050720 LAASS FAQ v5.0

LAASS PROPOSER'S PLEASE NOTE:
The due date for "Initial Selections" has been moved. The due date for Initial selections had been 5pm EDT August 2, 2005. The due date for Initial Selections is now 5:00 PM EDT on 16 August 2005. The link to the official posting of this extension is:
`http://www2.eps.gov/spg/ODA/DARPA/CMO/BAA05%2D39/Modification%2001.html`

Frequently Asked Questions:

Q1) Page 6 of the PIP indicates that one should submit a proposal that covers either configuration 1 and 2, or configuration 3.
Can a contractor respond to only configuration 1 or only configuration 2 with their proposal?

A1) No, LAASS EM/Acoustic Capability Proposals must address both Configurations 1 and 2. See Section 2.3 of PIP.

Q2) Logically, even though phase 2 tasks have an overlap with the EM research results that could be applicable to both configurations, there also appears to be a sufficient amount of differences that an individual bid on either configuration 1 or 2 could also be justified. These differences are based on the major deviations found in the operational concept, the significant SWAP differences which also influences the equipment processing performance and therefore phase 2 design decisions, the equipment packaging and functionality related to communications, power, and the safety aspects which all impact the phase 3 determinations and cost. It also seems realistic that company resources and talents could fit extremely well in configuration 1 and not in configuration 2 and vice versa. These differences seem significant enough that it makes sense to submit a separate response on either configuration 1 or configuration 2 could be provided and not necessarily on both.

A2) DARPA realizes that certain companies may be better matched to one Configuration or another. They should team to provide a comprehensive capability. DARPA does not want to be the Prime, and we want to exploit developmental synergies across the Configurations.

Q3) If the proposal submitted supports both configurations 1 and 2, but not 3, is the proposal required to take a form and direction much in the same manner that DARPA has requested when a contractor is proposing 1 and 2 and also proposing configuration 3?

A3) See Section 2.3. A joint proposal may be submitted for all of Configurations 1, 2, and 3, or separate proposals for Configs 1 and 2 (together), and Config 3.

Q4) During the presentations given at the LAASS proposer's briefing it was mentioned that during Phase II, there would be an opportunity to collect some data during test flights about 6 and 9 months into the contract. I'm hoping to get some clarification on what those test flights will entail. Some specific questions are:

Q4.1) What aircraft will be flown?
A4.1) UAV is TBD, but likely Javelin. MAC is likely Blackhawk.

Q4.2) Who will perform the installation of sensors and electronics into the flight package?
A4.2) Bidder should propose to install the sensors and electronics. The Government team can aid in this activity, and could take the lead if you prefer. You must state your needs very clearly in the GFI/GFE section if Government team help is desired, as the Government must cost this activity.

Q4.3) How will the data be collected?
A4.3) You may use the same data collection capability provided for the Baseline Government Team sensor outlined in the PIP and detailed in the Proposer's Day Briefings. If you have your own, you must ensure that it fits within the payload constraints of the UAV above.

Q5) Can you please clarify a point that has been interpreted differently by people that attended Industry Day: With respect to Configurations 1 and 2, must BOTH configurations be included our proposal, or can each be proposed separately (e.g. only Configuration 1)? (We understand that Configuration 3 may be separately.)
A5) Configurations 1 and 2 must be proposed in a single proposal. Please see PIP Section 2.3, and Q1 above.

Q6) I'm hoping you can clarify in 4.1 Proposal Structure, it states "Phase 3 should have a preliminary costing of the design, development, and demonstration of their LAASS concept as currently envisioned; it will be updated in the Phase 3 Proposal Update deliverable at the end of phase 2." Can you elaborate on what kind of cost depth you're expecting as "preliminary costing"?

