

AMENDMENT OF SOLICITATION/MODIFICATION OF CONTRACT

1. Contract ID Code
Firm Fixed Price

Page 1 Of 12

2. Amendment/Modification No.

P00001

3. Effective Date

2013SEP13

4. Requisition/Purchase Req No.

SEE SCHEDULE

5. Project No. (If applicable)

6. Issued By

U.S. ARMY CONTRACTING COMMAND
RACHEL HEANEY
WARREN, MICHIGAN 48397-5000
HTTP://CONTRACTING.TACOM.ARMY.MIL

EMAIL: RACHEL.HEANEY@US.ARMY.MIL

Code

W56HZV

7. Administered By (If other than Item 6)

DCMA MANASSAS
10500 BATTLEVIEW PKWY
SUITE 200
MANASSAS VA 20109-2342

Code

S2404A

8. Name And Address Of Contractor (No., Street, City, County, State and Zip Code)

SCIENCE APPLICATIONS INTERNATIONAL CORPORATION
DEFENSE SOLUTIONS SERVICES
1710 SAIC DR
MCLEAN, VA 22102-3703

9A. Amendment Of Solicitation No.

9B. Dated (See Item 11)

10A. Modification Of Contract/Order No.

W56HZV-13-C-0349

10B. Dated (See Item 13)

2013AUG22

Code 5UTP8

Facility Code

11. THIS ITEM ONLY APPLIES TO AMENDMENTS OF SOLICITATIONS

The above numbered solicitation is amended as set forth in item 14. The hour and date specified for receipt of Offers

is extended, is not extended.

Offers must acknowledge receipt of this amendment prior to the hour and date specified in the solicitation or as amended by one of the following methods:
(a) By completing items 8 and 15, and returning _____ copies of the amendments; (b) By acknowledging receipt of this amendment on each copy of the offer submitted; or (c) By separate letter or telegram which includes a reference to the solicitation and amendment numbers. **FAILURE OF YOUR ACKNOWLEDGMENT TO BE RECEIVED AT THE PLACE DESIGNATED FOR THE RECEIPT OF OFFERS PRIOR TO THE HOUR AND DATE SPECIFIED MAY RESULT IN REJECTION OF YOUR OFFER.** If by virtue of this amendment you desire to change an offer already submitted, such change may be made by telegram or letter, provided each telegram or letter makes reference to the solicitation and this amendment, and is received prior to the opening hour and date specified.

12. Accounting And Appropriation Data (If required)

NO CHANGE TO OBLIGATION DATA

13. THIS ITEM ONLY APPLIES TO MODIFICATIONS OF CONTRACTS/ORDERS

It Modifies The Contract/Order No. As Described In Item 14.

- A. This Change Order is Issued Pursuant To: _____ The Changes Set Forth In Item 14 Are Made In _____
The Contract/Order No. In Item 10A.
- B. The Above Numbered Contract/Order Is Modified To Reflect The Administrative Changes (such as changes in paying office, appropriation data, etc.) Set Forth In Item 14, Pursuant To The Authority of FAR 43.103(b).
- C. This Supplemental Agreement Is Entered Into Pursuant To Authority Of: _____
Mutual Agreement Between Parties
- D. Other (Specify type of modification and authority)

E. IMPORTANT: Contractor is not, is required to sign this document and return _____ copies to the Issuing Office.

14. Description Of Amendment/Modification (Organized by UCF section headings, including solicitation/contract subject matter where feasible.)

SEE SECOND PAGE FOR DESCRIPTION

Except as provided herein, all terms and conditions of the document referenced in item 9A or 10A, as heretofore changed, remains unchanged and in full force and effect.

15A. Name And Title Of Signer (Type or print)		16A. Name And Title Of Contracting Officer (Type or print)	
		LYNN M. BYRNE LYNN.M.BYRNE@US.ARMY.MIL (586)282-6553	
15B. Contractor/Offeror	15C. Date Signed	16B. United States Of America	16C. Date Signed
_____ (Signature of person authorized to sign)		By _____ /SIGNED/ (Signature of Contracting Officer)	2013SEP13

NSN 7540-01-152-8070

PREVIOUS EDITIONS UNUSABLE

30-105-02

STANDARD FORM 30 (REV. 10-83)

Prescribed by GSA FAR (48 CFR) 53.243

CONTINUATION SHEET	Reference No. of Document Being Continued	Page 2 of 12
	PIIN/SIIN W56HZV-13-C-0349 MOD/AMD P00001	
Name of Offeror or Contractor: SCIENCE APPLICATIONS INTERNATIONAL CORPORATION		

