Other Transactions (OT) Agreement/Modification P00001
OTHER TRANSACTION FOR PROTOTYPE AGREEMENT

BETWEEN

Smiths Detection, Inc.
2202 Lakeside, Boulevard
Edgewood, MD 21040

AND

The Department of Homeland
Office of Procurement Operations
245 Murray Drive, Building 410
Washington, DC 20528

CONCERNING:

BAA-05-08 – Low-Cost Biological Agent Sensor System (LBASS)
Phase I – Low-Cost Biological Agent Sensor System (LBASS)
Agreement No.: HSHQPA-06-9-0002/P00001
HSARPA Order No.: BAA-05-08
Total Estimated Government Funding of the Phase I Agreement: $1,499,129
Team's Cost Share/Contribution: $0
Funds Previously Obligated Phase I - $1,499,129.00
Funds Obligated this Modification (Phase I): $0.00

Authority: Authority: Section 831 of the Homeland Security Act of 2002, Public Law 107-296

Line of Appropriation this Modification: N/A
Purchase Requisition Number: RSCB-07-00357

This Agreement is entered into between the United States of America, hereinafter called the Government represented by The Department of Homeland Security and Smiths Detection, Inc. pursuant to and under U.S. Federal law.

FOR: SMITHS DETECTION, INC.

Jill McClune Myrick

Jill McClune Myrick
Director, Contracts & Compliance

Date

FOR: THE UNITED STATES OF AMERICA THE DEPARTMENT OF HOMELAND SECURITY

for Timothy B Dunn

Linda Mulligan
OTA Officer

5/9/2007
Date

This Other Transaction Agreement (OTA) is hereby amended to (1) modify Article IV: Payable Event Schedule and Deliverables and (2) modify Article II: Term of the Agreement.

Pursuant to mutual agreement, the articles are modified as follows:

ARTICLE II: TERM is modified as follows:

This Period of Performance for Phase I is extended through 30 November, 2007.

ARTICLE IV: PAYABLE EVENT SCHEDULE AND DELIVERABLES is modified as follows:

B. Schedule of Payments and Payable Milestones

Milestone	Event	Payment Milestone
0	Kickoff Meeting	(b) (4)
A	40 Days from Commencement	(b) (4)
B	85 Days from Commencement	(b) (4)
C	366 Days from Commencement	(b) (4)
D	378 Days from Commencement	(b) (4)
E	433 Days from Commencement	(b) (4)
F	409 Days from Commencement	(b) (4)
G	497 Days from Commencement	(b) (4)
Total		**100% ($1,499,129)**

All other ARTICLES in Agreement HSHQPA-06-0-00002 remain unchanged and in full force and effect.

Other Transactions (OT) Agreement/Modification P00002
OTHER TRANSACTION FOR PROTOTYPE AGREEMENT

BETWEEN

Smiths Detection, Inc.
2202 Lakeside, Boulevard
Edgewood, MD 21040

AND

The Department of Homeland
Office of Procurement Operations
245 Murray Drive, Building 410
Washington, DC 20528

CONCERNING:

BAA-05-08 – Low-Cost Biological Agent Sensor System (LBASS)
Phase I – Low-Cost Biological Agent Sensor System (LBASS)
Agreement No.: HSHQPA-06-9-0002/P00001
HSARPA Order No.: BAA-05-08
Total Estimated Government Funding of the Phase I Agreement: $1,499,129
Team's Cost Share/Contribution: $0
Funds Previously Obligated Phase I - $1,499,129.00
Funds Obligated this Modification (Phase I): $0.00

Authority: Authority: Section 831 of the Homeland Security Act of 2002, Public Law 107-296

Line of Appropriation this Modification: N/A
Purchase Requisition Number: RSCB-07-00503

This Agreement is entered into between the United States of America, hereinafter called the Government represented by The Department of Homeland Security and Smiths Detection, Inc. pursuant to and under U.S. Federal law.

FOR: SMITHS DETECTION, INC.

Jill McClune Myrick
Director, Contracts & Compliance

9/12/2007
Date

FOR: THE UNITED STATES OF AMERICA THE DEPARTMENT OF HOMELAND SECURITY

Timothy Davis
OTA Officer

9/12/2007
Date

This Other Transaction Agreement (OTA) is hereby amended to modify Article II: Term of the Agreement.

Pursuant to mutual agreement, the article is modified as follows:

ARTICLE II: TERM is modified as follows:

This Period of Performance for Phase I is extended through 31 January, 2008.

All other ARTICLES in Agreement HSHQPA-06-0-00002 remain unchanged and in full force and effect.

MODIFICATION TO OTHER TRANSACTION FOR PROTOTYPE AGREEMENT

BETWEEN
Smiths Detection
2202 Lakeside Boulevard
Edgewood, MD 21040
AND
The Department of Homeland Security
Science & Technology Directorate
Washington, DC 20528

4

Agreement Number:	HSHQPA-06-9-0002
Modification Number:	P00004
Concerning:	BAA-05-08, Low-Cost Biological Agent Sensor System (LBASS)

Total Estimated Government Funding of the Phase I Agreement:	$1,379,198.68
Team's Cost Share/Contribution:	$0.00
Funds Previously Obligated:	$1,499,129
Funds De-Obligated this Modification:	($119,930.32)

Line of Appropriation for this Modification: NONE000-6X-01-15-04-000-06-01-0000-00-00-00-00-GF-DL-25-50-MAE000 Net Decrease: $119,930.32

Authority: Section 831 of the Homeland Security Act of 2002, Public Law 107-296

The Modification of the Agreement is entered into between the United States of America, hereinafter called the Government, represented by The Department of Homeland Security (DHS), and Smiths Detection, pursuant to and under US Federal law.

FOR Smiths Detection:

Smiths Detection/Date 3/7/2006

FOR DHS:

OT Agreements Officer/Date 3/7/05

The purpose of this modification is to reduce the scope of the Statement of Work, revise the Schedule of Payments and Payable Milestones, and decrease the amount of funds obligated on this agreement by $119,930.32.

ARTICLE III, STATEMENT OF OBJECTIVES, is replaced in its entirely with Attachment A, Revised Statement of Work and Attachment B, Contract Data Requirements List.

ARTICLE IV: PAYABLE EVENT SCHEDULE AND DELIVERABLES is revised as follows:

The Revised Schedule of Payments and Payable Milestones:

Milestone	Event	Payment Milestone
0	Kickoff Meeting	(b) (4)
A	40 Days From Commencement	
B	85 Days from Commencement	
C	366 Days from Commencement	
D	378 Days from Commencement	
E	Execution of P00004	
F	Not Applicable	
G	At Conclusion of Phase 1	
TOTAL		$1,379,198.68

All other terms and conditions remain the same.

Attachment A – Revised Scope of Work

1. LBASS Phase I Scope of Work

Smiths Detection (Smiths) and Luminex Corporation (Luminex) will conduct a one year Phase I effort to develop a low cost biological aerosol sensor system (LBASS) that will meet the goals of HSARPA BAA05-08, LBADS. The technical approach builds off of the promising work done at MIT/Lincoln Labs on the Biological Aerosol Sensor Testbed (BAST) under DARPA's SUVOS program.

The ultimate goal in Phase I is to develop a working prototype that will demonstrate how our design concepts for LBASS will produce a low cost optical sensor for biological aerosols. LBASS development is broken into the following WBS tasks:

a. Program Management
b. Optical Design
c. Mechanical Systems Design
d. Electrical System Design
e. Data Processing/Algorithm S/W Design
f. System Fabrication and Integration
g. Test Program

There will be two stages of prototype development during Phase I. The first stage prototype will be developed with machined optics in order to provide proof of principle for the overall design, component choice, and optical and sample chamber designs. The second stage prototype will incorporate improvements as suggested from the first stage design.

The tasks outlined in are described in detail below. This is in addition to the management deliverables described below.

1.1 Program Management

Throughout the duration of Phase I, Smiths will submit narrative reports within one week after the last day of each month. The report will describe the previous 30 days' activity, technical progress achieved against each WBS, difficulties encountered, recovery plans (as needed), and explicit plans for the next 30 days. These reports will be submitted electronically. Smiths will submit quarterly reports to the program manager describing the activities of the previous 90 days, including:

Principals involved in the actual work for that quarter,
Technical progress achieved against the program goals,
Difficulties encountered and recovery plans (as needed),
Funds expended against each sub-task, and
Specific plans for the next quarter.

