

**ORDER FOR SUPPLIES OR SERVICES**

1. CONTRACT/PURCH. ORDER/ AGREEMENT NO. DASG60-02-D-0009	2. DELIVERY ORDER/ CALL NO. 008802	3. DATE OF ORDER/CALL 2003 May 19	4. REQ./ PURCH. REQUEST NO. SB3R205700-01	5. PRIORITY DX-A2	
6. ISSUED BY US ARMY SPACE & MISSILE DEFENSE COMMAND PO BOX 1500 HUNTSVILLE AL 35807-3801		7. ADMINISTERED BY DCM BIRMINGHAM BURGER PHILLIPS CENTER 1910 THIRD AVE., NORTH, RM. 201 BIRMINGHAM AL 35203-2376	10. DELIVER TO FOB POINT BY (Date) <b>SEE SCHEDULE</b>		

9. CONTRACTOR BAE SYSTEMS ANALYTICAL SOLUTIONS INC 1525 PERIMETER PKW, STE 500 HUNTSVILLE AL 35806	CODE 0JLS6	FACILITY	11. MARK IF BUSINESS IS <input type="checkbox"/> SMALL <input type="checkbox"/> SMALL DISADVANTAGED <input type="checkbox"/> WOMEN-OWNED	12. DISCOUNT TERMS <b>SEE SCHEDULE</b>
			13. MAIL INVOICES TO THE ADDRESS IN BLOCK See Item 15	

14. SHIP TO <b>SEE SCHEDULE</b>	CODE	15. PAYMENT WILL BE MADE BY DFAS-COLUMBUS CENTER DFAS-CO/SOUTH ENTITLEMENT OPERATION P.O. BOX 182264 COLUMBUS OH 43218-2264	CODE HQ0338	<b>MARK ALL PACKAGES AND PAPERS WITH IDENTIFICATION NUMBERS IN BLOCKS 1 AND 2.</b>
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16. TYPE OF ORDER	DELIVERY/ CALL	<input checked="" type="checkbox"/>	This delivery order/call is issued on another Govt. agency or in accordance with and subject to terms and conditions of above numbered contract.
	PURCHASE	<input type="checkbox"/>	Reference your quote dated Furnish the following on terms specified herein. REF:

ACCEPTANCE. THE CONTRACTOR HEREBY ACCEPTS THE OFFER REPRESENTED BY THE NUMBERED PURCHASE ORDER AS IT MAY PREVIOUSLY HAVE BEEN OR IS NOW MODIFIED, SUBJECT TO ALL OF THE TERMS AND CONDITIONS SET FORTH, AND AGREES TO PERFORM THE SAME.

NAME OF CONTRACTOR	SIGNATURE	TYPED NAME AND TITLE	DATE SIGNED (YYYYMMDD)
<input type="checkbox"/> If this box is marked, supplier must sign Acceptance and return the following number of copies:			

17. ACCOUNTING AND APPROPRIATION DATA/ LOCAL USE  
**See Schedule**

18. ITEM NO.	19. SCHEDULE OF SUPPLIES/ SERVICES	20. QUANTITY ORDERED/ ACCEPTED*	21. UNIT	22. UNIT PRICE	23. AMOUNT
	<b>SEE SCHEDULE</b>				

* If quantity accepted by the Government is same as quantity ordered, indicate by X. If different, enter actual quantity accepted below quantity ordered and encircle.	24. UNITED STATES OF AMERICA	25. TOTAL \$100,000.00
		29. DIFFERENCES

26. QUANTITY IN COLUMN 20 HAS BEEN <input type="checkbox"/> INSPECTED <input type="checkbox"/> RECEIVED <input type="checkbox"/> ACCEPTED, AND CONFORMS TO THE CONTRACT EXCEPT AS NOTED	27. SHIP NO.	28. DO VOUCHER NO.	30. INITIALS	33. AMOUNT VERIFIED CORRECT FOR
DATE _____ SIGNATURE OF AUTHORIZED GOVT. REP. _____	<input type="checkbox"/> PARTIAL <input type="checkbox"/> FINAL	32. PAID BY		34. CHECK NUMBER