SECTION A - SUPPLEMENTAL INFORMATION

Buyer Name: RACHEL HEANEY
Buyer Office Symbol/Telephone Number: CCTA-ASG-C/(586)282-9712
Type of Contract: Firm Fixed Price
Kind of Contract: Research and Development Contracts
Type of Business: Large Business Performing in U.S.
Surveillance Criticality Designator: C
Weapon System: No Identified Army Weapons Systems
Contract Expiration Date: 2015AUG21

*** End of Narrative A0000 ***

Modification P00001

1. This modification P00001 to contract W56HZV-13-C-0349 is a bilateral supplemental agreement.
2. The purpose of this modification P00001 is to:
 - a. Extend the delivery date for Sub-CLINs 0003AA and 0005AA.
 - b. Revise Section C paragraphs C.2.3.9, C.4.3, and C.4.4
 - c. Add Section C paragraph C.2.3.15
3. The parties agree that the changes set forth herein are at no additional cost to the Government.
4. As a result of this modification P00001, the contract is revised as follows:
 - a. Section B:
 - i. Sub-CLIN 0003AA: The performance completion date is extended by six weeks from 20 December 2013 to 31 January 2014, and the narrative is revised accordingly.
 - ii. Sub-CLIN 0005AA: The performance completion date is extended by eight weeks from 20 March 2014 to 15 May 2014, and the narrative is revised accordingly.
 - b. Section C:
 - i. Paragraph C.2.3.9(a): Revised from Induction PM machine to Interior Permanent Magnet Machine for clarity.
 - ii. Paragraph C.2.3.9(b): Revised from Surface-mount PM machine to Surface-mount Permanent Magnet machine for clarity.
 - iii. Paragraph C.3.15: Added to clarify the minimum number of required configurations for digital to analog outputs which are required per C.2.3.9.
 - iv. Paragraph C.4.3: The date for the Critical Design Review (CDR) is revised from no later than four (4) months after contract award to no later than 31 January 2014.
 - v. Paragraph C.4.4: The date for the Final Design Review (FDR) is revised from no later than seven (7) months to no later than 15 May 2014.
5. No funding is associated with this modification. As a result, the obligated amount of the contract remains unchanged at \$2,499,011.70.
6. Except as specifically stated above, all other terms and conditions of the contract remain unchanged and in full force and effect.

*** END OF NARRATIVE A0001 ***

CONTINUATION SHEET

Reference No. of Document Being Continued
 PIIN/SIIN W56HZV-13-C-0349 MOD/AMD P00001

Name of Offeror or Contractor: SCIENCE APPLICATIONS INTERNATIONAL CORPORATION

ITEM NO	SUPPLIES/SERVICES	QUANTITY	UNIT	UNIT PRICE	AMOUNT								
0003AA	<p>SECTION B - SUPPLIES OR SERVICES AND PRICES/COSTS</p> <p><u>CRITICAL DESIGN REVIEW & DELIVERABLES</u></p> <p>GENERIC NAME DESCRIPTION: SAIC - SiC ISG Contr CLIN CONTRACT TYPE: Firm Fixed Price PRON: R32MC112R3 PRON AMD: 03 ACRN: AA</p> <p>The Contractor shall provide all of the Supplies and Services to accomplish the Critical Design Review (CDR) IAW Section C.4.3 of the Statement of Work, and CDRLs A003, A004, and A006.</p> <p>The price for the CDR and associated deliverables is shown in the "Amount" field.</p> <p>The CDR deliverables include: (1) the revised functional diagrams, schematics, and PRO-E compatible models of the exterior envelope; (2) Presentation Materials; and (3) Minutes.</p> <p>The CDR shall be conducted no later than 31 January 2014.</p> <p>Inspection and Acceptance to determine successful completion of the CDR will be IAW the requirements detailed in Section E.</p> <p>*CLIN revised by Modification P00001.</p> <p>(End of narrative B001)</p> <p><u>Inspection and Acceptance</u> INSPECTION: Destination ACCEPTANCE: Destination</p> <p><u>Deliveries or Performance</u></p> <table border="0"> <tr> <td>DLVR SCH</td> <td>PERF COMPL</td> </tr> <tr> <td><u>REL CD</u> <u>QUANTITY</u></td> <td><u>DATE</u></td> </tr> <tr> <td>001 1</td> <td>31-JAN-2014</td> </tr> <tr> <td style="text-align: right;">\$ 205,939.60</td> <td></td> </tr> </table>	DLVR SCH	PERF COMPL	<u>REL CD</u> <u>QUANTITY</u>	<u>DATE</u>	001 1	31-JAN-2014	\$ 205,939.60		1	LO		\$ 205,939.60
DLVR SCH	PERF COMPL												
<u>REL CD</u> <u>QUANTITY</u>	<u>DATE</u>												
001 1	31-JAN-2014												
\$ 205,939.60													
0005AA	<p><u>FINAL DESIGN REVIEW & DELIVERABLES</u></p> <p>GENERIC NAME DESCRIPTION: SAIC - SiC ISG Contr CLIN CONTRACT TYPE: Firm Fixed Price PRON: R32MC112R3 PRON AMD: 03 ACRN: AA</p> <p>The Contractor shall provide all of the Supplies and Services to accomplish the Final Design Review (FDR) IAW Section C.4.4 of the Statement of Work, and CDRLs</p>	1	LO		\$ 368,497.14								