These reports will be submitted electronically no later than one week prior to quarterly reviews. Smiths will coordinate with the HSARPA program manager to determine a time and place for an in-person quarterly review.

At the conclusion of Phase I, Smiths will submit a final report detailing the work performed under this effort. This report will be a cumulative, stand-alone document describing the conceptual design process, rationale for design decisions, technical data

gathered during the effort, "lessons learned," and recommendations for future research. The rationale for design decisions will be supported primarily in terms of their effect on predictions for system performance, unit cost, and cost of ownership. The design trades leading to the final Phase I system will be detailed, including how the chosen approaches were made to refine the system. The remaining uncertainties and unknowns will also be discussed.

A comprehensive and detailed account of all funds expended will be also included, as will a proposal and preliminary design for Phase II. The Phase II proposal will include a detailed Statement of Work, experimental work plan, activity schedule and budget, and cost breakdown.

2.1 Optical Design

In this task the LBASS optical subsystem will be designed and tested based in part on work done on the BAST system.

1.2.1 Critical path component specification

Typically we would prefer to only order components for the prototype optics platforms after design completion and a peer design review. However, in order to accelerate the schedule to maintain a 12 month effort, it will be necessary to place orders for several long-lead components that otherwise would be on the critical path. Fortunately, characteristics of the band pass filters, lasers, LED's and APD's are well known. The highest risk items are the LEDs since the technology is advancing so rapidly.

1.2.2 Design excitation collimator

The excitation collimator combines the three light sources and focuses them into a single beam inside the collection chamber. Each LED reflector will be designed to accommodate LED die emission area shape, size and output power. Both reflectors will be machined from acrylic to closely match the molded material utilized in production. UV compatible reflective coatings applied to the acrylic will enable the performance of the production configuration to be evaluated. The dichroic design is a long lead item that will be ordered immediately after specification. LEDs will be evaluated for current performance and optimal emission area form factor and size.

1.2.3 Design Collection Optics

The light emitted and scattered from the particle of interest will be collected and focused using an elliptical and spherical mirror. Each mirror will be designed to collect as much light as possible. Zemax optical design software will be employed to design the mirror configuration and specify tolerances for each iteration. An aspheric lens will be utilized to collimate the collected light and direct it to the detectors.

1.2.4 Design composite optical assembly

After each of the two major optics assemblies have been designed, a framework will be designed to physically tie these two assemblies into a functional system.

1.2.5 Order components & services from vendors

All component orders are captured in this section of the WBS. Some long-lead items

will be ordered at the project start on risk, rather than waiting for the end of the design cycle for the containing assembly.

1.2.6 Build individual optical elements & test

In this step the collimator and collection optics will be physically assembled and tested separately. Electronics and software from Smiths will be integrated at this time.

1.2.7 Integrate optics platform and test

The collimator / collector assembly from 1.2.6 are integrated on a common base plate for system testing. Sample air input injectors, pumps, and associated test fixtures and software from Smiths will be integrated as part of this task. A second collimator / collector assembly will be delivered to Smiths for integration and testing at the Smiths facility.

1.2.8 Test molded mirror concept

One of the keys to cost reduction in the optics assembly in the Phase II of LBADS is to create the mirrors via a mass-production technique. During Phase I, an investigation of materials, methods and potential vendors for molding and coating mirrors with high optical efficiency at low wavelengths will be executed. Specific design considerations will target the LED reflector mirrors. If techniques can be identified to successfully mold and coat these mirrors while maintaining efficiency and stability at the lower excitation wavelengths, it is logical that the collector mirrors, which operate at higher wavelengths, could be constructed in the same manner.

3.1 Mechanical Systems Design

1.3.1 Mechanical System Configuration

The first task will be to define and write the mechanical specifications requirements as derived from upper level system requirements. Based on these requirements, the mechanical system configuration will be defined relative to optical, electrical, pneumatic, and sample chamber design layouts and packaging.

In conjunction with this effort internal and program design reviews will be conducted with submitted monthly reports. The final task will be writing a "Mechanical Design Disclosure" for the mechanical system detailing the system, chamber, and packaging design and relevant test data.

1.3.2 Flow Chamber Design

The first task will define and write flow chamber specification requirements per upper level requirements and optical and electronic requirements. Then, per these requirements, the chamber design and pneumatics configuration design will be developed creating 3D models and drawings. The pneumatic and piece parts components will be defined and specified with a complete parts list for each assembly designed.

In conjunction with this effort, computational fluid dynamic (CFD) flow analysis and component machining precision analysis will be performed on the baseline design then revised per this analysis.

A breadboard stage 1 prototype will be fabricated and testing will be conducted to verify performance relative to the initial analysis. The analysis and chamber design will

be refined and retested. The final task will be defining and completing the stage II final design, models and drawings

1.3.3 Electronic/Optical/Mechanical Packaging

The first task will define and write system packaging specification requirements per upper level requirements. Per the requirements, the component layout configuration for optics, pneumatics, electronics, and chamber design will be defined creating 3D models and drawings. Per the design, required piece part components required to package the optical, electrical, and mechanical system assemblies will be defined with complete parts list for each portion of the assembly.

The cooling and heating requirements will be defined followed by a CFD "Thermal Analysis". A stage I breadboard prototype will be fabricated and tested. Test results will be used to refine the design for a stage II prototype design, which will undergo limited testing prior to CDR.

1.3.4 Prototype Fabrication

This task encompasses all the work required to fabricate stage I and II prototypes for each of the mechanical subsystems. The first task will be to order parts for stage I breadboard fabrication and testing per defined components and preliminary drawings. Upon receipt of the components, fabrication and testing of stage I subassemblies will be performed. Test results will be used to refine the design for a stage II prototype design.

After the completion of the stage II design, additional parts and components will be purchased, followed by fabrication and limited testing prior to CDR.

4.1 Electrical system design

1.4.1 Design Specification

This task involves developing the electrical part of the LBASS system specification. The output of this task includes a detailed block diagram showing each planned circuit card assembly (CCA) with its inputs, outputs, and interconnections. Functional descriptions of each CCA will be developed.

1.4.2 Schematic Design

Schematics will be developed for each required CCA. Schematics will be captured in OrCAD. The output of this task will be schematics for each CCA and a net list.

1.4.3 Board Layout and Component Specification

Board layouts will be performed in OrCAD layout using the schematics and net list developed in Task

2.4.2. Components will be chosen and fully specified. Parts for two prototype systems will be ordered.

The output of this task will be the gerber files necessary for board layout and assembly documentation including a complete Bill of Materials (BOM).

1.4.4 Prototype Development

Boards will be fabricated, assembled and tested. Engineering evaluations will be

performed on the prototypes and any changes to schematic, layout, or BOM completed.

The output of this task will be two assembled prototype board sets that have been tested.

1.4.5 TDP Update

This will be an ongoing task through the balance of the program to maintain all aspects of the schematic, system, assembly, and BOM.

5.1 Data Processing/Algorithm S/W Design

1.5.1 Design Specification

This task involves developing the software part of the LBASS system specification. The output of this task includes a functional flow diagram of the major software section involved with processing the raw signal through the alarm decision.

1.5.2 Software Design

A document will be developed including each software function along with the required input, outputs, and a functional description.

6.1 System Fabrication and Integration

1.6.1 Stage I Prototypes

In conjunction with the stage I prototype tasks for sections 2.1, 3.1, and 4.1, this work will entail the ordering and receiving of components and machined and fabricated parts. After receipt of the parts, technicians will assist the design engineers in the assembly, integration and testing of breadboard systems for stage I prototypes. Technicians will follow written test procedures, record test results and submit them to the design engineers for review. Where required, refinement of the design for stage II prototypes and retesting will be performed.

