

**HR0011SB20254-P01**  
**Spectrum Monitoring and Awareness in Real-Time (SMART)**  
**Frequently Asked Questions (FAQs)**

1. SDR Replacement: May we replace the existing reconfigurable SDR with a different device if it meets the same size, weight, and power (SWaP) constraints?  
**A: Yes, the replacement of DoD SDRs with another SDR is acceptable. However, the SDR Replacement should meet the same SWaP constraints and must retain the functionality of the original radio (i.e., the ability to communicate and share data using the SDR must be retained).**
2. PED Connectivity and Multi-Node Geolocation: Is it permissible to connect to PED (Processing, Exploitation, and Dissemination) systems via tactical-communications/JICD interfaces, thereby enabling collaborative processing and multi-unit geolocation?  
**A: The SBIR is focused on leveraging edge compute resources that are common with tactical end users. This is often a tablet running TAK Government-off-the-Shelf (GOTS) software (e.g., Samsung Tablet running ATAK).**
3. Edge-Only in DDIL: Should we assume that the solution must operate exclusively at the edge in a denied, degraded, intermittent, or limited (DDIL) communications environment? Or can we partially rely on reach-back or cloud-based resources when available?  
**A: Yes, assume that the solution should operate at the edge in DDIL communications environment.**
4. SDR Development Framework: Are you seeking the development of an SDR framework?  
**A: We are seeking a variety of innovative solutions to the problem described in the solicitation and not specifically looking for an SDR Development Framework.**
5. It was our interpretation that the man-packed system that is being discussed in the call has three interconnected parts:
  - ATAK tablet
  - Tactical comms radio (e.g. L3Harris AN/PRC-117G or AN/PRC-152A)
  - Generic SDR (e.g. Hedgehog SDR)

Where we might replace the generic SDR with a novel solution. Is our interpretation of the man-packed system being described correct?

**A: The man-packed system consists of only two interconnected parts:**

**a. ATAK Tablet**

**b. Tactical comms radio, in the form of an SDR. Examples of this radio would be the AN/PRC-117G or AN/PRC-152. The generic SDR listed (Hedgehog SDR) is an example of a recent advancement in SDR technology that could be leveraged as a part of a SMART solution. The tactical comms radio could be replaced in this scenario with an SDR that can execute the**

**same primary functions as the tactical radio it is replacing and meets the same SWaP constraints.**

6. Can you share the specific SWaP constraints for the perspective replacement SDR?

**A: The AN/PRC-152 and AN/PRC-117G are representative examples of tactical radios. The replacement radios should have similar SWaP characteristics/capabilities.**

7. Can you clarify what is meant by “the ability to communicate and share data using the SDR must be retained”. Does this mean the generic SDR will need to integrate with a tactical radio to communicate and share data?

**A: No. There is no generic SDR. If the tactical SDR is being replaced as a part of the solution, it must be capable of performing the same functions as the primary tactical SDR.**

8. Is proposing a new SDR-based hardware sensor product for the dismounted warfighter in scope for the topic? Modifying a third-party SDR product (hardware or software) is not practical since only the company who built it can do that. Replacing the SDR suggests replicating the communications and data sharing functions of products like the AN/PRC-117G (also not practical).

a. If the Q1 answer is “yes,” then it would seem to be incongruous with “introducing an additional sensor/antenna/radio/tablet is not [acceptable].”

b. If the Q1 answer is “no,” then it would seem like any SDR-related proposal would need to be limited to software enhancements of third-party SDR products (not practical).

**A: As stated in the solicitation, “The Defense Advanced Research Projects Agency (DARPA) solicits technologies that, leveraging advancements in SDR technology, and handheld or tablet-based compute, optimize warfighter capabilities in one or more of the three technical capability areas described above.” The L3 Harris AN/PRC-117G and AN/PRC-152A were used as an example of a man-portable tactical SDRs commonly employed in the DoD, and the Hedgehog SDR was provided as an example of a recent advancement in SDR technology that enables rapid reconfiguration and/or adaptation for various tasks. By “replacement” we mean that proposers may introduce a surrogate SDR capable of voice communications and data sharing that replicates comparable functionality, and SWaP, to tactical SDR solutions like the AN/PRC-117G. Replication of the exact functionality (e.g., proprietary waveforms, encryption capabilities, etc.) is not required, nor expected; however, surrogate capabilities must be considered to demonstrate that the proposed solution does not degrade or interfere with the primary function of the SDR to provide tactical communication capability to the warfighter. Introduction of additional SDR-based hardware is not in scope for SMART.**

9. Is proposing a software-modified Android smartphone (vs. tablet) in scope for the topic? The topic description mentions Android tablets four times but only refers to a “handheld... compute” device tangentially.

**A: Yes. Handheld compute solutions (phone/tablet) capable of running ATAK/WinTAK are in scope for SMART.**

10. Would an ideal prototype in Phase II involve SDR (like Hedgehog) interfaced with A-TAK ? Or Are there other transition platforms or programs you have in mind beyond Phase II?