36. I certify this account is correct and proper for payment.		31. PAYMENT <input type="checkbox"/> COMPLETE <input type="checkbox"/> PARTIAL <input type="checkbox"/> FINAL	35. BILL OF LADING NO.
DATE _____	SIGNATURE AND TITLE OF CERTIFYING OFFICER _____		

37. RECEIVED AT	38. RECEIVED BY	39. DATE RECEIVED (YYYYMMDD)	40. TOTAL CONTAINERS	41. S/R ACCOUNT NO.	42. S/R VOUCHER NO.
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## Section B - Supplies or Services and Prices

ITEM NO	SUPPLIES/SERVICES	MAX QUANTITY	UNIT	UNIT PRICE	MAX AMOUNT
0001	SETAC - FP Labor COST	1	Lot	UNDEFINED	UNDEFINED
	Provide services outlined in the scope of work (SOW), as defined in a given task order (T/O), at the fixed prices/government labor category specified in Section B paragraph entitled, "GOVERNMENT LABOR CATEGORIES AND ASSOCIATED FIXED PRICES PER DPPH"				
	PURCHASE REQUEST NUMBER: SB3R205700-01				
				MAX COST	\$94,800.00

FOB: Destination

ITEM NO	SUPPLIES/SERVICES	MAX QUANTITY	UNIT	UNIT PRICE	MAX AMOUNT
0003	Consultants COST	1	Lot	UNDEFINED	UNDEFINED
	Provide services outlined in the scope of work (SOW) at the cost reimbursable amounts as approved on a task-order-by-task-order basis. Total Fee, including prime and subcontractor/consultant, shall not exceed 3% of the estimated costs. This CLIN is valid during the three-year base period as well as any/all award term extensions earned by the contractor.				
	PURCHASE REQUEST NUMBER: SB3R205700-01				
				MAX COST	\$0.00

FOB: Destination

ITEM NO	SUPPLIES/SERVICES	MAX QUANTITY	UNIT	UNIT PRICE	MAX AMOUNT
0004		1	Lot	UNDEFINED	UNDEFINED

Materials and STE

COST

Provide materials, special test equipment (STE), and associated services outlined in the individual task orders at the cost reimbursable amounts as approved by the T/OM and the Contracting Officer. NO FEE ON THIS CLIN. This CLIN is valid during the three-year base period as well as any/all award term extensions earned by the contractor.

PURCHASE REQUEST NUMBER: SB3R205700-01

MAX COST

\$0.00

FOB: Destination

ITEM NO	SUPPLIES/SERVICES	MAX QUANTITY	UNIT	UNIT PRICE	MAX AMOUNT
0005		1	Lot	UNDEFINED	UNDEFINED

Travel

COST

Travel as directed in the individual task orders. Travel must be completed within the cost reimbursable amounts allowed per the Joint Travel Regulations and the DCAA-approved Company-Implemented Policy and Procedures. NO FEE ON THIS CLIN. This CLIN is valid during the three-year base period as well as any/all award term extensions earned by the contractor.

PURCHASE REQUEST NUMBER: SB3R205700-01

MAX COST

\$5,200.00

FOB: Destination

BLOCK 17 (DD1155) CONTINUED

TASK ORDER FUNDS REQUIRED \$ 100,000

TASK ORDER FUNDS AVAILABLE \$ 100,000

UNFUNDED BALANCE \$ 0

BLOCK 18 (DD1155) CONTINUED: In the performance of this Task Order (T/O), the contractor shall provide the total Direct Productive Person Hours (DPPHs), plus or minus 10 percent, as stated for fixed-price labor categories stated in Section B of the contract listed in Block 1 of the DD Form 1155. These DPPHs shall be billed at the fixed price stated in Exhibit V of the contract. The contractor shall not exceed the DPPHs, nor the total dollars, stated for consultant below. The contractor is allowed to provide up to 10 percent less than the DPPHs stated for consultant and still expend the total dollars as stated in the T/O. Furthermore, under no circumstance shall the contractor exceed the dollars stated for Materials, Travel, or Total T/O.