A6) DARPA understands that there are significant uncertainties in what the performer will build in Phase 3, since Phase 2 is a Concept Design. This is compounded by the fact that final selection of the platforms will be done during Phase 2. For this reason, the proposer's current vision for the Phase 3 system should be used as a "sample problem" for costing. That is, if the proposer's going-in vision were to survive Phase 2 intact, and be selected for Phase 3 development, how much would it cost? DARPA understands that much will be learned during Phase 2, and the design will change. Phase 2 performers will be able to revise their Phase 3 execution plan and cost, up or down, at the end of Phase 2. Taking the above into consideration, detailed teaming agreements, official subcontractor proposals, materials cost backup, and other official costing processes are <u>not</u> needed for the Phase 3 costing.
However, DARPA desires that the proposer construct a Phase 3 SOW based on their current concept, and provide cost information for Phase 3 broken down into major cost categories, i.e., labor, materials, subcontracts, etc. by SOW element. These should have

enough basis of estimate that the Government can understand the proposer's thought process.

Q7) Could we get an electronic copy of the DD-254 emailed to us so we can get ready to receive and store the information sent in?

A7) The DD-254 is on the FedBizOps website. It was posted for all. The link is http://fs2.eps.gov/EPSData/ODA/Synopses/4965/BAA05-39/BAA05-39DD254.pdf

Q8) What is the unit of airspeed in the Missions table in the Briefing Material?

A8) The units are nautical miles per hour (knots).

Q9) Will the LAASS MATLAB Toolbox run under Linux?

A9) The GUI is written for, used under and tested under WINDOWS only. Some of the command line tools (lload.m in particular) are also WINDOWS path dependent. You'll have to modify the m-files yourself to get a Linux friendly version.

Q10) Why should a proposer choose to develop their own sensor packaging when the Government team has offered its Phase 1 sensor packaging designs, and is continuing improvement of these technologies to support the platform-specific data collects?

A10) (This is to clarify and elaborate on Section 3.3.2, Activity 2) Please distinguish between sensors, and sensor packages. DARPA believes that COTS/GOTS sensors (e.g. microphones, magnetometers, and E-field sensors) are available from the proposers and external suppliers, and does not desire to sponsor fundamental sensor development in this program. However, DARPA recognizes that getting these “raw” sensors to work in a platform environment may require additional mechanical design, addition of supporting sensors, and noise reduction signal processing algorithms. We refer to these additional activities in general as “sensor packaging”. The Phase 2 Government team efforts in sensor packaging for platform noise reduction are very limited in scope. The Phase 1 design of the towbody magnetic sensor package worked well enough in the moderate vibration and low EMI environment to prove the feasibility of the LAASS concept. However, it is still 6-15 dB above sensor noise and environmental clutter even in that benign towbody environment when using electronic noise cancellation from the reference accelerometers. We do not know how well it will work in the UAV and Helicopter data collections to be conducted during summer 2005. These data collections are being conducted to provide platform-specific data to the selected LAASS performer(s) as a baseline dataset for noise reduction algorithm design in Phase 2. It is expected that these data will be no better than the Phase 1 towbody, and may be worse due to the more severe environment. Thus further sensor packaging innovation by the performers may be one method to obtain system performance enhancement.

Achieving the Phase 1 level of performance required three mechanical and reference sensor design iterations on the part of the Government team. We expect that some improvements will be made in the Government team sensors for the Additional Phase 2 EM/Acoustic Collection Opportunities (to be done in parallel with any performer-provided risk-reduction designs on the UAV and Helicopter in months 6 and 9), but the Government team effort is not planned to be heavily funded and thus is not expected to achieve the best possible noise reduction.

Any significant additional sensor package mechanical improvements for suppression of platform noise should be proposed by the performers in the (optional) Activity 2 of Section 3.3.2 of the PIP. [This is optional both in the sense that performers do not have to propose to do it, and, if proposed, they may indicate it as an optional task to be selected by the Government if desired. Alternatively it may be deemed essential by the proposer, and not indicated as optional in their offer.] DARPA has made risk-reduction sensor packaging activities an option in Phase 2 for the proposer because what is important to DARPA is end-to-end performance against the stated goals in the classified addendum to the PIP, not the performance at a midpoint in the system (such as sensor SNR). We offer the LAASS Government Team sensor packaging designs as a baseline to potential performers who cannot, or choose not, to propose further sensor mechanical packaging efforts for noise reduction, but instead focus on noise reduction, detection, localization, and imaging algorithms for the current design because they feel it provides enough performance, or that additional performance can be provided by better trades elsewhere in the system or CONOPs.