**A: The solicitation identifies the target user, “military dismounted ground tactical units,” common hardware configurations employed by ground tactical units in the DoD (i.e., SDR and tablet running ATAK), and states that “The Defense Advanced Research Projects Agency (DARPA) solicits technologies that, leveraging advancements in SDR technology, and handheld or tablet-based compute, optimize warfighter capabilities in one or more of the three technical capability areas described above.” Additionally, the solicitation states that “Solutions can be algorithmic, software, hardware, and/or material in nature; however, hardware/material solutions should not introduce a new physical burden on the warfighter (i.e., modifying or replacing an antenna/SDR is acceptable, but introducing an additional sensor/antenna/radio/tablet is not). Moreover, proposed solutions should not interfere with the primary function of the equipment (i.e., warfighter communication capability must not be degraded).” For clarity, by “replacement” we mean that proposers may introduce a surrogate SDR capable of voice communications and data sharing that replicates comparable functionality, and SWaP, to tactical SDR solutions like the AN/PRC-117G [e.g., hardware-agnostic (yet aware)].**

11. Is DARPA interested in other COTs SDRs too, for example, GPU-embedded SDRs from Deepwave or CMOSS aligned SDR that the Army prefers? In general, is a hardware-agnostic (yet aware) solution preferred? For example, hardware agnostic would imply the solutions work across multiple hardware in Phase II.

**A: The solicitation identifies the target user, “military dismounted ground tactical units,” common hardware configurations employed by ground tactical units in the DoD (i.e., SDR and tablet running ATAK), and states that “The Defense Advanced Research Projects Agency (DARPA) solicits technologies that, leveraging advancements in SDR technology, and handheld or tablet-based compute, optimize warfighter capabilities in one or more of the three technical capability areas described above.” Additionally, the solicitation states that “Solutions can be algorithmic, software, hardware, and/or material in nature; however, hardware/material solutions should not introduce a new physical burden on the warfighter (i.e., modifying or replacing an antenna/SDR is acceptable, but introducing an additional sensor/antenna/radio/tablet is not). Moreover, proposed solutions should not interfere with the primary function of the equipment (i.e., warfighter communication capability must not be degraded).” For clarity, by “replacement” we mean that proposers may introduce a surrogate SDR capable of voice communications and data sharing that replicates comparable functionality, and SWaP, to tactical SDR solutions like the AN/PRC-117G [e.g., hardware-agnostic (yet aware)].**

12. What is the expected real-time processing latency for detection, characterization, and geolocation to be considered operationally relevant?

**A: The SMART SBIR is an Open topic and does not have specific metrics associated with the three technical capability areas. Our goal is to determine the limits of what is possible in the three technical areas using the hardware described in the solicitation, or a surrogate (as described above). In other words, we don't have a metric for processing latency to define operational relevance, a time constraint for POL, or frequency range expectations. We expect proposers to identify, and provide technical justification for, what they believe is feasible. From the solicitation: "Proposals should include the RF bandwidth covered by the proposed solution and, if targeting the POL technical capability, the timeframe for POL required to gain specific insights."**

13. For Pattern of Life (POL) analysis, what timeframe of RF observations is considered useful for actionable insights for the envisioned mission? Minutes, hours, or days? In other words, what would be the time constraint for POL?

**A: The SMART SBIR is an Open topic and does not have specific metrics associated with the three technical capability areas. Our goal is to determine the limits of what is possible in the three technical areas using the hardware described in the solicitation, or a surrogate (as described above). In other words, we don't have a metric for processing latency to define operational relevance, a time constraint for POL, or frequency range expectations. We expect proposers to identify, and provide technical justification for, what they believe is feasible. From the solicitation: "Proposals should include the RF bandwidth covered by the proposed solution and, if targeting the POL technical capability, the timeframe for POL required to gain specific insights."**

14. What are the specific RF bandwidth and frequency range expectations for a viable solution? Are there priority bands of interest?

**A: The SMART SBIR is an Open topic and does not have specific metrics associated with the three technical capability areas. Our goal is to determine the limits of what is possible in the three technical areas using the hardware described in the solicitation, or a surrogate (as described above). In other words, we don't have a metric for processing latency to define operational relevance, a time constraint for POL, or frequency range expectations. We expect proposers to identify, and provide technical justification for, what they believe is feasible. From the solicitation: "Proposals should include the RF bandwidth covered by the proposed solution and, if targeting the POL technical capability, the timeframe for POL required to gain specific insights."**

15. For clarity, in regards to "dismounted tactical ground units" is the term "dismounted" more or less synonymous with "human beings on foot"?

**A: Yes**

16. Other than the implied, broad requirement that any resulting implemented solution has to be usable and transportable by the above-mentioned dismounted units, are there any hard SWaP requirements that the government can share at this time?

**A: The solicitation describes hardware configurations common to dismounted tactical ground units (i.e., “man-portable software defined radios” and “Android tablets running the Android Tactical Assault Kit”), proposed solutions should have similar SWaP constraints.**

17. Does the government intend for this application to be applied to an existing RF collection front-end or would the offerer’s solution inform this? By “RF collection front-end” we mean everything from the antenna(s) through the receiver/tuners/filters and finally through digitization (ADC).

