# Amendment 1 to DARPA-BAA-08-62 Panoptic Analysis of Chemical Traces (PACT)

The purpose of Amendment 1 to BAA08-62 Panoptic Analysis of Chemical Traces (PACT) is to make the following changes:

1. Page 4, Part One, Overview information, change the **PROPOSAL DUE DATE** from 14 October 2008 to 22 October 2008.

2. Section 1.1 second paragraph is replaced with the following:

The ultimate objective of the program is to develop a capability for comprehensive analysis of up to one hundred thousand samples per eight-hour shift at a total cost of $0.10 per sample at the end of Phase 2. Total costs will include amortization of capital equipment cost over ten years at 5% interest, electrical power, and all consumable supplies necessary for operation of the system (excluding labor). This capability would revolutionize our understanding of the chemical environment and enable routine chemical mapping of strategically and tactically important regions. Current approaches to trace analysis take hours or days and cost hundreds of dollars per constituent, primarily because expert human labor is required and standardization is poor. The PACT program will overcome these limitations.

3. Section 1.1.2. The following is to be <u>added</u> as a second paragraph to Section 1.1.2 (Phase 2 (Option 1): Integration and Prototype Scaling):

The final system must be able to process 12,500 samples per hour without exceeding a system volume of 67 cubic meters. System volume must include all consumable supplies for 24 hours of continuous operation, as well as any power supplies internal to the instrument. An external power source from an electrical grid or external generator that does not count in the volume budget may be presumed.

4. Section 1.1.3 is replaced with the following:

### 1.1.3. Phase 3 (Option 2): Forensics

The third phase of the program will develop systems and methods to identify pure gases and mixtures whose spectral properties are not contained in libraries. The system will identify the chemical composition of micromole samples of pure gas with 90% confidence at a rate of 100 samples in 50 hours and resolve mixtures of up to five unknown components present in quantities of between one nanomole and one micromole at in less than 2 hours.

5. Section 1.1.4 is replaced with the following:

1.1.4. Acquisition Strategy

Proposers are required to propose all technical areas of interest and all Program Phases. The Government recognizes that proposals for Phases 2 and 3 (Options 1 and 2) must be approximate because the core technologies that are to be scaled to high throughput and library-free analysis will remain uncertain until the end of Phase 1. Although a comprehensive cost proposal for the first (base) phase is required, cost proposals for the two options may be rough order of magnitude (ROM) estimates. The Government will provide technical information about the configuration of HAST sampling technology during Phase 1 to assist in the preparation of Phase 2 technical and cost proposals. These ROM estimates will be refined into detailed technical and cost proposals thirty days prior to completion of the base effort to facilitate a smooth transition into the second and third phases. Final testing of the candidate technologies may be at the performer's location or at a site selected by the Government for independent validation and verification. Realistic cost proposals will contain provisions for either contingency. Presume Washington, DC as the location for testing at a Government facility in preparing the cost proposals.

6. Section 1.2, page 8, paragraph 3 is replaced with the following:

A list of one hundred chemical compounds will be provided by the Government at the beginning of Phase 1. Calibrated samples containing one or more of these gases in quantities of between 500 picomoles and 50 micromoles will be analyzed by PACT prototype systems. The metrics for Phase 1 are to obtain accuracy and fidelity as defined in Section 1.1 above exceeding 85% and to process one hundred mixtures in less than 24 hours and to demonstrate a probability of detection of more than 0.85 and a probability of false alarm of less than 0.25 for 500 picomole samples of library materials.

7. Section 1.2, paragraph 4 is replaced with the following:

At the end of Phase 2, proposers will be given ninety-six hours to analyze twelve thousand samples of pre-concentrated gases on HAST adsorbents in quantities of fifty picomoles to fifty micromoles per analyte and a total cost of $0.10 per sample. The library of reference materials will be expanded to three hundred substances, and the requirements for fidelity and accuracy (as defined in Section 1.1) will be increased to 95%. The probability of detection for 50 picomole samples of library materials will be greater than 0.95, and the probability of a false alarm will be less than 0.1.

8. Section 1.2, last paragraph is replaced with the following:

Testing at the end of Phase 3 will include analytes that are unlikely to appear in existing libraries—identification will require first-principles analysis of the acquired data. Correct identification requires, at a minimum, the number and type of atomic elements and the connectivity of atoms in the molecule. The system will be presented with one hundred, one micromole samples of pure materials and will determine their chemical compositions in less than fifty hours with correct identification not less than 90% of the time. The system will then resolve mixtures of five compounds not found in libraries with

accuracy and fidelity of more than 90% at an average analysis time of less than two hours.

9. Replace Table 1, page 9, section 1.2 with the following:

Table 1: Program Metrics

| Phase | Months After Contract Award | Program Metrics |
|---|---|---|
| 1 (Base) | To Be Specified by Performer | • Identify the composition of 100 mixed gas samples comprised of up to 100 components from a library of 100 reference materials in 24 hours or less. Each component will be present in quantities between 500 picomoles and 50 micromoles.<br>• Achieve accuracy and fidelity of more than 85%, including the relative amount of material that is not in the library.<br>• Demonstrate a probability of detection > 0.85 and a probability of false alarm < 0.25 for samples of 500 picomoles of library materials.<br>• Demonstrate a system design and process flow that will analyze 12,500 samples per hour at a total cost of $0.10 per sample. Total costs will include amortization of capital equipment cost over ten years at 5% interest, electrical power, and all consumable supplies necessary for operation of the system. |
| 2 (Option 1) | To Be Specified by Performer | • A complete system that will process a total of 125 samples per hour (1/100$^{th}$ scale), demonstrate a sensitivity of 50 picomoles, fidelity and accuracy of more than 95%, and an expanded library of 300 target gases for a total cost of less than $0.10 per sample.<br>• Demonstrate a probability of detection > 0.95 and a probability of false alarm < 0.10 for samples of 50 picomoles of library materials.<br>• Present a design for extension of the analytical method to 300,000 samples per day with a total system volume of less than 67 cubic meters and a total cost (including amortized capital equipment, reagents, chromatographic media, cryofluids, and power) of less than $0.10 per sample. |
| 3 (Option 2) | To Be Specified by Performer | • Demonstrate a system and method that will automatically deduce the chemical composition of one micromole samples of pure unknown gases, with 90% confidence, in an average of less than 30 minutes.<br>• Demonstrate a system and method that will resolve the identities of five unknown compounds in a mixture where each analyte is present in quantities ranging from one nanomole to one micromole and accuracy and fidelity are greater than 90% in less than two hours. |

10. Section 4.4.1, change the proposal date from 14 October 2008 to 22 October 2008.

11. Solicitation questions and answers are attached.