CONTINUATION SHEET

Reference No. of Document Being Continued
 PIIN/SIIN W56HZV-13-C-0349 MOD/AMD P00001

Name of Offeror or Contractor: SCIENCE APPLICATIONS INTERNATIONAL CORPORATION

ITEM NO	SUPPLIES/SERVICES	QUANTITY	UNIT	UNIT PRICE	AMOUNT										
	<p>A003, A004, and A006.</p> <p>The price for the FDR and associated deliverables is shown in the "Amount" field.</p> <p>The FDR deliverables include: (1) the Final functional diagrams, schematics, and PRO-E compatible models of the exterior envelope; (2) Presentation Materials; and (3) Minutes.</p> <p>The FDR shall be conducted no later than 15 May 2014.</p> <p>Inspection and Acceptance to determine successful completion of the FDR will be IAW the requirements detailed in Section E.</p> <p>*CLIN revised by Modification P00001.</p> <p>(End of narrative B001)</p> <p><u>Inspection and Acceptance</u> INSPECTION: Destination ACCEPTANCE: Destination</p> <p><u>Deliveries or Performance</u></p> <table data-bbox="261 1050 771 1176"> <thead> <tr> <th>DLVR SCH</th> <th>PERF COMPL</th> </tr> <tr> <th><u>REL CD</u></th> <th><u>DATE</u></th> </tr> </thead> <tbody> <tr> <td>001</td> <td>15-MAY-2014</td> </tr> <tr> <td></td> <td></td> </tr> <tr> <td>\$</td> <td>368,497.14</td> </tr> </tbody> </table>	DLVR SCH	PERF COMPL	<u>REL CD</u>	<u>DATE</u>	001	15-MAY-2014			\$	368,497.14				
DLVR SCH	PERF COMPL														
<u>REL CD</u>	<u>DATE</u>														
001	15-MAY-2014														
\$	368,497.14														

CONTINUATION SHEET	Reference No. of Document Being Continued	Page 5 of 12
	PIIN/SIIN W56HZV-13-C-0349	MOD/AMD P00001
Name of Offeror or Contractor: SCIENCE APPLICATIONS INTERNATIONAL CORPORATION		

SECTION C - DESCRIPTION/SPECIFICATIONS/WORK STATEMENT

Silicon Carbide Generator Controllers

C.1 OBJECTIVES:

C.1.1 The objective of this statement of work is for the contractor to design, develop and deliver two ruggedized Silicon Carbide (SiC) Integrated Starter/ Generator (ISG) controllers (hereinafter referred to as generator controller) that enable high temperature operation of high voltage integrated starter/generators for vehicle applications.

C.1.2 The contractor, acting as an independent contractor and not an agent of the government, shall provide the necessary personnel, facilities, materials and services to complete the effort described herein other than those facilities and services offered for rent free use by the Government under Section H of this contract.

C.1.3 Requirements listed are for continuous operation unless otherwise specified. The generator controller(s) shall be capable of meeting all requirements as stated within this statement of work continuously without reducing the capability of one requirement in order to meet another requirement.

C.1.4 In the event of conflict between the text of this specification and the references cited herein, the text of this specification takes precedence.

C.1.5 Unless otherwise specified, all requirements must be met without the assistance of external devices such as capacitors, inductors, or other electronic devices.