In either case, it is important to state that although the physical design of the sensor packaging and mounting for each of the towbody, the UAV and the Helicopter data collection configurations will be provided, noise cancellation algorithms will not be GFI and these must be developed by the performers - if desired. Proposers should also note that a sensor packaging concept design is still required in the Phase 2 deliverables (even if it is just stated that it is the Government Team design), and a sensor packaging detailed design, development, and platform integration are required in Phase 3.

As a matter of record, the baseline Government team acoustic sensor is a design developed by SARA, Inc. on an Army SBIR program, and the B-field & E-field sensors are designs developed by Quasar, Inc. on non-LAASS DARPA SBIR programs. These are the devices that are shown in the Proposer's Day Briefing. The magnetic field, electric field, and acoustic sensors used in the Government team sensor packaging designs for the GFI measurements are available from these manufacturers. These may be replaced by the proposer with any (non-developmental) sensor of the proposer's choice. If bidders desire to propose the use of the sensors used by the Government in the proposer's Phase 2 or Phase 3 efforts, the following provides the procedure.

For acoustics, the Government team is using sensors developed by SARA Inc, a member of the Government team during Phase 2. If specific configurations (i.e. locations on the airframe) of these sensors are desired in the Additional Collects at 6 and 9 months into Phase 2, this should be requested as GFE/GFI. If these sensors are desired for the Phase

3 effort, the Proposer's Day Briefing provides a flat cost for purchasing the sensors off the shelf from SARA and a flat rate for using their engineers during Phase 3 if needed to help with improvements or integration. These costs may be cited in your current proposal without any further documentation, that is, you do not need to get a costed SOW from SARA.

For the magnetic field or electric field sensors, the Government team has purchased sensor systems from Quasar Inc. of San Diego, California. Quasar is not a member of the LAASS Government team. If Quasar Inc. magnetic or electric field sensors, or design assistance, are needed for performer sensor packaging designs for Phase 2 risk-reduction testing, or for Phase 3 development, these should be procured or contracted directly from Quasar.

Q11) Since SARA is on the Government Team, and their Acoustic Sensor may be used in Phase 3, doesn't this constitute a potential conflict of interest?

A11) SARA personnel may supply technical advice as part of the Government Team, but SARA personnel will not be evaluating proposals. Only Government personnel will be evaluating proposals. If you do not want non-Government personnel to have access to all or parts of your proposal, it may be marked as indicated in Section 7.7 of the PIP.

Q12) In Section 2.3 (page 6) of the LAASS Program PIP for BAA 05-39, it states that proposers may elect to propose for the EM/Acoustic Capability and/or the Gravity Gradiometer Capability. If we choose option 1, namely a combined proposal for both capabilities, with one as the baseline and the other an option, do the page limits (50 pages for section 2 of Volume 1) still hold? Can the optional capability be discussed in a separate section beyond the 50 page limit?

A12) No, the fifty page limit holds for each proposal. If you want more space choose the two proposal option.

Q13) One immediate question on the EM signal processing involved wondering to what degree you think the inversions would be sensitive to better physical models, versus generic signal-processing approaches.

A13) Model-based signal processing is of great interest to this program.

Q14) What model microphone element was used in the LAASS Phase I data collects?

A14) The SARA "LOSAS" acoustic system used on the LAASS towbody employed a Gentex microphone, P/N: N100525. The same system was used on the "Buster" UAV example whose photo and performance is provided in the Classified Proposer's Day Briefing.

It should be noted that SARA's engineers have used various Gentex microphones, Knowles microphones and custom-built microphones for various atmospheric acoustic applications across the past 20 years, and the microphone has NEVER been the limiting feature of performance. On the LAASS towbody, the nearby helicopter noise (engine/exhaust, main & rotor blades, etc) clearly dominates. In the LAASS proposer's day briefing a spectrum is provided which shows the same acoustic system operating on the "Buster" UAV. Once again, the engine (broadband) and propeller (narrow band) noise tend to dominate, although some frequencies are wind/flow noise dominated. When such acoustics have been applied to unpowered aircraft (gliders) the noise is typically dominated by colored-but-broad-band wind noise – either wind directly on the windscreens or wind encountering nearby aero-structure surfaces (wings, flaps, body,…). These principle contributors and the published state of the art performance are also provided in the acoustic discussion in the classified Proposer's Day Briefing.