**A: The SMART SBIR is aimed at developing “advanced capabilities that provide military dismounted ground tactical units real-time awareness of the radio frequency (RF) spectrum” using hardware commonly employed by ground tactical units. It should be noted that the solicitation also allows proposers to replace specific components. By “replacement” we mean that proposers may introduce a surrogate SDR capable of voice communications and data sharing that replicates comparable functionality, and SWaP, to tactical SDR solutions like the AN/PRC-117G. Replication of the exact functionality (e.g., proprietary waveforms, encryption capabilities, etc.) is not required, nor expected; however, surrogate capabilities must be considered to demonstrate that the proposed solution does not degrade or interfere with the primary function of the SDR to provide tactical communication capability to the warfighter.**

18. Would the government consider solutions that employ, small aerial drones as RF collection platforms?

**A: No. The proposals including drones or other additional components or equipment are out of scope.**

19. Does the government have a set of preferred signals and RF environment scenarios for this effort? If so would the government be willing to provide exemplar data sets for test and demonstration?

**A: No**

20. If field data is not available, would testing with realistic synthetic or lab generated data be acceptable for Phase I?

**A: Yes**

21. What is the governments understanding of the term “communication protocol”? Does this term include modulation type (e.g. FSP, QPSK, QAM), access type (e.g. TDMA, CDMA), something else or all of the above?

**A: Identification of characteristics like modulation type and access type are important; however, as stated in the solicitation, “information should be presented in an intuitive manner that enhances situational awareness and does not impose an additional cognitive burden on the warfighter who does not have expertise in the**

field of RF spectrum operations.” As such, identification of protocols like (list non-inclusive) 802.11, Bluetooth Low Energy (BLE), Global System for Mobile communications (GSM), etc. is what was meant by “communications protocol.”

22. Given the three goals of 1) RF spectrum characterization, 2) pattern-of-life (POL) recognition and 3) localization or geolocation, does the government have some prioritization of these three? For example, is it better to know some information about all three or is it better to know a great deal about one or two of them even if it means knowing little or nothing about the last? Or is this left completely to the offerer?

**A: This is left to the proposer.**

23. In addition to on/off times and potential emitter motion, are there any other signatures that the government is particularly interested in as POL that it can share at this time?

**A: This is left to the proposer to identify what is possible.**

24. Do we know the frequency ranges or the extent of the spectrum (lowest/highest frequencies) for the potential RF signal source? Can we assume the existing hardware (antenna frontend and SDR) is capable of sensing the entire spectrum? If not, is it allowable to propose a hardware (pluggable to a given SDR) to sense/scan the spectrum?

**A: The SMART SBIR is an Open topic and does not have specific metrics associated with the three technical capability areas. Our goal is to determine the limits of what is possible in the three technical areas using the hardware described in the solicitation, or a surrogate. In other words, we don't have a metric for processing latency to define operational relevance, a time constraint for POL, or frequency range expectations. We expect proposers to identify, and provide technical justification for, what they believe is feasible. From the solicitation: “Proposals should include the RF bandwidth covered by the proposed solution and, if targeting the POL technical capability, the timeframe for POL required to gain specific insights.” As stated in the solicitation, the SMART SBIR is aimed at developing “advanced capabilities that provide military dismounted ground tactical units real-time awareness of the radio frequency (RF) spectrum” using hardware commonly employed by ground tactical units. It should be noted that the solicitation also allows proposers to replace specific components. By “replacement” we mean that proposers may introduce a surrogate SDR capable of voice communications and data sharing that replicates comparable functionality, and SWaP, to tactical SDR solutions like the AN/PRC-117G. Replication of the exact functionality (e.g., proprietary waveforms, encryption capabilities, etc.) is not required, nor expected; however, surrogate capabilities must be considered to demonstrate that the proposed solution does not degrade or interfere with the primary function of the SDR to provide tactical communication capability to the warfighter. Introduction of additional SDR-based hardware is not in scope for SMART.**

25. Does the existing/target hardware have an array of antennas or just a single omnidirectional antenna?

**A: Existing tactical SDRs use multiple antennas depending on the operational mission. These antennas can be directional or omnidirectional. Some tactical SDRs,**

**like the PRC-163, are multi-channel and will employ multiple antennas simultaneously.**

26. Is there any known power budget for spectrum sensing?

**A: SWaP constraints should be comparable to existing tactical SDR solutions like the AN/PRC-117G. Proposers should identify the power budget required for the proposed solution.**

27. For POL, can we assume the portable units will eventually put the data in a server capable of AI-enabled processing and analysis?

**A: No**

28. Will the portable units work individually or in the form of a group or swarm?

**A: Individually.**

29. Can the portable units exchange small information in real-time in peer-to-peer communication fashion or through infrastructure-based communication (base-station based, similar to 802.11/wifi)?

**A: No**

30. SDR Replacement: Regarding the FAQ on SDR Replacement, it was said that *'the replacement must retain the functionality of the original radio'*. Can you elaborate on what is meant by "retain functionality of the original radio"? Does this functionality need to be integrated/ demonstrated as part of the Ph 1 and 2 SOW along with the proposed spectrum monitoring and awareness capability? Or can this occur in a Ph 3? As the exact cryptographic core is unknown, is it suitable to reserve space on the SDR for a communication IP core to be added at a later date to enable that full communication and data sharing functionality?