1.6.2 Stage II Prototypes

In conjunction with the stage II prototype tasks for sections 2.1, 3.1, and 4.1, this work will entail the reordering and receiving of components and machined and fabricated parts. After receipt of the parts, technicians will assist the design engineers in the assembly, integration and testing of redesigned systems for stage II prototypes. Technicians will follow written test procedures, record test results and submit them to the design engineers for review and analysis.

7.1 Test Program

1.7.1 Laboratory data collection for Stage I prototype

The stage I prototype design will be tested extensively at Smiths in an aerosol test chamber. Tests will focus on gathering baseline performance data with simulants.

1.7.2 Laboratory data collection Stage II prototype

An abbreviated sample program will be performed at Smiths to compare stage II prototype performance with that of the stage I prototype.

2. Government Furnished Equipment

The Smiths - Luminex team will require a fully detailed design package for the BAST system and access to MIT/LL personnel to finalize the Phase I design of LBASS. The technical package will need to be more detailed than the presentation made available for the proposal process.

The Smiths - Luminex team also requests the use of an Ink Jet Aerosol Generator (IJAG) device for testing in the Smiths aerosol test chamber. In addition, the team requests simulants and background matrices that will be used in government testing for in-house testing as described in section 7.1.

Attachment B - Contract Data Requirements List (CDRL)

Low-Cost Biological Agent Sensor System (LBASS)

Phase I Contract Data Requirements List (CDRL)

Data Item Deliverables

CDRL-1. Monthly Reports
Monthly after contract signing

The report will describe the previous 30 days' activity, technical progress achieved against each Work Breakdown Structure (WBS) element, difficulties encountered, recovery plans (as needed), and explicit plans for the next 30 days.

CDRL-2. Quarterly Reports
Quarterly after contract signing

Smiths will submit quarterly reports to the program manager describing the activities of the previous 90 days, including:

- Principals involved in the actual work for that quarter.
- Technical progress achieved against the program goals.
- Difficulties encountered and recovery plans (as needed).
- Funds expended against each sub-task, and
- Specific plans for the next quarter.

Smiths will coordinate with the HSARPA program manager to determine a time and place for an in-person quarterly review.

CDRL-3. Final Report
12 months after contract signing

At the conclusion of Phase I, Smiths will submit a final report detailing the work performed under this effort. This report will be a cumulative, stand-alone document describing the conceptual design process, rationale for design decisions, technical data gathered during the effort, "lessons learned," and recommendations for future research. The rationale for design decisions will be supported primarily in terms of their effect on predictions for system performance, unit cost, and cost of ownership. The design trades leading to the final Phase I system will be detailed, including how the chosen approaches were made to refine the system. The remaining uncertainties and unknowns will also be discussed.

This report will include:

- A computational fluid dynamic (CFD) flow analysis and component machining precision analysis on the baseline stage I prototype design. The stage II prototype design will then be revised per this analysis.
- System packaging specification requirements per upper level electronic, optical, pneumatic, and chamber requirements.
- Electrical circuit card assembly (CCA) with its inputs, outputs, and interconnections. Functional descriptions of each CCA will be developed and described in detail.
- A functional flow diagram of the major software section.
- Testing results from both stage I and stage II prototype systems at the Smiths aerosol chamber facility. Data will be analyzed with and without incorporating the elastic scatter measurements to determine the effect of removing these detection channels.

In addition, a comprehensive and detailed account of all funds expended will be also included, as will a proposal and preliminary design for Phase II. The Phase II proposal will include a detailed Statement of Work, experimental work plan, activity schedule and budget, and cost breakdown.

Other Transactions (OT) Agreement/Modification P00003
OTHER TRANSACTION FOR PROTOTYPE AGREEMENT

BETWEEN

Smiths Detection, Inc.
2202 Lakeside, Boulevard
Edgewood, MD 21040

AND

The Department of Homeland
Office of Procurement Operations
245 Murray Drive, Building 410
Washington, DC 20528

CONCERNING:

BAA-05-08 – Low-Cost Biological Agent Sensor System (LBASS)
Phase I – Low-Cost Biological Agent Sensor System (LBASS)
Agreement No.: HSHQPA-06-9-0002/P00003
HSARPA Order No.: BAA-05-08
Total Estimated Government Funding of the Phase I Agreement: $1,499,129
Team's Cost Share/Contribution: $0
Funds Previously Obligated Phase I - $1,499,129.00
Funds Obligated this Modification (Phase I): $0.00

Authority: Authority: Section 831 of the Homeland Security Act of 2002, Public Law 107-296

Line of Appropriation this Modification: N/A
Purchase Requisition Number: RSCB-08-00033

This Agreement is entered into between the United States of America, hereinafter called the Government represented by The Department of Homeland Security and Smiths Detection, Inc. pursuant to and under U.S. Federal law.

FOR: SMITHS DETECTION, INC.

Jill McClune Myrick
Director, Contracts & Compliance
11/27/2007
Date

FOR: THE UNITED STATES OF AMERICA THE DEPARTMENT OF HOMELAND SECURITY

Timothy Davis
OTA Officer
15 Jan 07
Date

This Other Transaction Agreement (OTA) is hereby amended to modify Article II: Term of the Agreement.

Pursuant to mutual agreement, the article is modified as follows:

ARTICLE II: TERM is modified as follows:

This Period of Performance for Phase I is extended through 31 March, 2008.

All other ARTICLES in Agreement HSHQPA-06-0-00002 remain unchanged and in full force and effect.

OTHER TRANSACTION FOR PROTOTYPE

BETWEEN

Smiths Detection, Inc.
2202 Lakeside, Boulevard
Edgewood, MD 21040

AND

THE DEPARTMENT OF HOMELAND SECURITY
Office of Procurement Operations
245 Murray Drive, Building 410
Washington, DC 20528

CONCERNING:

BAA 05-08 - Low-Cost Biological Agent Sensor System (LBASS)
Phase I - Low-Cost Biological Agent Sensor System (LBASS)
Agreement No.: HSHQPA-06-9-0002
HSARPA Order No.: BAA 05-08
Total Estimated Government Funding of the Phase I Agreement: $1,499,129
Team's Cost Share/Contribution: $0
Funds Obligated: $1,499,129.00

Authority: Section 831 of the Homeland Security Act of 2002, Public Law 107-296

Line of Appropriation: NONE000-000-6x-01-15-04-000-06-01-0000-00-00-00-00-GE-DL-25-50-MAE000
Procurement Request No: RSAR-06-00097

This Agreement is entered into between the United States of America, hereinafter called the Government, represented by the Department of Homeland Security and Smiths Detection, Inc. pursuant to and under U.S. Federal law.

FOR THE CONTRACTOR.

Jill McClune Myrick 6/22/06
Jill McClune Myrick Date
Director, Contracts & Compliance

FOR THE UNITED STATES OF AMERICA

Linda Mulligan 6/22/2006
Signature Date
Linda Mulligan, OT Contracting Officer

TABLE OF CONTENTS

ARTICLE I: SCOPE OF THE AGREEMENT

Smiths Detection (Smiths) proposes to commercialize an enhanced version of the Massachusetts Institute of Technology/Lincoln Laboratory (MIT/LL) Biological Agent Sensor Test bed (BAST). The BAST technology is well suited as the solution to the Low Cost Bio-Aerosol Detector Systems (LBADS) Broad Agency Announcement (BAA) based on existing performance data and technological readiness. Smiths plans to partner with LUMINEX Corporation (LUMINEX) to develop a fully integrated sensor system based on a novel redesign of the BAST optical architecture coupled with a new, streamlined air sampling system to meet the rigorous cost and performance goals of the LBADS program. We will exploit the combined talents of Smiths and LUMINEX to produce a new class of detect-to-warn sensors suitable for DHS and DOD applications. The proposed Low Cost Biological Aerosol Sensor System (LBASS) will be low in cost and therefore suitable for widespread distribution and networking. The Smiths –LUMINEX approach to LBASS will significantly reduce the current BAST component costs, while maintaining or improving specific performance metrics.

The Government will have continuous involvement with the Contractor. The Government will obtain access to program results and certain rights to patents and data pursuant to Articles VIII and IX. The Government and the Contractor are bound to each other by a duty of good faith and best effort in achieving the program objectives.