LABOR CATEGORIES: Labor categories are as listed in the contract, Section B, paragraph entitled "GOVERNMENT LABOR CATEGORIES AND ASSOCIATED FIXED PRICES PER DPPH"

	DPPHs ORDERED	NTE AMOUNT
FIXED-PRICE LABOR TOTAL	 DPPHs	\$ 94,800
*CONSULTANT TOTAL	 DPPHs	\$ -0-
T/O TOTAL LABOR	 DPPHs	\$ 94,800
MATERIAL	NTE	\$ -0-
TRAVEL	NTE	\$ 5,200
T/O TOTAL		\$ 100,000

\*Consultant requirements must have prior written approval of the Administrative Contracting Officer (ACO) (via subcontract consent package) before any costs are incurred under the consultant CLIN.

## Section C - Descriptions and Specifications

### STATEMENT OF WORK

#### “BEAM REDISTRIBUTION SYSTEM (BRS)”

### 1.0 BACKGROUND

#### 1.1 Laser Beam Control Background

1.1.1 While laser test centers such as the High Energy Laser Systems Test Facility (HELSTF) have conducted extensive laser testing, to date, no ground based high-energy-laser (HEL) tests have had realistic beam distribution. Currently no ground-based test and evaluation (T&E) capability provides the ability to simulate high-energy laser engagement at range. Ground test ranges will be several hundred meters to possibly several kilometers. Operational ranges can be from a few hundred meters to over 200 kilometers. The operational beam diameters may range from several centimeters to over 1.25 meters with a near Gaussian distribution. Ground tests can start with a 10 to 25 cm nominal top hat distribution, and over a few hundred meters, the beam must become Gaussian over the range of sizes of a few centimeters to 1.25 meters. This cannot be done by conventional optics.

1.1.2 T&E capability is needed to distribute a HEL beam on close range targets to emulate long-range beam-on-target irradiance profiles. Realistic lethality assessments require a laser beam on target similar to an operational laser beam on target. The T&E laser test centers need a portable optical system that can acquire, diagnose, and reshape a high power HEL beam to simulate high-energy laser engagement at range within a ground-based test setting. The Beam Redistribution System (BRS) is the critical element of a laser test cell that would have the capability to accomplish high power laser engagement testing.

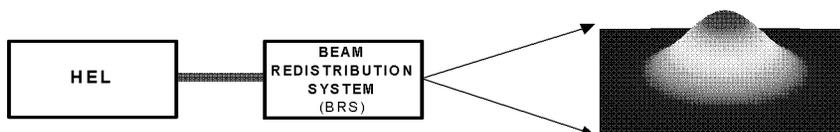
1.1.3 In a real world scenario, the laser engages a target at some substantial range. An optical system is needed to simulate high-energy laser engagement at range within the short ranges available in a ground-based test setting. For testing, the target is located close to the test laser. That is the target is in the near field of the test laser beam. Generally, actual targets are in the far field of the laser weapon. It is believed that beam reshaping can simulate the correct laser beam shape and size of the far field beam in the near field distances expected for ground based testing.

#### 1.2 General BRS Performance Parameters:

1.2.1 Flexible: High Energy Lasers will perform a number of missions, such as missile defense and tactical engagements for air-to-air and air-to-ground missions. A beam reshaping optical system shall be sufficiently flexible, so that a number of different engagement scenarios could be simulated. The BRS concept would have to support a variety of wavelengths. The BRS shall be capable of providing a variety of laser spot sizes, from a few centimeters to over a meter.

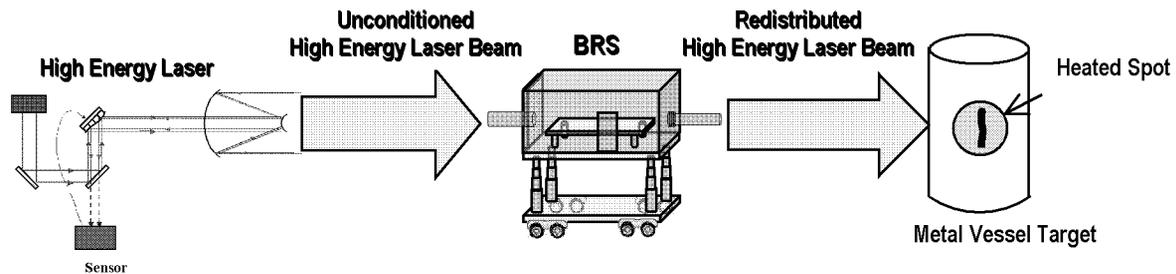
1.2.2 Portable: The optical system shall be portable, so that it could be used at multiple laser test locations such as Kirtland AFB, Edwards AFB, White Sands Missile Range, Eglin AFB, China Lake, and other laser test sites as required.