**A: As stated in the solicitation, the SMART SBIR is aimed at developing “advanced capabilities that provide military dismounted ground tactical units real-time awareness of the radio frequency (RF) spectrum” using hardware commonly employed by ground tactical units. It should be noted that the solicitation also allows proposers to replace specific components. By “replacement” we mean that proposers may introduce a surrogate SDR capable of voice communications and data sharing that replicates comparable functionality, and SWaP, to tactical SDR solutions like the AN/PRC-117G. Replication of the exact functionality (e.g., proprietary waveforms, encryption capabilities, etc.) is not required, nor expected; however, surrogate capabilities must be considered to demonstrate that the proposed solution does not degrade or interfere with the primary function of the SDR to provide tactical communication capability to the warfighter. Introduction of additional SDR-based hardware is not in scope for SMART.**

31. Regarding addressing capability 1 ("Detect, separate from background noise, and characterize signals of interest..."), must the solution address all three of these components or is it acceptable to focus on specific components of this capability?

**A: The SMART SBIR is an Open topic and does not have specific metrics associated with the three technical capability areas. Our goal is to determine the limits of what is possible in the three technical areas using the hardware described in the solicitation, or a surrogate. In other words, we don't have a metric for processing latency to define operational relevance, a time constraint for POL, or frequency range expectations. We expect proposers to identify, and provide technical justification for, what they believe is feasible. To explicitly address the question regarding technical capability 1, proposals should clearly identify the technical capability area the proposed solution is targeting and include the limitations of the proposed approach with respect to the desired technical capability description provided in the abstract.**

32. There are existing systems that have been fielded that are capable of characterizing RF environments and provide some amount of signal localization. Is the government willing to elaborate on how it envisions this effort moving past these currently fielded systems. Are current systems not able to perform on one or more of the three stated goals in some fundamental way, or is the government looking for improvements on performance of existing systems? Are current systems that can perform on the goal not man-portable?

**A: While there are existing systems that are capable of characterizing RF environments and provide some amount of signal localization, the introduction of additional SDR-based hardware is not in scope for SMART. Furthermore, the target audience of the existing systems is limited to specialized units.**

The solicitation identifies the target user, “military dismounted ground tactical units,” common hardware configurations employed by ground tactical units in the DoD (i.e., SDR and tablet running ATAK), and states that “The Defense Advanced Research Projects Agency (DARPA) solicits technologies that, leveraging advancements in SDR technology, and handheld or tablet-based compute, optimize warfighter capabilities in one or more of the three technical capability areas described above.” Additionally, the solicitation states that “Solutions can be algorithmic, software, hardware, and/or material in nature; however, hardware/material solutions should not introduce a new physical burden on the warfighter (i.e., modifying or replacing an antenna/SDR is acceptable, but introducing an additional sensor/antenna/radio/tablet is not). Moreover, proposed solutions should not interfere with the primary function of the equipment (i.e., warfighter communication capability must not be degraded).” For clarity, by “replacement” we mean that proposers may introduce a surrogate SDR capable of voice communications and data sharing that replicates comparable functionality, and SWaP, to tactical SDR solutions like the AN/PRC-117G [e.g., hardware-agnostic (yet aware)].

33. As a point of clarity, proposing a completed COTS SDR with additional processing hardware but with relatively the same form factor and SWAP as the listed radios is acceptable as long as the current mission and capabilities of the radios are not impacted? It is also acceptable to send detected signal data to the ATAK network for



visualization/alerts. What is unacceptable is to propose the need for duplicate or excessive SWaP increases to any component or the system at large.

**A: That is correct. As stated in the solicitation, the SMART SBIR is aimed at developing “advanced capabilities that provide military dismounted ground tactical units real-time awareness of the radio frequency (RF) spectrum” using hardware commonly employed by ground tactical units. It should be noted that the solicitation also allows proposers to replace specific components. By “replacement” we mean that proposers may introduce a surrogate SDR capable of voice communications and data sharing that replicates comparable functionality, and SWaP, to tactical SDR solutions like the AN/PRC-117G. Replication of the exact functionality (e.g., proprietary waveforms, encryption capabilities, etc.) is not required, nor expected; however, surrogate capabilities must be considered to demonstrate that the proposed solution does not degrade or interfere with the primary function of the SDR to provide tactical communication capability to the warfighter. Introduction of additional SDR-based hardware is not in scope for SMART.**

34. At this point in the research how much focus should be placed on the OPSEC issues that RF PoL data stored on a device can present? For example, to build long-term PoLs, a GPS location can be used to indicate when the radio is moving or observed and thereby decide if detected signals can be integrated for longer duration PoL.

**A: We recognize that there are some OPSEC considerations when storing data on device. At this point in the research, this should not be the focus of the effort.**

35. With regard to adhere to blue force emissions control (EMCON), are we able to assume that the radios as part of their regular operations (communications and data sharing) are able to share some results between units in close proximity? In other words, can we leverage a low power mesh network as part of a solution? If the radios cannot directly share information, can detection information be passed over the ATAK network to share the observed patterns across devices?

**A: The focus of the SMART SBIR is on what can be accomplished as a single node. Leveraging networking capabilities is not in scope.**

36. Is there additional detail that can be provided regarding the spectral pattern of life that is of highest importance to the anticipated end user? Is there interest in detecting the emergence of new signals, geospatial RF PoL, etc?