This Agreement is an 'other transaction' pursuant to Section 831 of the Homeland Security Act of 2002, Public Law 107-296. The Parties agree that the purpose of this Agreement is to acquire Research or Development services and prototypes. The Federal Acquisition Regulation (FAR) does not apply to this Agreement. This Agreement is not intended to be, nor shall it be construed as, by implication or otherwise, a partnership, a corporation, or other business organization.

This is a Firm Fixed Price type Other Transaction Agreement.

ARTICLE II: TERM

A. The Term of this Agreement

This Agreement commences upon the date of the last signature hereon and continues for the duration of Phase I of the HSARPA Low-Cost Biological Agent Sensor System (LBASS) Program. For planning purposes, the estimated period of performance for Phase I is from the date of award through 12 months. This Agreement will be updated to modify the Agreement for the Team entering Phase II. Completion criteria for Phase I are defined in Article IV, Payment Event Schedule and Deliverables.

If exercised by the Government, the Phase II Period of Performance will be 12 months commencing on the date of Phase II Option exercise.

The option will be executed utilizing the following process:

The Government will determine prior to the conclusion of the Phase I Base Period if the option will be exercised. The option exercised based upon availability of funds and programmatic needs, as determined by the Government. The Government will notify the Contractor in writing, prior to the end of the Phase I Base Period, whether or not it will exercise the option. If the Government chooses to exercise the option, the Contractor will be notified in writing to submit a complete proposal for Phase II.

B. Termination Provisions

Subject to a reasonable determination that this Agreement will not produce beneficial results commensurate with the expenditure of resources, either Party may terminate this Agreement by written notice to the other Party. In the event of termination of the Agreement, the Government and the Contractor will negotiate in good faith a reasonable and timely adjustment of all outstanding issues between the Parties as a result of termination. Failure of the Parties to agree to a reasonable adjustment will be resolved pursuant to Article VII, Disputes. The Government has no obligation to reimburse the Contractor beyond the last completed and paid milestone if the Contractor decides to terminate.

C. Extending the Term

The Parties may extend by mutual written agreement the term of this Agreement if funding availability and research opportunities reasonably warrant. Any extension shall be formalized through modification of the Agreement by the Agreements Officer and The Contractor.

ARTICLE III: STATEMENT OF OBJECTIVES

Smiths Detection, Inc. and its subcontractors shall perform the following Phase I tasks:

1) Key scientific, technical and engineering innovations and uniqueness of approach:
- Monolithic optical subsystem with UV excitation beam collimator/combiner
- Redesigned air sampling system for improved particle delivery (1-10 μm)
- Use of state-of-the-art UV LEDs and alternative photo detectors.
- Reduced number of components and overall reduced cost
- Proven multivariate data analysis for handling complex data streams
- ISO certified volume manufacturing

2) Management approach:
- integrated product teams with co-leads at Smiths and LUMINEX
- Frequent technical meetings via video and teleconferencing with team members
- Monthly written reports; quarterly reviews with DHS representatives
- Forward-looking risk assessment mapped against WBS tasks

4) Program tasks to meet Technical Topic Area (TTA) goals

- Phase I: design, test and validate each relevant hardware subsystem and data processing algorithms. Government Furnished Technology (GFT) testing of integrated LBASS prototype.
- Phase II: optimization of all subsystems and field validation of pre-production system.

5) LBASS components and integration:
- Optical subsystem interface to mechanical at air sampling system
- Opt-mechanical subsystems controlled by streamlined electronics
- Two phase prototype build and test
- Testing at government or other third party facility prior to CDR.

6) Anticipated performance:
- Meet or exceed all TTA technical performance goals
- Substantively approach TTA cost objectives.

7) Attachment A (Statement of Work) sets forth the nature and scope of the work to be performed under this Agreement, including any equipment, maintenance and other support, and any associated reporting requirements. Smiths Detection will perform the work set forth in Attachment A and shall deliver that data required in Attachment B, Contract Data Requirements List in accordance with the schedule set forth therein.

ARTICLE IV: PAYABLE EVENT SCHEDULE AND DELIVERABLES

A. Payable Schedule
Smiths Detection shall perform the work required by Article III. Smiths shall be paid for each Payable Milestone accomplished and delivered in accordance with the Schedule of Payments and Payable Milestones set forth below. The Agreement may be revised or modified in accordance with subparagraph C of this article.

B. Schedule of Payments and Payable Milestones

Milestone	Event	Payment Milestone (%)
0	Kickoff Meeting	(b) (4)
A	40 Days from Commencement	
B	85 Days from Commencement	
C	175 Days from Commencement	
D	230 Days from Commencement	
E	290 Days from Commencement	
F	300 Days from Commencement	
G	330 Days from Commencement	
Total		**100% (1,499,129)**

Payment milestone detail:

Kickoff Meeting

1. The Department of Homeland Security's Program Manager, Michael Mcloughlin, will meet with technical representatives from Smiths Detection, Inc. and LUMINEX, Corporation. This meeting will be held to discuss the Low-Cost Biological Agent Sensor System (LBASS) – Phase I effort.

Task A: The Task A Payment milestone consists of the following:

1. Smiths to provide Program Management.
2. Critical path component specification.
3. Initial excitation optics design.
4. Initial flow cell design.

Task B: The Task B Payment milestone consists of the following:

1. Program management.
2. Initial collection optics design.
3. System configuration layout.
4. Electronic system layout.

Task C: The Task C Payment milestone consists of the following:

1. Program management.
2. Design composite optical assembly.
3. System configuration complete.
4. Flow cell design complete.
5. Electronic system design complete.

Task D: The Task D Payment milestone consists of the following:

1. Program management.
2. Design composite optical assembly.
3. Packaging design complete.

Task E: The Task E Payment milestone consists of the following:

1. Program management.
2. Data processing design complete.

Task F: The Task F Payment milestone consists of the following:

1. Program management
2. System integration and test.

Task G: The Task G Payment milestone consists of the following:

1. Program management.
2. Final reporting.

C. Modifications

1. At any time during the term of the Agreement, progress or results may indicate that a change in the Statement of Objectives and/or the Payable Milestones would be beneficial to the program objectives. Recommendations for modifications, including justifications to support any changes to the Statement of Objectives and/or the Payable Milestones, will be documented in a letter and submitted by the Team to the Government Program Manager with a copy to the Government OT Contracting Officer. This letter will detail the technical, chronological and financial impact of the proposed modification to the research program. Any resultant modification is subject to mutual agreement of the parties. The Government is not obligated to pay for additional work or revised Payable Milestones until the Payable Milestones Schedule agreement is formally revised by the Government OT Contracting Officer and made part of this Agreement.

2. The Government Program Manager shall be responsible for the review and verification of milestone accomplishment criteria and any recommendations to revise or otherwise modify the Agreement Statement of Objectives, Schedule of Payments and Payable Milestones, or other proposed changes to the terms and conditions of this Agreement.

3. For Minor or administrative Agreement modifications (e.g., changes in the paying office or appropriations data, changes to the Government personnel identified in the Agreement, etc.), the Government shall make these types of changes unilaterally.

4. The Government will be responsible for effecting all modifications to this Agreement

ARTICLE V: AGREEMENT ADMINISTRATION

Administrative and contractual matters under this Agreement shall be referred to the following representatives of the parties:

Government: Linda Mulligan, OT Contracting Officer, Tel: 202-254-6677
Contractor: Jill Myrick, Director, Contracts & Compliance, Tel: 410-510-9212

Technical matters under this Agreement shall be referred to the following representatives:

Government: Michael Mcloughlin, Program Manager, Tel: 202-254-6134
Contractor: Mary Beth Tabacco, Tel: 617-443-0066 ex. 1

Either party may change its representatives named in this Article by written notification to the other party. The Government will effect the change as stated in subparagraph C.4 of Article IV above.

ARTICLE VI: OBLIGATION AND PAYMENT

A. Obligation

The Government's liability to make payments to Smiths is limited to only those funds obligated under this Agreement or by amendment to the Agreement. The Government may obligate funds to the Agreement incrementally.