1.2.3 Rugged: It shall also be rugged enough for outdoor use at the test ranges and in other adverse environments.



1.2.4 The BRS is conceived as a portable optical system that can acquire, diagnose, and reshape a high power HEL beam to simulate high-energy laser engagement at range within a ground-based test facility setting. The BRS shall be capable of distributing the HEL beam on static targets at close range (a few hundred meters) so as to emulate long-range beam-on-target irradiance profiles. The BRS laser test cell may make use of the actual HELs and/or

appropriate surrogates and support realistic conditions in ground facilities. The laser test cell will support various fluence levels, beam sizes and deliver a spatially stable beam representative of the far field at the target.



2.0 REQUIREMENTS: The contractor shall perform a BRS Concept Study to propose the best BRS concept and then model and simulate that BRS concept.

2.1 Analysis of Alternatives. The contractor shall begin with a BRS Concept Study to evaluate beam redistribution concepts. The BRS will require a beam distribution concept that supports the spot sizes and intensities that are expected in ABL and THEL operations for complete and meaningful ground tests. The study will allow the government to assess BRS concepts, understand the HEL test and evaluation requirements, identify uncertainties, and determine the modeling and simulation (M&S) requirements and specifications. Some candidate alternative approaches are:

- 2.1.1 Telescope focus/defocus: Potential problems with holes in intensity pattern due to defocusing, Beam-on-target pattern dictated by HEL intensity distribution
- 2.1.2 Beam Integrator: Both multiple segmented mirrors and optical channels, such as beam tubes have been used to redistribute high-energy laser beams
- 2.1.3 Deformable mirror: This may be limited in tilt and piston
- 2.1.4 Piston-Tilt Synthesizer: issue is the number of segments required to obtain adequate emulation
- 2.1.5 Hybrid Optical System: Some combination of the elements above may be necessary to accomplish this task

2.1.2 The study shall quickly address which of these alternative approaches offers the most viable solution for testing parameters relevant to Airborne Laser (ABL), Advanced Tactical Laser (ATL), Mobile Tactical High Energy Laser (MTHEL), and Tactical High Energy Laser (THEL) ground-based testing.

2.2 Vibration and Thermal Sensitivity Analysis. The BRS Concept Study shall also include vibration and thermal sensitivity analyses and suggest a reasonable isolation system for the BRS test cell (such as a Barry mounted optical bench) to provide adequate stability for ground tests. The study will also conceptually address BRS test methods and measurement parameters. The BRS simulation shall use simulated laser beam profiles (such as the ABL, THEL, or ATL profile) to model and simulate the BRS. The BRS concept shall support rapid test turn around, safe operations, a variety of laser power levels and spot sizes, and operation at multiple wavelengths, including 1.315 microns (ABL and ATL) and 3.8 microns (THEL and MTHEL). With available low absorption coatings, it is anticipated that the BRS will use un-cooled optical components.

2.3 BRS Required Equipment. The study shall determine a suitable design concept for a BRS that is a portable outdoor test stand structure with electrical power and vibration isolation. Optical requirements include beam diagnostics, optics for beam conditioning and beam transfer, and beam shaping (mounts, lenses, mirrors) with beam profile diameters ranging from 5 cm to 1 meter or suitable size shall be determined by the Concept Study. The Concept Study shall determine any additional diagnostic requirements.

2.4 Concept Modeling and Simulation (M&S)

2.4.1 After choosing the best BRS concept the contractor shall develop beam redistribution simulation to further characterize the BRS. This BRS study will address performance-degrading elements of the BRS to establish the expected optical performance of the BRS for simulated laser beams. This simulation tool shall also be transportable to other computer systems, so that it can be incorporated with testing and analysis software.

2.4.2 The BRS simulation model shall be adaptable, so that it can readily be incorporated with laser beam train analysis tools and can be utilized by test centers to establish testing requirements within that center. The model will accurately and reliably evaluate optical performance of the BRS in the off-nominal configuration. The study shall include an initial optical system error budget to assess the affect of fabrication errors, misalignment, thermal distortion, and jitter on beam redistribution system performance.