C.2 SCOPE OF WORK:

C.2.1 Specifications: Unless specifically attached hereto, all MIL-STDs referenced herein may be downloaded from <https://assist.daps.dla.mil/quicksearch/>. The generator controller(s) shall meet the following specifications:

C.2.1.1 The generator controller shall output 600 volts direct current (VDC) in accordance with (IAW) MIL-PRF-GCS600A Characteristics of 600 Volt DC Electrical Systems for Military Ground Vehicles (Attachment 002). The generator controller shall be capable of handling a step load of 45kW with a cable length between the controller and the generator of five (5) meters.

C.2.1.2 The generator controller shall meet its operational performance requirements described in this statement of work during and after being subjected to the following emission and susceptibility requirements of MIL-STD-461F:

- a. Conducted Emissions, Power Leads, 10 kHz to 10 MHz (CE102),
- b. Conducted Susceptibility, Power Leads, 30 Hz to 150 kHz (CS101),
- c. Conducted Susceptibility, Bulk Cable Injection, 10 kHz to 200 MHz (CS114),
- d. Conducted Susceptibility, Bulk Cable Injection, Impulse Excitation (CS115),
- e. Conducted Susceptibility, Damped Sinusoidal Transients, Cables and Power Leads, 10 kHz to 100 MHz (CS116),
- f. Radiated Emissions, Electric Field, 10 kHz to 18 GHz (RE102),
- g. Radiated Susceptibility, Electric Field, 2 MHz to 40 GHz (RS103).

C.2.1.3 The generator controller shall meet its operational performance requirements described in this statement of work immediately after being subjected to the Radiated Susceptibility, Transient Electromagnetic Field (RS105) requirement of MIL-STD-461F.

C.2.1.4 The generator controller shall meet its operational performance requirements described in this statement of work when exposed to the radio frequency electromagnetic environment (RF EME) described in paragraph 5.3 of MIL-STD-464C, Table 4.

C.2.1.5 The generator controller shall meet MIL-STD-810G environmental requirements necessary for integration onto combat and tactical vehicles.

C.2.2 Performance Requirements: The generator controller shall meet the following performance requirements:

C.2.2.1 Electric Machine Compatibility

C.2.2.1.1 The generator controller shall be compatible with a 3 phase permanent magnet (PM) machine with and without a position feedback device in both motoring and generating modes.

CONTINUATION SHEET	Reference No. of Document Being Continued	Page 6 of 12
	PIIN/SIIN W56HZV-13-C-0349	MOD/AMD P00001
Name of Offeror or Contractor: SCIENCE APPLICATIONS INTERNATIONAL CORPORATION		

C.2.2.1.2 The generator controller shall have inputs and function with all of the following position feedback devices: Resolver, Encoder, Hall Effect sensor.

C.2.2.2 Power and Torque

C.2.2.2.1 The generator controller shall provide 175 kilowatts (kW) of continuous power output on the 600 volts direct current (VDC) side.

C.2.2.2.2 The generator controller shall operate an electric machine in torque mode and speed mode to allow for vehicle engine starting and burst acceleration.

C.2.2.2.3 The generator controller shall motor the ISG to perform the engine cranking function pursuant to the following:

- a. Minimum torque capability shall be 700 Newton-meter (N-m) steady-state.
- b. Minimum peak (five (5) second transient) torque capability shall be at least 1500 N-m, 600 Amps Root-Mean-Square (RMS) output, with an objective of 1200 Amps RMS output.
- c. Minimum sustained cranking speed shall be 300 revolutions per minute (RPM), with a capability of at least 300 Amps RMS output, with an objective of 600 Amps RMS output.
- d. Minimum sustained cranking time (single event) shall be 30 seconds.
- e. Coolant flow shall be zero during cranking event.
- f. Bulk coolant maximum temperature before cranking event shall be 105 degrees Celsius (C).

C.2.2.2.4 The generator controller shall have an output direct current (DC) link capacitance no less than 100 micro-Farads (uF) for DC bus stability. The generator controller shall minimize the effects of source harmonics from the effects of dead time, unbalance of alternating current (AC) input, and torque ripple. The generator controller shall absorb up to three percent harmonics Root Mean Square (RMS) values relative to the DC magnitude in current from the other DC bus loads.

C.2.2.2.5 The generator controller shall provide 175 kW of continuous power output to the motor.