Q15) What is the accuracy of the reported X Y Z coordinates of the pod? Is it GPS quality (~10 m?), or improved GPS quality (e.g., DGPS)?

A15) It was improved using WAAS (Wide Area Augmentation System) but not as good as a ground based DGPS. The terrain at Area 12 precluded the latter for an airborne system. The GPS spec which include links to the manufacturer's web site can be found on the hard disk in ..\CFT2\Metadata\Sensors\GPS\Csi\ . We estimate the performance to be 1-3 meter accuracy based on review of the data.

Q16) I tried running your GUI procdata and I can't get the entire window to display on my screen. It is cut off above the Coordinate Systems part, so I don't see any part of the screen for Select PXI Folder or Select Working Folder. Any idea what is wrong? I am running MatLab 7.04 on a Dell Latitude/D800, where I set the highest monitor resolution.

A16) The GUI should work at 1024x768 but looks better at 1280x1024. That being said, try double-clicking on a visible outer corner of the window (e.g. where you would normally click-hold-drag to resize the window). If this doesn't work on your system, click the figure, then type the following MATLAB command:

```
>> set(gcf, 'position', [0 0 693 693])
```

The window should move to the lower left corner of your screen.

Q17). We would like to obtain information on packaging design as soon as possible to assess the value of proposing the optional task of noise mitigation. We would like to obtain the following design information

a) Regarding the magnetic sensor the government team used in Phase 1: size, weight, detailed mechanical design, magnetic noise floor, and data acquisition/processor provided.

b) Regarding the vibration isolation the government team employed in Phase 1: size, weight, detailed mechanical design, measured performance (how much vibration isolation does it provide).

c) Regarding the acoustic sensor the government team employed in Phase 1: size, weight, detailed mechanical design, installation constraints and recommendation, noise performance (against flow noise and engine noise, for typical LAASS operations such as small UAV at cruising speed), and information regarding data acquisition/processor that may come with the sensor.

A17a) The LAASS Government team purchased "3-axis compact Magnetic sensors" from QUASAR of San Diego, California. These are the devices that will be used in Phase 2 for the upcoming UAV and Helicopter experiments, the results of which will be provided to performers early in Phase 2.
Specifics and photographs of the device are available at the QUASAR web site. The link to the specific page is http://www.quasarusa.com/tp.html#dg.
The as-tested sensor includes low noise front-end electronics (as per the website) but no "data acquisition/processor" was provided with it. Rather, a single data acquisition system was used for all sensors on the towbody pod, and all processing was conducted post-test.

A17b) The LAASS Government team did not attempt "vibration isolation" per se during Phase 1. Rather, the 3-axis compact Magnetic senor was flown mounted directly ("simple mount") to the towbody pod internal frame in the first series of testing, and was mounted into a solid wood block ("restrained mount") in later testing. The photo of each of these configurations and the as-flown noise of the sensor in each of these configurations was provided in the classified LAASS Technical Survey portion of the Proposer's Day Briefing, section "What should you propose?", subsection "What will you get to prove your case? - UAV-borne EM and Acoustic testing", on a chart titled "Flight Test 4b (UAV) Sensor Mounts Concept".

The restrained mount was designed to suppress flexing of the long-thin sensors - in response to input vibration – rather than to isolate it from vibration. Tilting modes were observable by the reference accelerometers, but flex was not. Mechanical vibration isolation may be attractive for LAASS, but has not yet been attempted on the compact sensor. Vibration Isolation (using rubber bushings) was attempted on a larger sensor, but the results were inconclusive mostly due to factors other than the isolators- it was a larger and more complex sensor, with many more vibrational modes.

As can be seen from the chart, the wood block "restrained mount" worked well enough to achieve 6 to 15 db of open-loop (mechanical) noise reduction. Further - by virtue of two accelerometer triads which were tightly coupled to the compact magnetometer by virtue of being co-mounted in the wood block – the resultant signal accrued as much as another 6-15 dB of SNR improvement when the accelerometers were used in an adaptive noise cancellation algorithm (this algorithm is not available to performers – please see Q/A #10).