**A: No additional detail.**

37. Is an antenna array that is man packable an acceptable component of a system under this effort?

**A: As stated in the solicitation, modifying or replacing an antenna/SDR is acceptable, but introducing an additional sensor/antenna/radio/tablet is not. The replacement solution should have similar SWaP and should not degrade or interfere with the primary function of the system (i.e., tactical communication capability).**

38. We are trying to gauge what level of work is needed to satisfy the requirement that “surrogate capabilities must be considered”. Is a demonstration required, like a bench-top

measurement of communication between two radios while showing spectrum-monitoring capabilities? Since neither the exact signal nor encryption are required, what other communication metrics are we required to meet to demonstrate that our proposed solution doesn't degrade tactical communication? Are calculations or paper analysis sufficient to demonstrate that surrogate capabilities are being considered?

**A: Although demonstration is not required for Phase I, the calculations and paper analysis conducted in Phase I must be rigorous enough to demonstrate that surrogate capabilities are being considered and that the proposed solution is compatible with the stated constraints. Consideration should be given to both voice, data, and simultaneous voice/data communications across the applicable communications bands advertised by the associated tactical SDR.**

39. Can you provide any reference regarding existing military SDRs, such as the L3Harris AN/PRC-117G or AN/PRC-152A?

**A: The L3 Harris AN/PRC-117G and AN/PRC-152A were used as an example of a man-portable tactical SDRs commonly employed in the DoD, and the Hedgehog SDR was provided as an example of a recent advancement in SDR technology that enables rapid reconfiguration and/or adaptation for various tasks. Information on these SDRs can be found on the manufacturer's website.**

**a. PRC-117G: <https://www.l3harris.com/all-capabilities/an-prc-117gv1c-multiband-networking-manpack-radio>**

**b. PRC-152A: <https://www.l3harris.com/all-capabilities/falcon-iii-an-prc-152a-wideband-networking-handheld-radio>**

**c. Hedgehog SDR: <https://www.baesystems.com/en-media/uploadFile/20210404060814/1434640495846.pdf>**

40. How critical is interoperability with existing SDRs and other communication equipment for the proposed solutions?

**A: The SMART SBIR is aimed at developing “advanced capabilities that provide military dismounted ground tactical units real-time awareness of the radio frequency (RF) spectrum” using hardware commonly employed by ground tactical units. It should be noted that the solicitation also allows proposers to replace specific components. By “replacement” we mean that proposers may introduce a surrogate SDR capable of voice communications and data sharing that replicates comparable functionality, and SWaP, to tactical SDR solutions like the AN/PRC-117G.**

**Replication of the exact functionality (e.g., proprietary waveforms, encryption capabilities, etc.) is not required, nor expected; however, surrogate capabilities must be considered to demonstrate that the proposed solution does not degrade or interfere with the primary function of the SDR to provide tactical communication capability to the warfighter.**

41. Are there any specific communication protocols or standards that proposed solutions should adhere to for seamless integration?

**A: The focus of the SMART SBIR is on what can be accomplished as a single node. Leveraging networking capabilities is not in scope.**

42. Are there any specific performance metrics or benchmarks that proposed solutions should aim to achieve?

**A: The SMART SBIR is an Open topic and does not have specific metrics associated with the three technical capability areas. Our goal is to determine the limits of what is possible in the three technical areas using the hardware described in the solicitation, or a surrogate (as described above). In other words, we don't have a metric for processing latency to define operational relevance, a time constraint for POL, or frequency range expectations. We expect proposers to identify, and provide technical justification for, what they believe is feasible. From the solicitation: "Proposals should include the RF bandwidth covered by the proposed solution and, if targeting the POL technical capability, the timeframe for POL required to gain specific insights."**

43. Can you provide insights into the expected field conditions and operational scenarios in which the proposed solutions will be tested?

**A: The solicitation identifies the target user, "military dismounted ground tactical units," and states that in Phase II, prototype solutions will be developed that enable mission essential tasks in more complex field conditions. Proposers should expect the field conditions to be tactically relevant for the target user (e.g., dense, complex, and denied/degraded RF environment).**

44. How do end users need the signals categorized?

**A: As stated in the solicitation, technical area one is focused on detecting, separating from background noise, and characterizing signals of interest, including identifying the communications protocol for signals within the RF communications band. We expect proposers to identify, and provide technical justification for, what they believe is feasible in terms of signal characterization using the proposed approach.**

45. For pattern of life - Do you have any additional information on pattern of life requirements? What pattern is priority for detection? Ex. Busy times, jammed times, detonations, etc? If there are multiple can you rank them from most to least desired.

**A: The SMART SBIR is an Open topic and does not have specific metrics associated with the three technical capability areas. Our goal is to determine the limits of what is possible in the three technical areas using the hardware described in the solicitation, or a surrogate (as described above). In other words, we don't have a metric for processing latency to define operational relevance, a time constraint for POL, or frequency range expectations. We expect proposers to identify, and provide technical justification for, what they believe is feasible. From the solicitation: "Proposals should include the RF bandwidth covered by the proposed solution and, if targeting the POL technical capability, the timeframe for POL required to gain specific insights."**

46. What level of accuracy do you need to achieve with geolocation and at what distance? What is the ideal end state for the geolocation feature? Please share any high level use cases.