2.5 Kick-Off & Technical Interchange Meetings (TIM). The contractor shall hold a kick-off meeting at the start of the effort. The contractor shall hold a technical interchange meeting upon completion of the effort at AFRL/DEL Kirtland AFB, NM.

#### PERIOD OF PERFORMANCE

19 MAY 03 – 31 DEC 03

#### KEY PERSONNEL

#### DELIVERABLES

Item/Title	CDRL#	# Copies	Delivery Date
Task Order Management Plan	A001	1 *	Per CDRL
FMER	A003	1 *	Per CDRL
Interim Technical Report <sup>1</sup>	A004	1	Monthly
Final Technical Report <sup>2</sup>	A005	2 */**	31 DEC 03

<sup>1</sup> The contractors shall provide monthly status reports that cover technical progress, technical issues, and action items (limited to two pages). The Interim Report will summarize the monthly reports, and include schedules, costs, and significant events associated with the task. The Interim Report shall include work accomplished during the previous period including planning, data and data analyses, a review of the simulations and theoretical modeling with assumptions and limitations of the modeling used and clearly defined parameters, and plans for the next period if not included in the original schedule.

<sup>2</sup> At completion of this Task Order, the contractor shall deliver a Final Report describing the task effort including results of the BRS Concept Study and BRS Simulation results. The first draft of the final report shall be due 14 days prior to completion of the final task. The first draft will be reviewed by the T/OM and returned to the contractor for changes within 7 days. Within 7 days thereafter, the contractor shall make final changes and return the final draft to the T/OM.

The BRS simulation model will be delivered under this effort with the Final Report for use with other software. A users manual will also be included to describe the capabilities, algorithms, and interface methodologies utilized by the simulation.

Quarterly Transmittal Listing      A007                      1                      Per CDRL

\* Plus Electronic Version.

\*\* One (1) hardcopy to the T/OM, and one (1) hardcopy to the SMDC Command Library (SMDC-IM-PL/Fred Mathews)

#### TRAVEL

Except for the locations listed below, the contractor has no authority to incur travel costs without explicit prior written approval (email acceptable) of the Task Order Monitor. Under no circumstance shall the contractor incur travel costs in excess of the NTE amount stated herein. NTE: \$5,200.

HELSTF, WSMR, NM      Kirkland AFB, Albuquerque, NM                      Eglin AFB, Valparaiso, FL

#### MATERIALS

ESTIMATED COST FOR MATERIALS AND/OR SPECIAL TEST EQUIPMENT: The contractor has no authority to incur material costs without the explicit prior written approval of the contracting officer. Prior to forwarding requests to the contracting officer, the contractor shall obtain the Task Order Monitor's concurrence. Electronic Mail (email) shall be utilized for both steps in this process. Under no circumstance shall the contractor incur materials costs in excess of the NTE amount stated herein. NTE: \$0

#### SPECIAL INSTRUCTIONS

Cost data shall be segregated/reported/vouchered/paid at the ACRN level.

The "Limitation of Funds" is applicable at the ACRN level.

The effort described in the Task Order Statement of Work anticipated to be performed in FY03, is subject to the Clause at FAR 52.232-18, Availability of Funds.

All of the terms and conditions of the contract listed in Block 1 above are applicable to this T/O.

All of the provisions and clauses of the contract listed in Block 1 above are applicable to this T/O.

No Government Furnished Property or Test Facilities are available for use in performance of this Task Order.

It is incumbent upon the contractor and/or subcontractor to ensure that appropriate Technical Assistance Agreements (TAAs) and/or applicable export licenses are in place before conducting any activity under the SOW which requires such approval and documentation.

#### DISTRIBUTION

TASK ORDER MONITOR:   


MAILING ADDRESS:    US Army Space and Missile Defense Command  
                                 SMDC-AC-H-T  
                                 HELSTF

White Sands Missile Range, NM 88002

Section G - Contract Administration Data

ACCOUNTING AND APPROPRIATION DATA

AA: 213 2040.0000 36 6020 P665605E97 2514 SB3R205700 S01021 SB3R205700/3HHRD4/H  
AMOUNT: \$100,000.00