The block was a 6" x 6" solid (laminated) wood block. The block was cut in half and each half had relief for the sensor "arms" and center electronics block. The sensor was soft-potted into the tight-fit block with RTV, and then the halves were clamped shut with

plastic bolts. The wood block is considered impractical (due to weight) for eventual LAASS applications.

A17c) LAASS secured a "4-element Acoustic sensor" from Government Team member SARA Inc. of Cypress, California. These are the devices that will be used in Phase 2 for the upcoming UAV experiments, and whose results will be provided to performers early in Phase 2.
Specifics and photographs of the device are available at the SARA web site. The link to the specific page is http://www.sara.com/acousticsensor.html
The as-tested sensor for the Phase 1 data includes preamplifier electronics (as per the website) but no "data acquisition/processor" was used with it. Rather, a single data acquisition system was used for all sensors on the towbody pod, and all processing was conducted post-test. For the Government Team-conducted Phase 2 UAV data collection efforts a digitizer and on-board storage system will be provided. This data will be supplied to Phase 2 performers. This digitizer and on-board storage system is also available without additional "GFE" citation for use in the performer-identified risk reduction measurements (if such optional measurements are proposed by performers).

The as-flown noise of the sensor on the "Buster" UAV was provided in the classified LAASS Technical Survey portion of the Proposer's Day Briefing, section "What should you propose?", subsection "Performance Goals & how to score higher (FOMs) - 3) UGF Wide Area Search (A or EM or GG)", on a chart titled "Acoustic Search". Further discussion of the considerations and expected noise performance of such an Acoustic system on a LAASS-relevant UAV was provided in the classified LAASS Technical Survey portion of the Proposer's Day Briefing, section "What have we done to get it started?", subsection "Acoustic".

Q18) In the classified LAASS Technical Survey portion of the Proposer's Day Briefing, section "What should you propose?", subsection "What will you get to prove your case? - Data Base(s)" the mini data base is described as including "Relevant Script, Ground Reference Sensor & Ground Truth" data, and the same line indicates that they are classified "SECRET". Since the mini-database was provided as an unclassified drive, where are these elements of provided?

A18) The "Relevant Script" is provided in the Classified Proposer's Day Briefing, in the same section as above, on two classified charts. Full waveform-level "Ground Truth" data will only be provided after contract award. It will be provided to the selected performers with the "Full" data base at the Phase 2 kickoff meeting.

We should distinguish between "ground truth", which provides information on details of the source/structure that will never be directly available to the sensor systems, and "ground reference" data.

The "Ground Reference Sensor" data is equivalent to having a ground sensor nearby. This data is unclassified by virtue of separation of the ground truth script and structural data, and is in the provided unclassified drive of the mini-data base.

While the Government Team has not jointly processed ground and airborne data, we point out that a tactical LAASS may collaborate with Ground Sensors. Thus the proposer's were encouraged to consider the benefit of such collaboration and are equipped to conduct such consideration with the data that is provided.

Q19) Is mains power provided on the manpack UAV? If so, what is the approximate power supply rating, and what limitations if any on power dissipation are placed? May we assume airflow cooling?

A19) The manpack UAV for LAASS has not yet been selected. As such the proposer is encouraged to consider the variability of possible resources implied by the range of candidate UAVs that were presented in the Proposer's Day Briefings. While power is available from some of these, it is not available from others. Ram-air for payload cooling is not known to be a feature of any of the UAVs mentioned in the Proposer's Day Briefings.

Q20) For the Gravity Gradiometer rotary wing UAV, we assume significant power and weight are allowable, but can you quantify this in any way? Can we also assume forced air cooling on this platform?

A20) The Gravity Gradiometer UAV (or MAC) platform for LAASS has not yet been selected. As such the proposer is encouraged to consider the variability of possible resources implied by the range of candidate UAVs (or MAC) platforms that were presented in the Proposer's Day Briefings, and to make their own recommendations for this platform. Ram-air for payload cooling and some power is available from some of these, but not available from others.