**A: The SMART SBIR is an Open topic and does not have specific metrics associated with the three technical capability areas. Our goal is to determine the limits of what is possible in the three technical areas using the hardware described in the solicitation, or a surrogate (as described above). In other words, we don't have a metric for processing latency to define operational relevance, a time constraint for POL, or frequency range expectations. We expect proposers to identify, and provide technical justification for, what they believe is feasible. From the solicitation: "Proposals should include the RF bandwidth covered by the proposed solution and, if targeting the POL technical capability, the timeframe for POL required to gain specific insights."**

47. What specific hardware and software interfaces are available for integration with the L3 Harris or Hedgehog SDRs? Have L3 or BAE expressed that they would open up their systems for us to be able to integrate?

**A: The L3 Harris AN/PRC-117G and AN/PRC-152A were used as an example of a man-portable tactical SDRs commonly employed in the DoD, and the Hedgehog SDR was provided as an example of a recent advancement in SDR technology that enables rapid reconfiguration and/or adaptation for various tasks. Information on these SDRs can be found on the manufacturer's website.**

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**c. Hedgehog SDR: <https://www.baesystems.com/en-media/uploadFile/20210404060814/1434640495846.pdf>**

48. Do you know specifically what ATAK hardware platforms this application is targeting?

**A: The solicitation stated that "warfighters are often equipped with Android tablets running the Android Tactical Assault Kit (ATAK)" and did not specify the hardware platform because the hardware is being updated on regular intervals. The proposed solution should leverage handheld (i.e., tablet/phone form factor) compute running the Android Tactical Assault Kit (ATAK).**

49. Do these dismounted units have a high-precision synchronous (ideally non-GPS-based) clock source?

**A: No. These dismounted tactical units do not have access to high-precision synchronous, non-GPS-based clock sources.**

50. Are there RF metrics you're looking to achieve similar to the SDRs in the solicitation, were we to propose our own solution?

**A: The SMART SBIR is an Open topic and does not have specific metrics associated with the three technical capability areas. Our goal is to determine the limits of what is possible in the three technical areas using the hardware described in the solicitation, or a surrogate. In other words, we don't have a metric for processing latency to define operational relevance, a time constraint for POL, or frequency range expectations. We expect proposers to identify, and provide technical**

justification for, what they believe is feasible. From the solicitation: “Proposals should include the RF bandwidth covered by the proposed solution and, if targeting the POL technical capability, the timeframe for POL required to gain specific insights.” As stated in the solicitation, the SMART SBIR is aimed at developing “advanced capabilities that provide military dismounted ground tactical units real-time awareness of the radio frequency (RF) spectrum” using hardware commonly employed by ground tactical units. It should be noted that the solicitation also allows proposers to replace specific components. By “replacement” we mean that proposers may introduce a surrogate SDR capable of voice communications and data sharing that replicates comparable functionality, and SWaP, to tactical SDR solutions like the AN/PRC-117G. Replication of the exact functionality (e.g., proprietary waveforms, encryption capabilities, etc.) is not required, nor expected; however, surrogate capabilities must be considered to demonstrate that the proposed solution does not degrade or interfere with the primary function of the SDR to provide tactical communication capability to the warfighter. Introduction of additional SDR-based hardware is not in scope for SMART.

51. We understand the desire to reduce physical burdens by not introducing "another box," but what is the rationale for expecting no extra hardware for an entirely new capability set? Would you be open to extra hardware if it was designed to be as low-SWaP as possible?

**A:** The SMART SBIR is an Open topic and does not have specific metrics associated with the three technical capability areas. Our goal is to determine the limits of what is possible in the three technical areas using the hardware described in the solicitation, or a surrogate. In other words, we don’t have a metric for processing latency to define operational relevance, a time constraint for POL, or frequency range expectations. We expect proposers to identify, and provide technical justification for, what they believe is feasible. From the solicitation: “Proposals should include the RF bandwidth covered by the proposed solution and, if targeting the POL technical capability, the timeframe for POL required to gain specific insights.” As stated in the solicitation, the SMART SBIR is aimed at developing “advanced capabilities that provide military dismounted ground tactical units real-time awareness of the radio frequency (RF) spectrum” using hardware commonly employed by ground tactical units. It should be noted that the solicitation also allows proposers to replace specific components. By “replacement” we mean that proposers may introduce a surrogate SDR capable of voice communications and data sharing that replicates comparable functionality, and SWaP, to tactical SDR solutions like the AN/PRC-117G. Replication of the exact functionality (e.g., proprietary waveforms, encryption capabilities, etc.) is not required, nor expected; however, surrogate capabilities must be considered to demonstrate that the proposed solution does not degrade or interfere with the primary function of the SDR to provide tactical communication capability to the warfighter. Introduction of additional SDR-based hardware is not in scope for SMART.

52. If we replace the SDR, how much extra power draw is okay given the extra requested capabilities?

**A: As stated in the solicitation, the proposed solution should not degrade or interfere with the primary function of the SDR to provide tactical communication capability to the warfighter. We do not have specific metrics regarding additional power draw; however, we expect the proposer to identify the additional power draw and how it will impact the primary mission.**

53. Would you be open to a D2P2 proposal? Alternatively, is there another route that we should take if we were to propose our technology to DARPA as a solution for this problem set?

