicates that organizations may participate as a prime or a subcontractor in more than one submission. Can the prime submit more than one BAA for differing technologies/projects?**
- Answer: Yes. The prime can submit more than one proposal, each for a different technological approach. See BAA Section 3.A.2.
80. **3 A.2 Is there a funding maximum per project submission? If so, what is the funding maximum?**
- Answer: There is no funding maximum however, there is a limited budget. See Answer to question #9 and reference BAA Section 5.A.2. Budget Constraints.
81. **4 A; 4.C.2 The BAA states, "...the BAA Closing Date set forth in General Information, item 7.3." There is no item 7.3 nor indicator of a Closing Date in the General Information Section. Please clarify the Closing Date of the BAA if it is different than the Proposal Due Date for Initial Round of Sections listed in 7.2.**
- Answer: 7.3 has been added in BAA Amendment 001. Yes the BAA Closing Date is different than the Closing date for Initial Round of Selections. See BAA Section 4.A. It is best to submit by the Proposal Due Date for the Initial Round of Selections to ensure consideration in this round.
82. **4 B Does the black text requirement also apply to graphics, charts, images, text in tables, headers, and footers?**
- Answer: See answer to question #48.
83. **4.B Do the paper size, margins, and fonts also apply to the PowerPoint charts?**
- Answer: Yes in terms of paper size. Follow the format in Appendix A.5.
84. **4.B.1.d p. 29 This section indicates that Attachment 7 is required (does not say Not Applicable); however, section the referenced section 6.8.3 does not allow for Human Use for this BAA? Please clarify that Attachment 7 is Not Applicable to this BAA.**
- Answer: This is updated in Amendment 001. Human Use Documentation is not applicable to this requirement.

85. **4.B.1.d p. 29 For the Attachments that are Not Applicable to this BAA, please confirm that Offerors are not required to submit any blank forms or place holders for those Attachments.**
- Answer: For Attachments that are not applicable, offerors are not required to submit blank forms or place holders.
86. **4.B.1.d p. 29 Please confirm that Offerors are not required to submit a 5-page Security Plan.**
- Answer: A Security Plan is not applicable and is not required.
87. **4.B.1.d p. 29 Attachment 12, Privacy Plan references section 1.D.3. That section does not exist in this BAA. Can the Government provide more information and/or a template as to what is expected in the Privacy Plan attachment?**
- Answer: The Privacy Plan is not applicable. See BAA Amendment 001.
88. **4.B.2.b p. 3 Appendix B is reference for the Estimated Cost Breakdown. Please confirm that Offerors are to use “Appendix B.2 Prime/Subcontractor Cost Element Sheet for Volume 2: Cost Proposal” for their estimated cost breakdown.**
- Answer: Yes. If an offeror is selected for negotiations, Appendix B shall be used as a template for Volume 2: Cost Proposal, Estimated Cost Breakdown. This template shall be followed and submitted in an excel document. See BAA Section 4.B.2.b.
89. **4.C.2 p. 32 Offerors are required to register on the <https://iarpa-ideas.gov/>. When trying to register a new account for a specific BAA, there is not an option to select a specific BAA. When will Offerors be able to register? Or can you please provide additional instructions and/or guidelines on how to register?**
- Answer: We are in the process of uploading the BAA into IDEAS. It should be available shortly and well before proposal due date.
90. **4.C.2. Should Offerors submit attachments as separate files? or does the Government want Volume I as a single file except those items that are separate file formats?**
- Answer: Please follow the formatting that is set forth in IDEAS when you upload your proposal. Either way – one PDF document which includes Attachments or separate files for the Volume 1 proposal and Attachments is generally acceptable as long as applicable page limits for each section are followed.
91. **Appendix A.4: The template has a place holder for inserting an assigned proposal ID#, if received. Will Proposal ID’s be assigned to a proposal submission? If so, when are they assigned?**
- Answer: You will likely not receive an assigned proposal number until your proposal is uploaded. This is not significant. You can include your own proposal identifier if you would like.
92. **Appendix B.1: Item 16 required Offerors to provide a DUNS Number. DUNS numbers are no longer used by SAM.gov as of April 2022. Should Offerors provide their SAM Unique Entity ID instead?**
- Answer: Yes.

- 93. Appendix B.1: Item 21 requires Offerors to provide their business size for NAICS Code 541712. Please confirm Offerors should submit their business size for 541715, Research and Development in the Physical, Engineering, and Life Sciences (except Nanotechnology and Biotechnology), which replaced 541712.**
- Answer: Yes. Please include your business size for 541715.
- 94. Can a FVEY partner be a subcontractor if the prime is a US entity?**
- Answer: Yes. Reference BAA Section 3.A., Eligible Applicants. When including foreign subcontractors or personnel be mindful of any Export Control restrictions, See BAA Section 6.B.6.
- 95. Will IARPA accept a security assurance from the Canadian Government via existing bilateral agreement between Canada and the USA related to contract security?**
- Answer: The government anticipates that proposals submitted under this BAA will be unclassified and that any resultant contracts will be unclassified. If an offeror chooses to submit a classified proposal, the offeror must first contact IARPA. See BAA Section 4.C.2.
- 96. It appears that some footnotes appear at the bottom of the page and others are referenced on the last page of the BAA. Is this the intent?**
- Answer. Thanks for pointing out this error. In the interest of time, we will not be reformatting the BAA. If the footnote does not appear at the bottom of the page, please reference BAA Appendix B6 -Technical References/Footnotes.