Q21) Are there any existing command links which would accommodate payload control and data output?

A21) While the UAVs have not yet been selected, there will certainly be existing command links which would facilitate low-data-rate payload control.

Conversely, the communications links – and the displays - that will be needed to convey LAASS findings back to operators, data users and/or those links that might facilitate local collaboration (such as between ground sensors & the LAASS UAV and/or from one LAASS UAV to another) may very well not exist prior to configuring the UAV system for LAASS. As such, the proposer's are

expected to articulate their vision for the communications links & displays that will need to be employed AND to articulate which existing or emerging military systems may be most relevant to these aspects of the LAASS missions. The proposer's are reminded that "Phase 3 will not only require mature algorithms, sensors and mounts, but will also require a form-fit-function design & fab, flight-certified integration on the tactical platform and demonstrated operation in conjunction with tactically-appropriate comms and displays". Further elaboration is available from the "What should you propose? For Phase 3"chart from the "Which sensors? Which platforms?" subsection of the "What should you propose?" section of the classified LAASS Technical Survey portion of the Proposer's Day Briefing.

Q22) What is the anticipated contract type for the Phase 2 and Phase 3 awards?

A22) Offerors should propose an award type that they deem appropriate for that phase of the effort. Potential award types are listed in Section 7.1 of the PIP.

Q23) Can you provide a list of FAR, DFARS and other clauses that will be incorporated into the contract?

A23) A list of clauses will be provided during award negotiations.

Q24) During the Phase 2 risk reduction data collects will data be collected from the manned helicopter platform (currently the Blackhawk)? Of particular interest would be data needed to determine the noise environment of the platform to allow for algorithm improvements specific to that environment.

A24) Yes, data will be collected on the Manned Helicopter platform (which will most likely be a Blackhawk) in Phase 2 risk reduction test opportunities. Further, it is specifically the intent of the test team to secure data that will support the determination of "the noise environment of the platform to allow for algorithm improvements specific to that environment".

The planned Phase 2 test opportunities are mentioned in the Proposer's Information Packet in the last 2 paragraphs on Page 8. The phrase "MAC Platform" should be taken to be synonymous with the Blackhawk. Notions for the test approach were provided in the classified LAASS Technical Survey portion of the Proposer's Day Briefing, section "What should you propose?", subsection "What will you get to prove your case? - Helicopter-borne EM testing".

Q25) Is there any additional guidance concerning the elements of the LAASS system which make up the weight goals for the UAV System? For instance, does the 5 lb UAV weight goal include any communication equipment, attitude reference systems, or obstacle avoidance sensors that may be necessary?

A25) The LAASS development concept assumes that the User/Transition sponsor will choose a UAV system that is nearly complete – except for the inclusion of LAASS. It is therefore likely that it otherwise already satisfies the needs of other similar missions. Thus, it is reasonable to assume that this UAV already has a command link and some form of position and attitude reference system. These would not count in the 5 lb UAV payload weight goal.

Should an integrated LAASS system concept require a support system that exceeds these "nominal" capabilities, the proposer is encouraged to highlight them and to include them in their weight considerations. Such unusual capabilities might include: a local area communications network that might enable communication with collaborative ground sensors or other LAASS-equipped UAVs, an exfiltration data link for LAASS that might exceed the capability of "nominal" or pre-existing command links, an obstacle avoidance subsystem (if the proposed CONOPS deems such to be necessary) or other capabilities that would not be otherwise expected on this class of UAV. If the proposer plans to use only pre-existing or "nominal" UAV support system capabilities – these should still be explicitly cited and shown to be satisfactory for the Phase 3 LAASS concept that is envisioned.

For Phase 3 DARPA is interested in developing a complete system capability that can then be rapidly fielded. This involves LAASS sensing and processing capabilities, but also involves communications, navigation, mission support and operator interfaces (displays, networking with other assets, maintenance, etc.) The proposer that capably communicates an understanding of what types & capabilities of support systems are already available (or not) on typical UAVs of this class will implicitly convey an appreciation for the needs of a tactical transition & their own ability to satisfy these needs.