C.2.2.3 Environmental

C.2.2.3.1 The generator controller shall not suffer performance degradation or damage following exposure to water jet spraying when the jet spray is applied perpendicular to the surface being cleaned at a distance of not less than 1 foot (ft) [0.3 meter (m)] from the surface and a cleaning rate of 1 ft squared/minutes [930 centimeters (cm squared)/minutes]. The water jet shall be derived from a nozzle having a maximum orifice diameter of 0.25 inch (64 cm) and a maximum nozzle pressure of 25 pounds per square inch (psi) (172 kilopascal(kPa)).

C.2.2.3.2 The generator controller shall operate without performance degradation during basic shock conditions. Basic shock conditions consist of imposing shock half sine impulses of 40 g (1 g=acceleration due to earths gravity) with an effective duration of 11 millisecond (ms) at the interface between the subsystem and the location of the vehicle where it is mounted. This includes mounting brackets, weld joints, shock isolators, or any other mounting device as applicable. Verification shall be done by exposing the device to three shock impulses in each direction of three mutually perpendicular axes (total of 18 shock pulses) and verifying there is no damage.

C.2.2.3.3 The generator controller shall withstand minimum static equivalent loads of 10g vertical, 6g fore and aft, and 6g in the lateral direction for 48 hours.

C.2.2.3.4 The generator controller shall operate with no physical damage that affects the performance or functionality at the conditions described in this statement of work.

C.2.2.3.5 The generator controller shall operate without performance degradation during and after exposure to relative humidity up to 100%.

C.2.2.3.6 The generator controller shall be hardened with nuclear event detection circuitry.

C.2.2.3.7 The generator controller shall meet its full performance requirements without performance or physical degradation while operating to a minimum ambient air temperature of -60 degrees F (-51 degrees C).

CONTINUATION SHEET	Reference No. of Document Being Continued	Page 7 of 12
	PIIN/SIIN W56HZV-13-C-0349	MOD/AMD P00001

Name of Offeror or Contractor: SCIENCE APPLICATIONS INTERNATIONAL CORPORATION

C.2.2.3.8 The generator controller shall comply with the performance requirements defined in ATPD-2404 section 5 (Attachment 0003).

C.2.2.4 Safety

C.2.2.4.1 The generator controller shall have protection from short circuit conditions at the high voltage outputs as follows: Each high voltage output power connector on the generator controller shall accommodate a High Voltage Interlock Loop interface that detects if a high voltage connector to the load is disconnected (open circuit condition). The generator controller shall output 600 VDC only if the high voltage interlock is closed on the corresponding output. This high voltage interlock shall have the capability to be overridden via controller area network (CAN) through a safety override type command.

C.2.2.4.2 The generator controller shall sense a connection between its power circuitry and the chassis and notify the vehicle (broadcast) via Controller Area Network (CAN) if a Ground Fault is detected at the controller 600 VDC output. The ground-fault interrupter (GFI) hardware shall sense if there is a Ground Fault current of 3 milliamp (mA) from +300 VDC to chassis and from -300 VDC to chassis.

C.2.2.4.3 The generator controller high voltage (HV) power (600 VDC) and return shall be electrically isolated from the generator controller primary power (28 VDC) returns by a resistance of 100 Megaohms or greater.

C.2.2.4.4 The generator controller HV power (600 VDC) and return shall be electrically isolated from the equipment chassis by a resistance of 100 Megaohms or greater when not connected to the Ground Fault Detector circuitry.

C.2.2.4.5 The generator controller shall be designed and manufactured to comply with High Voltage Corona (HVC) pursuant to the requirements defined in MIL-HDBK-454, Guideline 45 for altitudes up to 15,000 ft (4,572 m).

C.2.2.4.6 The generator controller shall have a green light emitting diode (LED) indicator by the HV connector signifying if 600VDC is being outputted through the connection. The LED shall turn red if the safety interlock is open. The LED shall turn blue if the HV safety interlock has been overridden and the connection is outputting 600VDC.

C.2.2.4.7 The generator controller shall incorporate arc flash mitigation to limit incident energy as follows pursuant to the IEEE-1584 Arc Flash Standard:

- a. Bolted Fault current shall not exceed 15 kiloamps (kA)
- b. Clearing Time shall be less than or equal to .01 seconds
- c. Working Distance less than or equal to 18 inches
- d. System Voltage (Vs) equal to 623 VDC
- e. Arc Boundary distance shall be less than 10.4 cm

C.2.3 Control Interface

C.2.3.1 The generator controller shall be controllable via J1939 CAN protocol. The generator controller shall provide no network termination.