**A: We are not looking for D2P2 proposals for this topic.**

54. Is the goal to minimize the number of sensors needed to achieve a given accuracy or should we assume a single RF sensor?

**A: As stated in the solicitation, the SMART SBIR is aimed at developing “advanced capabilities that provide military dismounted ground tactical units real-time awareness of the radio frequency (RF) spectrum” using hardware commonly employed by ground tactical units. Moreover, the solicitation identifies common hardware configurations employed by ground tactical units in the DoD (i.e., SDR and tablet running ATAK). Introduction of additional hardware is not in scope for SMART.**

55. Is there interest to optimize deep learning models for the desired application to run on low-power, handheld tactical COTS devices?

**A: As stated in the solicitation, “Solutions can be algorithmic, software, hardware, and/or material in nature” (i.e., deep learning is in scope).**

56. Do you expect innovation in both the hardware (e.g. directional sensing) and software (data fusion and processing). Any preference on the focus between software R&D assuming COTS hardware vs. hardware R&D using standard software processing technique, including ML?

**A: The SMART SBIR is an Open topic, and there is no preference to any particular solution or approach.**

57. Are there specific emitters, specific technologies, band, or bandwidth that is of most interest?

**A: No.**

58. Do you prefer that "dismounted tactical units" act as local sensing and computing nodes or is computing infrastructure with a backhaul available?

**A: The focus of the SMART SBIR is on what can be accomplished as a local sensing and computing node. Use of additional computing infrastructure is not in scope.**

59. Do you desire a capability for a single dismounted tactical ground user or a group of users?

**A: Single user.**

60. Should our solution accommodate the tactical Android smartphones/tablets as the radio and computing platforms or can we prototype/demonstrate initially on a generic SDR, e.g., an Ettus Research USRP with powerful host computers?

**A: As stated in the solicitation, the SMART SBIR is aimed at developing “advanced capabilities that provide military dismounted ground tactical units real-time awareness of the radio frequency (RF) spectrum” using hardware commonly employed by ground tactical units. It should be noted that the solicitation also allows proposers to replace specific components. By “replacement” we mean that proposers may introduce a surrogate SDR capable of voice communications and data sharing that replicates comparable functionality, and SWaP, to tactical SDR solutions like the AN/PRC-117G. Replication of the exact functionality (e.g., proprietary waveforms, encryption capabilities, etc.) is not required, nor expected; however, surrogate capabilities must be considered to demonstrate that the proposed solution does not degrade or interfere with the primary function of the SDR to provide tactical communication capability to the warfighter. Introduction of additional SDR-based hardware and/or computers is not in scope for SMART.**

61. Is there any one topic of more importance than the others.

**A: No.**

62. Regarding Capability #1:

- a. Are there any time/latency requirements for characterizing signals and identifying comms protocols, in terms up update rates? (i.e., how soon from signal collection to characterization is required?)

**A: The SMART SBIR is an Open topic and does not have specific metrics associated with the three technical capability areas. Our goal is to determine the limits of what is possible in the three technical areas using the hardware described in the solicitation, or a surrogate (as described above). In other words, we don’t have a metric for processing latency to define operational relevance, a time constraint for POL, or frequency range expectations. We expect proposers to identify, and provide technical justification for, what they believe is feasible. From the solicitation: “Proposals should include the RF bandwidth covered by the proposed solution and, if targeting the POL technical capability, the timeframe for POL required to gain specific insights.”**

- b. Does detecting and characterizing signals of interest include intentional interference types of signals (i.e., jamming)?

**A: Yes.**

- c. Is anomaly detection of interest, i.e., detect “new” signals/protocols or flag uncertain decisions, and storing off samples for post-mission analysis?

**A: Yes**

63. Regarding Capability #2:

- a. Should POL be estimated for encampments/base areas vs deployed teams (foot patrols, planes, vehicles)?

**A: The solicitation identifies the target user, “military dismounted ground tactical units,” and the goal of technical capability #2 is to build a pattern of life (POL) over time in support of the target user wherever that user is deployed.**

- b. Is each SDR unit to construct its own POL and inform the user? Or is information for POL to be aggregated from many SDRs to build a broader RF usage map over an area and then distributed amongst SDRs?

**A: The goal of the SMART SBIR is to determine what is possible in the three technical capability areas as a single node. Aggregating data from multiple nodes is out of scope.**

64. Regarding Capability #3:

- c. Can it be assumed that the SDRs are sharing information necessary for emitter positioning between themselves?

**A: No. The goal of the SMART SBIR is to determine what is possible in the three technical capability areas as a single node. Aggregating data from multiple nodes is out of scope.**

- d. Can we assume each SDR has GPS or some other means to position itself?

**A: Yes. Access to GPS may be assumed.**

- e. How synchronized can we assume the dismount ground unit SDRs to be? (by GPS?)

**A: Access to GPS may be assumed.**

- f. Is it possible that the SDRs could be connected to an antenna array?