B. Payments

1. The following information shall be included on each invoice:

Agreement Number
Invoice Number
A description of services performed
Quantity of service received or performed
The time of period covered by the invoice
Terms of Payment
Payment Office
Amount claimed

2. The Contractor shall document each payable milestone by submitting deliverables in accordance with the payable milestone schedule and deliverable criteria. The Contractor shall submit an original and one (1) copy of all invoices to the OT Contracting Officer for payment approval.

DHS
Attention: Deborah Devault
S & T Directorate
245 Murray Drive, Bldg. 410
Washington, DC 20528

After written verification of the accomplishment of the Payable Milestone by the Government Program Manager, and approval by the OT Contracting Officer, the invoices will be forwarded to the payment office within fifteen (15) calendar days of receipt of the invoices by the Government. Payments will be made by Dallas Finance Center within fifteen (15) calendar days of the Governments transmittal. Subject to change only through written Agreement modification, payment shall be made via electronic funds transfer to the Contractor.

3. Financial Records and Reports: The Contractor's relevant financial records associated with this Agreement are not subject to examination or audit by the Government, except as noted

below, since the confirmed accomplishment of the appropriate milestone completes the obligation of both parties.

4. Comptroller General Access to Records: To the extent that the total Government payments under this Agreement exceed $5,000,000, the Comptroller General, at its discretion, shall have access to and the right to examine records of any party to the Agreement or any entity that participates in the performance of this Agreement that directly pertain to and involve transactions relating to, the Agreement for a period of three (3) years after final payment is made. This requirement shall not apply with respect to any party to this Agreement or any entity that participates in the performance of the Agreement, or any subordinate element of such party or entity, that has not entered into any other Agreement (contract, grant, cooperative agreement, or "other transaction") that provides for audit access by a Government entity in the year prior to the date of this Agreement. This paragraph only applies to any record that is created or maintained in the ordinary course of business or pursuant to a provision of law. The terms of this paragraph shall be included in all sub-agreements to the Agreement.

ARTICLE VII: DISPUTES

A. General

The Parties shall communicate with one another in good faith and in a timely and cooperative manner when raising issues under this Article.

B. Dispute Resolution Procedures

1. Any disagreement, claim or dispute between the Government and the Contractor concerning questions of fact or law arising from or in connection with this Agreement, and, whether or not involving an alleged breach of this Agreement, may only be raised under this Article.

2. Whenever disputes, disagreements, or misunderstandings arise, the Parties shall attempt to resolve the issue(s) involved by discussion and mutual agreement as soon as practicable. In no event shall a dispute, disagreement or misunderstanding which arose more than three (3) months prior to the notification made under subparagraph B.3 of this Article constitute the basis for relief under this Article unless the Government in the interests of justice waives this requirement.

3. Failing resolution by mutual agreement, the aggrieved Party shall document the dispute, disagreement, or misunderstanding by notifying the other Party (through the Contracting Officer) in writing of the relevant facts, identify unresolved issues, and specify the clarification or remedy sought. Within five (5) working days after providing notice to the other Party, the aggrieved Party may, in writing, request a joint decision by a Government Designee, and a designated Representative of the Contractor ("Contractor Representative"). The other Party shall submit a written position on the matter(s) in dispute within thirty (30) calendar days after being notified that a decision has been requested. The Government Designee and the Contractor Representative shall conduct a review of the matter(s) in dispute and render a decision in writing within thirty (30) calendar days of receipt of such written position. Any such joint decision is final and binding.

4. In the absence of a joint decision, the parties may raise any dispute to a higher level of official of the parties. These officials will review the dispute jointly. Following the review, these officials will resolve the issue(s) in writing. Such resolution is not subject to further administrative review and, to the extent permitted by law, shall be final and binding.

5. Should the parties still not be able to resolve the dispute after all the foregoing steps have been taken, the parties are free to pursue any legal action necessary.

6. Pending the resolution of any such dispute, work under this Agreement will continue as elsewhere provided herein unless terminated by one of the parties.

ARTICLE VIII: INTELLECTUAL PROPERTY

A. Definitions

As used in this Article, the following terms shall have the following meanings and such meanings shall be applicable to both the singular and plural forms of the terms. All other terms of this Agreement, shall be ascribed their plain, commonly accepted definitions.

1. "Created" in relation to any copyrightable work means when the work is fixed in any tangible medium of expression for the first time, as provided for at 17 U.S.C. § 101.

2. "Government" means, for this Article only, the Government of the United States of America, its States, Localities, and Tribal Councils.

3. "Invention" means any invention or discovery that is or may be patentable or otherwise protectable under Title 35 of the United States Code or any novel variety of plant which is or may be protectable under the Plant Variety Protection Act (7 U.S.C. 2321 et seq.).

4. "Made" in relation to any Invention means the conception or first actual reduction to practice of such Invention.

5. "Practical Application" means to manufacture, in the case of a composition of product; to practice, in the case of a process or method, or to operate, in the case of a machine or system; and, in each case, under such conditions as to reasonably establish that the Invention is capable of being utilized and that its benefits are, to the extent permitted by law or Government regulations, available to the public or the Government on reasonable terms.

6. "Proprietary Information" means information which embodies trade secrets or which:
   a) is not generally known, or is not available from other sources without obligations restricting its disclosure;
   b) has not been made available by the owners to others without obligation restricting its disclosure;

c) is not described in an issued patent or a published copyrighted work or is not otherwise available to the public without obligation restricting its disclosure; or
d) can be withheld from disclosure under the Freedom of Information Act, 5 U.S.C. § 552 *et seq.* and is identified as such by labels or markings designating the information as proprietary.

7. "Special Purpose License" means a license to the Government conveying a nonexclusive, nontransferable, irrevocable, worldwide, royalty-free license to practice and have practiced any Subject Invention for or on behalf of the Government for research or other Government purposes or conveying a nonexclusive, nontransferable, irrevocable, worldwide, royalty-free license to use, duplicate, prepare derivative works, distribute or disclose copyrighted works or Proprietary Information in whole or in part and in any manner, and to have or permit others to do so, for research on behalf of the Government, in each instance only for purposes of using Subject Invention with real-time biosensors for detection of biological weapons agents. Research or other Government purposes include competitive procurement, but do not include the right to have or permit others to practice an Invention or use, duplicate, prepare derivative works, distribute or disclose copyrighted works or Proprietary Information for commercial purposes.

8. "Subject Invention" means any Invention of any party made by its employees under this Agreement.

B. Patents

1. Allocation of Principal Rights. Each party shall separately own any Subject Inventions created solely by such party. The parties shall jointly own Subject Inventions made jointly by the Government and any Contractor employees. The Contractor hereby grants the Government a Special Purpose License to each Subject Invention. All intellectual property listed in the Agreement in Attachment C is specifically excluded from Special Purpose License rights granted by the Contractor to the Government.

2. Action to Protect the Government's Interest.

a. The Contractor agrees to execute or to have executed and promptly deliver to Government all instruments necessary to establish or confirm the rights the Government has throughout the world in those Subject Inventions.

b. The Contractor shall include, within the specification of any United States patent application and any patent issuing thereon covering a Subject Invention, the following statement: "This invention was made with Government support under Agreement No. HSHQPA-06-9-0002. The Government has certain rights in the invention."

3. Lower Tier Agreements. The Contractor shall include this Article, suitably modified, to identify the Parties, in all subcontracts or lower tier agreements, regardless of tier.

4. Reporting on Utilization of Subject Inventions. The Contractor shall submit a final report on the utilization of Subject Inventions or on efforts at obtaining such utilization that are being

made by the Contractor or its licensees or assignees. The report shall include information regarding the status of development, date of first commercial sale or use, gross royalties received by the Contractor subcontractor(s), and such other data and information as the Government may reasonably specify. The Contractor also agrees to provide additional reports as may be reasonably requested by the Government. The Government shall not disclose such information to persons outside the Government without permission of the Contractor.

