



S²MARTS Project No. 20-02

LOKI Electromagnetic Spectrum (EMS) Payload Prototype

Request for Solutions (RFS) Questions April 10, 2020 & Answers April 20, 2020

1. Question: What is the anticipated rated of data collection?
 - a. Response: Data rates may vary. Data collection should maximize signal fidelity on playback. Samples captured at speeds needed to correctly represent recorded signals so that no discernable difference can be seen. Reference: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6068503/> Table 1 for RF Candidates.
2. Question: What is the anticipated volume of data collection for a given mission or missions before data is offloaded?
 - a. Response: Volume of collected data should be kept at a level to optimize computational speeds. Data size will depend on the method of capture, IQ files sizes have been seen to exceed the 1Tb range. Data size will also be dependent on the system itself, the limitations of the capture methodology and sample rate of the recorded information. (Get what is needed to keep the computer running but also maintain good play back abilities.)
3. Question: Is there an anticipated classification level and encryption requirement of any collected data at rest?
 - a. Response: Systems will need the ability to handle classified information. Data at rest encryption requirements should be maintained on all stored data sets. Highest level of encryption within reason to allow for data transfer.(Simple hardware encrypted external HDDs should work, while the data is being received and re-transmitted software encryption would slow this down pretty bad, if we assume it is handled correctly data at rest should be the only issue.)(That and if one uses extreme care with data labeling nomenclature)
4. Question: What is the anticipated single mission duration for the LOKI EMS Payload?
 - a. Response: TBD, Duration will depend greatly on the developed tactics and procedures. Expected duration of a single mission, within reason one might expect 4-5 hours of operation with transmit or recording times included and on cycles. (May not need to transmit the entire time if done wisely, but emulating certain systems might call for that, so again it all depends. Will also impact data size, and battery life.)
5. Question: What is the size constraint of the overall payload?

- a. Response: System should be modular to allow for integration of different amplifiers, antennas... Size of the controlling piece should be kept to a minimum and be "man portable". (The smaller the foot print the better in terms of supporting classes of USV)
6. Question: Would this system benefit from or be a candidate for a data recorder that also serves as a mission computer handling data management, boot up sequence, operational flight programs, drivers, etc.?
 - a. Response: Perhaps, while not necessarily required this could be beneficial. Separate platforms "delivery vehicles" could integrate into or be a part of the system. (Might be nice but might also lock/limit future system capabilities.)
7. Question: Is it acceptable to defer facility clearance to phase II so during phase I, work performed will utilize unclassified waveforms?
 - a. Response: Yes.
8. Question: What frequency bands are of most interest to the LOKI effort?
 - a. Response: Reference: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6068503/> Table 1 for RF Candidates.
9. Question: What type of unmanned platform is envisioned as the end product for the application (e.g., ground, air, sea, etc.)? How far from the platform of interest is this envisioned to operate in? What sort of persistent false target detection range is objective? Should we assume that the platforms on which the jammer operates may not be in the same resolution cell (AZ / El/ Range gate) as the target whose EMS signature is protected by the system? Will Crane be able to provide sanitized EMS test case data?
 - a. Response: Ideally, the payload would be designed to work with multiple platforms and in multiple domains. Range will depend on Tactics and Technique Procedures (TTP). An initial range from platform goal might vary between 0-1 miles to 50+. System should have autonomous ability programed in. (Main focus is on payload and not unmanned platform.)
10. Question: In what environment will this system payload perform its functions? Or what platform will the payload reside on i.e. sea, airborne (what altitudes), ground?
 - a. Response: Maritime and low altitude initially.
11. Question: Phase 1 deliverables mention a demonstration of proof of concept. Is that preferred to be an outdoor range or can it be performed with the prototype system in an indoor range?
 - a. Response: While an outdoor range demonstration might add some value, it is not a requirement for Phase 1.
12. Question: Can NSWC Crane provide any guidance regarding what a \"A reasonably small footprint\" is?