**A: 4. No. The use or introduction of additional hardware is not in scope for SMART.**

65. What is the target platform/SDR of interest? Should we assume it has a CPU, GPU and NPU for AI/ML engines?

**A: The solicitation identifies the target user, “military dismounted ground tactical units,” common hardware configurations employed by ground tactical units in the DoD (i.e., SDR and tablet running ATAK), and states that “The Defense Advanced Research Projects Agency (DARPA) solicits technologies that, leveraging advancements in SDR technology, and handheld or tablet-based compute, optimize warfighter capabilities in one or more of the three technical capability areas described above.” Additionally, the solicitation states that “Solutions can be algorithmic, software, hardware, and/or material in nature; however, hardware/material solutions should not introduce a new physical burden on the warfighter (i.e., modifying or replacing an antenna/SDR is acceptable, but introducing an additional sensor/antenna/radio/tablet is not). Moreover, proposed solutions should not interfere with the primary function of the equipment (i.e., warfighter communication capability must not be degraded).” For clarity, by “replacement” we mean that proposers may introduce a surrogate SDR capable of voice communications and data sharing that replicates comparable functionality, and SWaP, to tactical SDR solutions like the AN/PRC-117G [e.g., hardware-agnostic (yet aware)].**

66. Is it desired to directly integrate into ATAK services like Cursor on Target?



**A: Integration into ATAK services is desired.**

67. Does ATAK have access to IQ samples from the SDR?

**A: ATAK does not inherently have access to IQ data from an SDR.**

68. AI Integration in RF Signal Processing:

- a. Does DARPA have specific performance benchmarks for AI-driven RF signal classification and anomaly detection in this topic?

**A: a. The SMART SBIR is an Open topic and does not have specific metrics or benchmarks associated with the three technical capability areas. Our goal is to determine the limits of what is possible in the three technical areas using the hardware described in the solicitation, or a surrogate. We don't have a metric for processing latency to define operational relevance, a time constraint for POL, or frequency range expectations. We expect proposers to identify, and provide technical justification for, what they believe is feasible.**

- b. Should proposals focus on software-only solutions, or are hardware modifications (e.g., SDR enhancements) within scope?

**A: b. The focus of the proposal is up to the performer, as stated in the solicitation, "Solutions can be algorithmic, software, hardware, and/or material in nature; however, hardware/material solutions should not introduce a new physical burden on the warfighter (i.e., modifying or replacing an antenna/SDR is acceptable, but introducing an additional sensor/antenna/radio/tablet is not)." It is up to the performer to determine the approach that they believe will address the technical area(s).**

69. Emitter Localization & Pattern-of-Life Analysis:

- a. Is there a minimum required accuracy or latency threshold for emitter geolocation solutions?

**A: The SMART SBIR is an Open topic and does not have specific metrics or benchmarks associated with the three technical capability areas. Our goal is to determine the limits of what is possible in the three technical areas using the hardware described in the solicitation, or a surrogate. We don't have a metric for processing latency to define operational relevance, a time constraint for POL, or frequency range expectations. We expect proposers to identify, and provide technical justification for, what they believe is feasible.**

- b. Would a hybrid AI and sensor fusion approach (e.g., integrating additional data sources beyond RF signals) be of interest?

**A: The SMART SBIR is open to proposed approaches that fit within the constraints defined within the SBIR solicitation. For example, "hardware/material solutions should not introduce a new physical burden on the warfighter (i.e., modifying or replacing an antenna/SDR is acceptable, but introducing an additional sensor/antenna/radio/tablet is not)."**

70. Tactical System Interoperability

- a. Are there preferred integration pathways with DoD tactical SDRs beyond ATAK (e.g., specific hardware constraints or software environments)?

**A: No. As mentioned in FAQ Question 10**

- b. Should proposals include demonstration plans for testing interoperability with existing DoD communication frameworks?

**A: No**

71. Security and Compliance:

- a. What export control considerations should be prioritized in relation to ITAR/EAR restrictions for AI-based RF analytics?

**A: From the solicitation, “The technology within this topic is restricted under the International Traffic in Arms Regulation (ITAR), 22 CFR Parts 120-130, which controls the export and import of defense-related material and services, including export of sensitive technical data, or the Export Administration Regulation (EAR), 15 CFR Parts 730-774, which controls dual use items. Offerors must disclose any proposed use of foreign nationals (FNs), their country(ies) of origin, the type of visa or work permit possessed, and the statement of work (SOW) tasks intended for accomplishment by the FN(s) in accordance with the Announcement. Offerors are advised foreign nationals proposed to perform on this topic may be restricted due to the technical data under US Export Control Laws.”**

- b. Would a zero-trust cybersecurity model for protecting AI-driven RF monitoring be of particular interest?

**A: No, this is out of scope for the SBIR.**

72. After POL is analyzed, is it of interest (or within scope) to be able to query in natural language to get a better understanding of POL?

**A: As stated in the solicitation, “information should be presented in an intuitive manner that enhances situational awareness and does not impose an additional cognitive burden on the warfighter who does not have expertise in the field of RF spectrum operations.” As such, techniques for making POL analysis more intuitive or easier to access for untrained operators are of interest to SMART.**

73. Is the focus to analyze POL based on history and provide input to the operator based on patterns that have already occurred- For example identify patterns in anomalies etc? Or is predicting future POL life based on the historical data of higher priority?

**A: Providing input to the operator based on patterns that have already occurred is of higher priority than predicting future POL.**