5. Non-exclusive Licenses to Others. In addition to the Special Purpose License, to the extent Contractor is unable to provide to the Government a Practical Application for Subject Invention as agreed to by the parties in this Agreement, the Contractor, its assignees or exclusive licensees agree to grant a non-exclusive license(s) to a responsible applicant(s) only for purposes of using of Subject Invention with real-time biosensors for detection of biological weapons agents, upon terms that are reasonable under the circumstances, if Government requests such a license be granted based on a determination that:

a. Such action is necessary because the Contractor or assignee has not taken effective steps, consistent with the intent of this Agreement, to achieve Practical Application of the Subject Invention;

b. Such action is necessary to alleviate health or safety needs that are not reasonably satisfied by the Contractor, assignee, or their licensees; or

c. Such action is necessary to meet requirements for public use and such requirements are not reasonably satisfied by the Contractor, assignee, or licensees; or

If the Contractor, assignee, or exclusive licensee refuses to grant such a non-exclusive license, Government has the right to grant such a non-exclusive license itself.

C. Copyrights

1. Copyright Ownership. The Contractor shall own the copyright in all works Created in whole or in part by the Contractor under this Agreement, which are copyrightable under Title 17, United States Code. The Contractor shall mark any such works with a copyright notice showing the Contractor as an owner and shall have the option to register the copyright at the Contractor's expense.

2. Government Rights. The Contractor hereby grants to the Government a Special Purpose License in all works Created under this Agreement.

3. Copyright Disclosure. The Contractor shall furnish to the Government, at no cost to the Government, three (3) copies of each work Created in whole or in part by the Contractor under this Agreement if the work is required to be delivered to the Government under this Agreement.

D. Proprietary Information

1. Outside Proprietary Information. Any Proprietary Information, which has not been developed under this Agreement, shall be expressly provided under a Non-Disclosure Agreement mutually agreed to by the parties. Unless otherwise expressly provided in the Non-Disclosure Agreement, the receiving party shall not disclose such Proprietary Information except under a written agreement of confidentiality to employees and contractors of the receiving party who have a need for the information in connection with their duties under this Agreement. The Government shall not be liable for release of unmarked information.

2. Proprietary Information Rights. Proprietary Information developed under this Agreement shall be owned by the developing party, and any jointly developed Proprietary Information shall be jointly owned. The Contractor hereby grants the Government a Special Purpose License in any such Proprietary Information developed under this Agreement. The Contractor may use, duplicate and disclose, in confidence, and authorize others on its behalf to use, duplicate and disclose, in confidence, any Proprietary Information provided by the Government. Proprietary Information developed under this Agreement shall be exempt from the Freedom of Information Act, 5 U.S.C. § 552 et seq.

3. Consultation Before Disclosure. The parties agree to confer and consult with each other prior to publication or other public disclosure of the results of work under this Agreement to ensure that no Proprietary Information or military critical technology or other controlled information is released. Prior to submitting a manuscript for publication or before any other public disclosure, each party will offer the other party ample opportunity to review such proposed publication or disclosure, to submit objections, and to file applications for patents in a timely manner.

ARTICLE IX: CIVIL RIGHTS ACT

This Agreement is subject to the requirements of Title VI of the Civil Rights Act of 1964 as amended (42 U.S.C. 2000-d) relating to nondiscrimination in employment.

ARTICLE X: SECURITY

The DD254 and/or Program Security Classification Guide, during the course of this Agreement may be incorporated into this Agreement upon the determination by the Government of the security requirements of this program.

If a DD254 is incorporated, the Contractor will have an opportunity to propose any additional costs that may be incurred as a result of the incorporation of the DD254.

ARTICLE XI: OPTIONAL FUTURE PHASES

The Government reserves the right to modify this Agreement to include terms and conditions for Phase II. The cost, technical content and duration of these additional periods shall be subject to negotiation between the parties. The parameters associated with Phase II shall be negotiated and agreed to prior to completion of Phase I.

ARTICLE XII: GOVERNMENT FURNISHED EQUIPMENT/PROPERTY, INFORMATION FACILITIES AND SERVICES

The following Government Equipment property, information facilities, and services shall be provided upon the written approval of the Smiths contracting officers:

1. A fully detailed design package for the BAST system and access to MIT/LL personnel to finalize the Phase I design of LBASS.
2. The use of an Ink Jet Aerosol Generator (IJAG) device for testing in the Smiths aerosol test chamber.
3. Simulants and background matrices that will be used in government testing for in-house testing

ARTICLE XIII: ORDER OF PRECEDENCE:

In the event of any inconsistency between the terms of this Agreement and its Attachments, the inconsistency shall be resolved by giving precedence in the following order: (1) the Agreement, (2) all other Attachments to the Agreement.

ARTICLE XIV: TITLE TO MATERIALS

A. Definitions

In this Article, "Deliverable Materials" shall mean any tangible personal property purchased with Government funds that is delivered to the Government as a deliverable or component of a deliverable. "Non-deliverable Materials" shall mean all other tangible personal property purchased with Government funds.

B. Title to Materials

Title to Deliverable Material shall vest in the Government upon shipment of the item by the Contractor to the Government. Title to Non-deliverable Materials shall vest with the Contractor.

ARTICLE XV: LIABILITY

A. Property.

All property is to be furnished "as is." Except as otherwise provided in this Agreement or the attached Statement of Work, no party to this Agreement shall be liable to any other party for any property of that other party consumed, damaged or destroyed in the performance of this Agreement, unless it is due to the gross negligence or willful misconduct of the party or an employee or agent of the party.

B. Contractor Employees.

The Contractor agrees to indemnify and hold harmless and defend the Government, its employees and agents, against any liability or loss for any claim made by an employee or agent

of the Contractor, or persons claiming through them, for death, injury, loss or damage to their person or property arising in connection with this Agreement, except to the extent that such death, injury, loss or damage arises from the negligence of the Government or its employees.

C. **NO WARRANTY.**

EXCEPT AS SPECIFICALLY STATED IN ARTICLE 9, THE PARTIES MAKE NO EXPRESS OR IMPLIED WARRANTY AS TO ANY MATTER WHATSOEVER, INCLUDING THE CONDITIONS OF THE RESEARCH OR ANY INVENTION OR OTHER INTELLECTUAL PROPERTY, OR PRODUCT, WHETHER TANGIBLE OR INTANGIBLE, MADE, OR DEVELOPED UNDER THIS AGREEMENT, OR THE MERCHANTABILITY, OR FITNESS FOR A PARTICULAR PURPOSE OF THE RESEARCH OR ANY INVENTION OR OTHER INTELLECTUAL PROPERTY, OR PRODUCT. THE PARTIES FURTHER MAKE NO WARRANTY THAT THE USE OF ANY INVENTION OR OTHER INTELLECTUAL PROPERTY OR PRODUCT CONTRIBUTED, MADE OR DEVELOPED UNDER THIS AGREEMENT WILL NOT INFRINGE ANY OTHER UNITED STATES OR FOREIGN PATENT OR OTHER INTELLECTUAL PROPERTY RIGHT. IN NO EVENT WILL ANY PARTY BE LIABLE TO ANY OTHER PARTY FOR PUNITIVE, EXEMPLARY, OR CONSEQUENTIAL DAMAGES.

D. Other Liability.

The Government shall not be liable to any party to this Agreement, whether directly or by way of contribution or indemnity, for any claim made by any person or other entity for personal injury or death or for property damage or loss, arising in any way from this Agreement, including, but not limited to, the later use, sale or other disposition of research and technical developments, whether by resulting products or otherwise, whether made or developed under this *Agreement* or contributed by either party pursuant to this Agreement, except as provided under the Federal Tort Claims Act (28 U.S.C. § 2671 *et seq*) or other Federal law where sovereign immunity has been waived.

ARTICLE XV: GENERAL TERMS AND PROVISIONS

A. Relationship of the Parties.

The parties to this Agreement and their employees are independent contractors and are not agents of each other, joint ventures, partners or joint parties to a formal business organization of any kind. Neither party is authorized or empowered to act on behalf of the other with regard to any contract, warranty or representation as to any matter, and neither party will be bound by the acts or conduct of the other.

B. Publicity/Use of Name Endorsement.

Any public announcement of this Agreement shall be coordinated between the Contractor, the Government and the public affairs office supporting the Government. By entering into this Agreement, the Government does not directly or indirectly endorse any product or service provided, or to be provided, by Contractor, its successors, assignees, or licensees. The Contractor shall not in any way imply that this Agreement is an endorsement of any such product or service.