- a. Response: No hard requirement at this time. Some team thoughts: could be smaller lighter units networked together. Man portable, <50lbs, smaller than a milk crate.
13. Question: Is there an estimate for the anticipated level of funding and estimated duration for Phases 2 and 3?
- a. Response: The responder should provide realistic budgetary and duration estimates to complete Phases 2 and 3.
14. Question: Is the Library of Recordings intended to match and recognize recorded waveforms or generate stored waveforms for playback?
- a. Response: Library would provide the means to emulate an RF system or System of Systems (SoS). Whether that be self-generated waveforms (communications, FM radio, WIFI...) or recorded waveforms replayed to "mimic" a known source.
15. Question: What hardware, if any, is expected as deliverable in Phase 1 CLINs 6 and 7?
- a. Response: While a range or lab demonstration of a hardware/software prototype solution set might have some advantages, it is not necessarily a hard requirement. It will really depend on the performers approach.
16. Question: Does the government expect that all Desired End State Objectives in Section 5 are required to be met in Phase 1?
- a. Response: No. Again, it will depend on the performers overall approach.
17. Question: Please clarify the meaning of swarm technology of multiple?
- a. Response: The ability to coordinate and control multiple payloads to "mimic" a set of systems. Two communications systems talking to each other over a geographical distance for example.
18. Question: In reference to the swarm technology mentioned in the Desired End State Objectives (Section 5), is that from a command and control aspect or synchronization of multiple payloads performing a simultaneous mission?
- a. Response: Both, the systems should be able to locate each other to conduct mission objectives, gain a position, and carry out a transmission or receive objective in a coordinated effort.
19. Question: In the desired outcomes on page #2 of the RFP there is a statement that reads, \"Capable of supporting distributed mulitstatic-netted operations. Supports swarm technology of multiple. This sentence seems to be just end without finishing. Can we get clarification of this statement?

- a. Response: Should have read, "Supports swarm technologies". The payloads should coordinate with themselves/each other to obtain mission success, coordinate time for receive / transmission as an example.

20. Question: What is the expected cost range in a low cost, rapidly fieldable solution?

- a. Response: Low cost meaning a non-traditional program of record solution. A per unit cost of less than \$25,000 is the objective.

21. Question: In order to support the limited budget in phase one would the performer be allowed to retain ownership of hardware not developed under the existing OTA?

- a. Response: So long as phase 2 resulted in a capability that the government owned. Data Rights and other Intellectual Property may be negotiated based on the offeror's proposed solution.

22. Question: For the initial demonstrations at the end of Phase 1 is a proof of concept demonstration with COTs hardware acceptable? If so can the vendor demonstrate disruption of a commercial system?

- a. Response: Yes. Absolutely. Depends on performers approach. As long as they follow the rules of the FCC/FAA, a proof of concept can be done on several different levels and systems. However, the system they would like to show proof of concept on should be authorized first. It is desirable that the commercial system be somewhat robust.

23. Question: As part of the effort, will the government provide access to a signal library or Interface Control Document (ICD) in order to program Radios with specific waveforms?

- a. Response: No current plans to do that.

24. Question: What level of complexity is required in the sense function? Identify specific modulation? Identify RF energy at a frequency?

- a. Response: Reference: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6068503/> Table 1 for RF Candidates. Level of complexity is up to vendor, whatever it takes to confidently record the targeted signal/waveform. (Power on band is a good trigger to start recording)

25. Question: What is the per-unit bandwidth required (sense and respond)? What is the overall system bandwidth required (sense and respond)? What are the defined bands?

- a. Response: Reference: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6068503/> Table 1 for RF Candidates.

26. Question: What are the limits to antenna elements? Interconnection with antenna matrices, proximity?

- a. Response: Mission dependent. Antenna limitations would play a part in the size of the payload and we would think a modular approach would work best for easy change out. Certain antennas for certain bands, certain sizes for certain missions...

27. Question: Please define frequency and power ranges desired? What are the signal demonstration goals in Phase 1 CLINs 6 and 7? (e.g.; signal(s) type, bandwidth, power)

- a. Response: Reference: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6068503/> Table 1 for RF Candidates. Something the vendor will deliver, power ranges again would depend on the amp selection, which could be modular in design, again different mission different supplemental bits.

28. Question: Will this be embedded and machine interface or does it require a human interface?

- a. Response: Human interface required, autonomy required. (Someone needs to be able to make adjustments to the systems, change freqs... it should also have a "headless" capability so they can turn it on and it does X...)

29. Question: Is the use of non-US hardware devices allowed for the prototype?

- a. Response: Yes but must comply with any DoD standard for the use of non-us hardware and chipsets in US DoD systems.

30. Question: Is there a simple use case for the record & playback features mentioned that can be shared? Is record and playback simply a feature for being able to retransmit adversary signals to confuse their systems.

- a. Response: We used a Motorola Family Radio Service (FRS) radio to simulate a conversation between two handsets, this would not fool a Machine Learn (ML) or Artificial Intelligence (AI) system but will to anyone listening in or watching with an analyzer of some sort.

31. Question: Is it assumed that units placed in-theater are reprogrammable in place?

- a. Response: Should be. Ideally both at location or through wireless comms.

32. Question: What geographic area of coverage is required?

- a. Response: Will be mission dependent.

33. Question: Can the measures be networked or are they required to operate entirely standalone?

- a. Response: Standalone in case of comms failure but also networked depending on system approach.

34. Question: Will future phases be interested in high data rate avionics connectivity for connecting the prototype to Aerial platforms?

a. Response: Yes