C. No Benefits.

No member of, or delegate to the United States Congress, or resident commissioner, shall be admitted to any share or part of this Agreement, nor to any benefit that may arise there from; but this provision shall not be construed to extend to this Agreement if made with a corporation for its general benefit.

D. Governing Law.

The laws applicable to the Government shall govern the construction, validity, performance and effect of this Agreement for all purposes.

E. Waiver of Rights.

Any waiver shall be in writing and provided to all other parties. Failure to insist upon strict performance of any of the terms and conditions hereof, or failure or delay to exercise any rights provided herein or by law, shall not be deemed a waiver of any rights of any party hereto.

F. Severability.

The illegality or invalidity of any provision of this Agreement shall not impair, affect or invalidate the other provisions of this Agreement.

G. Assignment.

Neither this Agreement nor any rights or obligations of any party hereunder shall be assigned or otherwise transferred by any party without the prior written consent of the Government.

H. Entire Agreement.

This Agreement constitutes the entire Agreement between the parties concerning the subject matter hereof and supersedes any prior understanding or written or oral agreement relative to said matter. This Agreement takes precedence over any terms in the Statement of Work, that may conflict with any terms stated herein.

ATTACHMENTS – Attachment A, Revised Scope of Work
Attachment B, CDRL
Attachment C, Pre-Existing Intellectual Property

Attachment A – Revised Scope of Work

1. LBASS Phase I Scope of Work

Smiths Detection (Smiths) and Luminex Corporation (Luminex) will conduct a one year Phase I effort to develop a low cost biological aerosol sensor system (LBASS) that will meet the goals of HSARPA BAA05-08, LBADS. The technical approach builds off of the promising work done at MIT/Lincoln Labs on the Biological Aerosol Sensor Testbed (BAST) under DARPA's SUVOS program.

The ultimate goal in Phase I is to develop a working prototype that will demonstrate how our design concepts for LBASS will produce a low cost optical sensor for biological aerosols. LBASS development is broken into the following WBS tasks:

a. Program Management
b. Optical Design
c. Mechanical Systems Design
d. Electrical System Design
e. Data Processing/Algorithm S/W Design
f. System Fabrication and Integration
g. Test Program

There will be two stages of prototype development during Phase I. The first stage prototype will be developed with machined optics in order to provide proof of principle for the overall design, component choice, and optical and sample chamber designs. The second stage prototype will incorporate improvements as suggested from the first stage design.

The tasks outlined in are described in detail below. At the end of Phase I, the Smiths – Luminex team will provide a prototype LBASS and the necessary support staff for CDR testing at a government sponsored testbed (GST). This is in addition to the management deliverables described below.

1.1 Program Management

Throughout the duration of Phase I, Smiths will submit narrative reports within one week after the last day of each month. The report will describe the previous 30 days' activity, technical progress achieved against each WBS, difficulties encountered, recovery plans (as needed), and explicit plans for the next 30 days. These reports will be submitted electronically. Smiths will submit quarterly reports to the program manager describing the activities of the previous 90 days, including:

Principals involved in the actual work for that quarter,
Technical progress achieved against the program goals,
Difficulties encountered and recovery plans (as needed),
Funds expended against each sub-task, and
Specific plans for the next quarter.

These reports will be submitted electronically no later than one week prior to quarterly reviews. Smiths will coordinate with the HSARPA program manager to determine a time and place for an in-person quarterly review.

At the conclusion of Phase I, Smiths will submit a final report detailing the work performed under this effort. This report will be a cumulative, stand-alone document describing the

conceptual design process, rationale for design decisions, technical data gathered during the effort, "lessons learned," and recommendations for future research. The rationale for design decisions will be supported primarily in terms of their effect on predictions for system performance, unit cost, and cost of ownership. The design trades leading to the final Phase I system will be detailed, including how the chosen approaches were made to refine the system. The remaining uncertainties and unknowns will also be discussed.

A comprehensive and detailed account of all funds expended will be also included, as will a proposal and preliminary design for Phase II. The Phase II proposal will include a detailed Statement of Work, experimental work plan, activity schedule and budget, and cost breakdown.

2.1 Optical Design

In this task the LBASS optical subsystem will be designed and tested based in part on work done on the BAST system.

1.2.1 Critical path component specification

Typically we would prefer to only order components for the prototype optics platforms after design completion and a peer design review. However, in order to accelerate the schedule to maintain a 12 month effort, it will be necessary to place orders for several long-lead components that otherwise would be on the critical path. Fortunately, characteristics of the band pass filters, lasers, LED's and APD's are well known. The highest risk items are the LEDs since the technology is advancing so rapidly.

1.2.2 Design excitation collimator

The excitation collimator combines the three light sources and focuses them into a single beam inside the collection chamber. Each LED reflector will be designed to accommodate LED die emission area shape, size and output power. Both reflectors will be machined from acrylic to closely match the molded material utilized in production. UV compatible reflective coatings applied to the acrylic will enable the performance of the production configuration to be evaluated. The dichroic design is a long lead item that will be ordered immediately after specification. LEDs will be evaluated for current performance and optimal emission area form factor and size.

1.2.3 Design Collection Optics

The light emitted and scattered from the particle of interest will be collected and focused using an elliptical and spherical mirror. Each mirror will be designed to collect as much light as possible. Zemax optical design software will be employed to design the mirror configuration and specify tolerances for each iteration. An aspheric lens will be utilized to collimate the collected light and direct it to the detectors.

1.2.4 Design composite optical assembly

After each of the two major optics assemblies have been designed, a framework will be designed to physically tie these two assemblies into a functional system.

1.2.5 Order components & services from vendors

All component orders are captured in this section of the WBS. Some long-lead items will be ordered at the project start on risk, rather than waiting for the end of the design cycle for the

containing assembly.

1.2.6 Build individual optical elements & test

In this step the collimator and collection optics will be physically assembled and tested separately. Electronics and software from Smiths will be integrated at this time.

1.2.7 Integrate optics platform and test

The collimator / collector assembly from 1.2.6 are integrated on a common base plate for system testing. Sample air input injectors, pumps, and associated test fixtures and software from Smiths will be integrated as part of this task. A second collimator / collector assembly will be delivered to Smiths for integration and testing at the Smiths facility.

1.2.8 Test molded mirror concept

One of the keys to cost reduction in the optics assembly in the Phase II of LBADS is to create the mirrors via a mass-production technique. During Phase I, an investigation of materials, methods and potential vendors for molding and coating mirrors with high optical efficiency at low wavelengths will be executed. Specific design considerations will target the LED reflector mirrors. If techniques can be identified to successfully mold and coat these mirrors while maintaining efficiency and stability at the lower excitation wavelengths, it is logical that the collector mirrors, which operate at higher wavelengths, could be constructed in the same manner.

3.1 Mechanical Systems Design

1.3.1 Mechanical System Configuration

The first task will be to define and write the mechanical specifications requirements as derived from upper level system requirements. Based on these requirements, the mechanical system configuration will be defined relative to optical, electrical, pneumatic, and sample chamber design layouts and packaging.

In conjunction with this effort internal and program design reviews will be conducted with submitted monthly reports. The final task will be writing a "Mechanical Design Disclosure" for the mechanical system detailing the system, chamber, and packaging design and relevant test data.

1.3.2 Flow Chamber Design

The first task will define and write flow chamber specification requirements per upper level requirements and optical and electronic requirements. Then, per these requirements, the chamber design and pneumatics configuration design will be developed creating 3D models and drawings. The pneumatic and piece parts components will be defined and specified with a complete parts list for each assembly designed.

In conjunction with this effort, computational fluid dynamic (CFD) flow analysis and component machining precision analysis will be performed on the baseline design then revised per this analysis.

A breadboard stage I prototype will be fabricated and testing will be conducted to verify performance relative to the initial analysis. The analysis and chamber design will be refined and retested. The final task will be defining and completing the stage II final design, models and drawings

1.3.3 Electronic/Optical/Mechanical Packaging

The first task will define and write system packaging specification requirements per upper level requirements. Per the requirements, the component layout configuration for optics, pneumatics, electronics, and chamber design will be defined creating 3D models and drawings. Per the design, required piece part components required to package the optical, electrical, and mechanical system assemblies will be defined with complete parts list for each portion of the assembly.

The cooling and heating requirements will be defined followed by a CFD "Thermal Analysis". A stage I breadboard prototype will be fabricated and tested. Test results will be used to refine the design for a stage II prototype design, which will undergo limited testing prior to CDR.

1.3.4 Prototype Fabrication

This task encompasses all the work required to fabricate stage I and II prototypes for each of the mechanical subsystems. The first task will be to order parts for stage I breadboard fabrication and testing per defined components and preliminary drawings. Upon receipt of the components, fabrication and testing of stage I subassemblies will be performed. Test results will be used to refine the design for a stage II prototype design.

After the completion of the stage II design, additional parts and components will be purchased, followed by fabrication and limited testing prior to CDR.

4.1 Electrical system design

1.4.1 Design Specification

This task involves developing the electrical part of the LBASS system specification. The output of this task includes a detailed block diagram showing each planned circuit card assembly (CCA) with its inputs, outputs, and interconnections. Functional descriptions of each CCA will be developed.

1.4.2 Schematic Design

Schematics will be developed for each required CCA. Schematics will be captured in OrCAD. The output of this task will be schematics for each CCA and a net list.

1.4.3 Board Layout and Component Specification

Board layouts will be performed in OrCAD layout using the schematics and net list developed in Task
2.4.2. Components will be chosen and fully specified. Parts for two prototype systems will be ordered.

The output of this task will be the gerber files necessary for board layout and assembly documentation including a complete Bill of Materials (BOM).

1.4.4 Prototype Development

Boards will be fabricated, assembled and tested. Engineering evaluations will be performed on the prototypes and any changes to schematic, layout, or BOM completed.

The output of this task will be two assembled prototype board sets that have been tested.

1.4.5 TDP Update

This will be an ongoing task through the balance of the program to maintain all aspects of the schematic, system, assembly, and BOM.

5.1 Data Processing/Algorithm S/W Design

1.5.1 Design Specification

This task involves developing the software part of the LBASS system specification. The output of this task includes a functional flow diagram of the major software section involved with processing the raw signal through the alarm decision.

1.5.2 Software Design

A document will be developed including each software function along with the required input, outputs, and a functional description. An Interface Design Document will be developed detailing the hardware and software protocols used to communicate with the LBASS. Software development tools will be selected and tested. The output of this task will be the Software Design Document and Interface Design Document.

1.5.3 Prototype Code Development

Coding will proceed according to the documents developed in Tasks 2.5.1 & 2.5.2. Changes will be made as required to the design documents. The output of this task will be the prototype executable.

1.5.4 Test and Debug

The code will be tested on the prototype hardware, debugged and retested as required. Changes will be made as required to the code and/or design documents. The output of this task will be tested code and updated documents.

1.5.5 Software Update

This will be an ongoing task through the balance of the program to maintain all aspects of the design, interface, operating code of the LBASS system.

6.1 System Fabrication and Integration

1.6.1 Stage I Prototypes

In conjunction with the stage I prototype tasks for sections 2.1, 3.1, and 4.1, this work will entail the ordering and receiving of components and machined and fabricated parts. After receipt of the parts, technicians will assist the design engineers in the assembly, integration and testing of breadboard systems for stage I prototypes. Technicians will follow written test procedures, record test results and submit them to the design engineers for review. Where required, refinement of the design for stage II prototypes and retesting will be performed.

1.6.2 Stage II Prototypes

In conjunction with the stage II prototype tasks for sections 2.1, 3.1, and 4.1, this work will entail the reordering and receiving of components and machined and fabricated parts. After receipt of the parts, technicians will assist the design engineers in the assembly, integration and testing of redesigned systems for stage II prototypes. Technicians will follow written test procedures, record test results and submit them to the design engineers for review and analysis.

7.1 Test Program

1.7.1 Laboratory data collection for Stage I prototype

The stage I prototype design will be tested extensively at Smiths in an aerosol test chamber. Tests will focus on gathering baseline performance data with simulants and backgrounds specified in Appendix D of the LBADS PIP. These data will be used to calculate sensitivity, generate initial ROC curves, and develop algorithms. Data will be analyzed with and without incorporating the elastic scatter measurements to determine the effect of removing these detection channels.

1.7.2 Laboratory data collection Stage II prototype

An abbreviated sample program will be performed at Smiths to compare stage II prototype performance with that of the stage I prototype. The focus of this testing will be on sensitivity and the effects of interferents.

2. Government Furnished Equipment

The Smiths - Luminex team will require a fully detailed design package for the BAST system and access to MIT/LL personnel to finalize the Phase I design of LBASS. The technical package will need to be more detailed than the presentation made available for the proposal process.

The Smiths - Luminex team also requests the use of an Ink Jet Aerosol Generator (IJAG) device for testing in the Smiths aerosol test chamber. In addition, the team requests simulants and background matrices that will be used in government testing for in-house testing as described in section 7.1.

Attachment B - Contract Data Requirements List (CDRL)

Low-Cost Biological Agent Sensor System (LBASS)

Phase I Contract Data Requirements List (CDRL)

Data Item Deliverables

CDRL-1. Monthly Reports
Monthly after contract signing

The report will describe the previous 30 days' activity, technical progress achieved against each Work Breakdown Structure (WBS) element, difficulties encountered, recovery plans (as needed), and explicit plans for the next 30 days.

CDRL-2. Quarterly Reports
Quarterly after contract signing

Smiths will submit quarterly reports to the program manager describing the activities of the previous 90 days, including:

- Principals involved in the actual work for that quarter,
- Technical progress achieved against the program goals,
- Difficulties encountered and recovery plans (as needed),
- Funds expended against each sub-task, and
- Specific plans for the next quarter.

Smiths will coordinate with the HSARPA program manager to determine a time and place for an in-person quarterly review.

CDRL-3. Final Report
12 months after contract signing

At the conclusion of Phase I, Smiths will submit a final report detailing the work performed under this effort. This report will be a cumulative, stand-alone document describing the conceptual design process, rationale for design decisions, technical data gathered during the effort, "lessons learned," and recommendations for future research. The rationale for design decisions will be supported primarily in terms of their effect on predictions for system performance, unit cost, and cost of ownership. The design trades leading to the final Phase I system will be detailed, including how the chosen approaches were made to refine the system. The remaining uncertainties and unknowns will also be discussed.

This report will include:

- A "Mechanical Design Disclosure" for the mechanical system detailing the system, chamber, and packaging design and relevant test data.
- A computational fluid dynamic (CFD) flow analysis and component machining precision analysis on the baseline stage I prototype design. The stage II prototype design will then be revised per this analysis.
- System packaging specification requirements per upper level electronic, optical, pneumatic, and chamber requirements.
- Electrical circuit card assembly (CCA) with its inputs, outputs, and interconnections. Functional descriptions of each CCA will be developed and described in detail.
- A functional flow diagram of the major software section involved with processing the raw signal through the alarm decision. Also both the *Software Design Document* and *Interface Design Document* will be included.
- Testing results from both stage I and stage II prototype systems at the Smiths aerosol chamber facility. These data will be used to calculate sensitivity, generate initial ROC curves, and develop algorithms. Data will be analyzed with and without incorporating the elastic scatter measurements to determine the effect of removing these detection channels.

In addition, a comprehensive and detailed account of all funds expended will be also included, as will a proposal and preliminary design for Phase II. The Phase II proposal will include a detailed Statement of Work, experimental work plan, activity schedule and budget, and cost breakdown.

CDRL-4. Prototype Fabrication

12 months after contract signing

Smiths – Luminex team will provide a prototype LBASS and the necessary support staff for CDR testing at a Government sponsored testbed (GST).

Attachment C - Pre-Existing Intellectual Property

Patent Application	Title	Date of Filing	Owner	Funding Type
60/772,105	Illumination Subsystems, Systems, and Methods for Illuminating Particles During Measurement	2/10/2006	Luminex	Private Company Funding
60/772,689	Illumination and Detection Systems, and Methods for Illuminating Particles and Detecting Fluorescence During Measurement	4/12/2006	Luminex	Private Company Funding