C.2.3.2 The generator controller shall make available on the CAN all monitored data; this includes phase voltages, DC bus voltage, currents, temperatures, fault status, feedback [bus voltage, current quadrature (Iq) component, and current direct (Id) component {higher update rate}, speed, available temperatures] and all other data that the controller monitors.

C.2.3.3 The generator controller shall make available on the CAN the following functions: Enable/disable, Torque command, speed command, voltage command, mode selection (torque, speed, voltage), and individual fault reset.

C.2.3.4 The generator controller shall be configurable via reprogramming through the CAN interface.

C.2.3.5 The generator controller CAN messages shall use the messaging format in the CAN message interface control document (ICD) template (Attachment 0001).

C.2.3.6 The generator controller shall monitor and report status of the high voltage interlocks via CAN.

C.2.3.7 The generator controller shall record faults and report them over the CAN for system diagnosis.

C.2.3.8 The generator controller software shall alert via CAN when regulation pursuant to MIL-PRF-GCS600A (Attachment 0002) is not possible due to ISG and generator controller limitations (Attachment 0002).

CONTINUATION SHEET	Reference No. of Document Being Continued	Page 8 of 12
	PIIN/SIIN W56HZV-13-C-0349	MOD/AMD P00001

Name of Offeror or Contractor: SCIENCE APPLICATIONS INTERNATIONAL CORPORATION

C.2.3.9 The following generator controller options shall be programmable via CAN and through an additionally provided serial port:

- a. Interior Permanent Magnet Machine
- b. Surface-mount Permanent Magnet machine
- c. Number of pole pairs
- d. Resolver, encoder, hall feedback
- e. Resolver configuration (excitation frequency, number of resolver poles, alignment)
- f. Encoder configuration (number of lines, alignment (index))
- g. Hall configuration (alignment)
- h. Tuning parameters (Proportional Integral Derivative gains for current/speed/voltage loops)
- i. Calibration (offset and gain on current/voltage sensors)
- j. Limits (current, voltage, slew rates, temperature, speed)
- k. Switching frequency
- l. Dead time
- m. Temperature foldback and shutdown current settings
- n. Digital to analog (D/A) output settings real-time update rate (e.g. Id, Iq, Volts Direct Current (Vdc), Phase Currents (Ia, Ib, Ic) Voltage quadrature (Vq) component, Voltage direct (Vd) component, position, speed)
- o. Field weakening parameters (e.g. Iq and Id profiles with respect to torque and speed)
- p. Save serial configuration options to non-volatile memory
- q. Calibration for operation without a position sensor.
- r. Calibration for operation with a position sensor.
- s. Save and restore all parameters to disk (on the programming computer)

C.2.3.10 The generator controller shall be designed to be programmable by the end user with minimal training to allow for integration with PM machines of varying designs as described in paragraph C.2.2.1.1.

C.2.3.11 The generator controller shall utilize a 28VDC input for low voltage control power. The 28 VDC bus shall be compatible with MIL-STD-1275E.

C.2.3.12 The generator controller application software shall provide access to:

- a. Input / Output (I/O) signals
- b. Status
- c. Drive faults
- d. Torque (current)
- e. Feedback signals (rotor position and rotor speed, current, bus voltage, and power delivered to the HV DC Link (HV Bus).)

C.2.3.13 The generator controller shall cease bus regulation and cease energizing the bus upon external command via messaging from the CAN bus.

C.2.3.14 The generator controller firmware and embedded operating system software shall be upgradable via the serial port described in section C.2.3.9.

CONTINUATION SHEET	Reference No. of Document Being Continued	Page 9 of 12
	PIIN/SIIN W56HZV-13-C-0349	MOD/AMD P00001

Name of Offeror or Contractor: SCIENCE APPLICATIONS INTERNATIONAL CORPORATION

C.3.15 The generator controller shall have a minimum of four (4) Digital to Analog (D/A) programmable outputs that are user selectable between Id, Ig, Volts Direct Current (Vdc), Phase Currents (Ia, Ib, Ic) Voltage quadrature (Vg), Voltage direct (Vd) component, position, and speed, at a minimum.

C.2.4 Cooling

C.2.4.1 The generator controller shall operate at full power with 105 degrees Celsius input coolant and 150 degrees Celsius ambient temperature. The flow rate shall not exceed 12 liters/minute, at 9 psig (Pounds Per Square Inch Gauge) inlet pressure. The maximum outlet steady state temperature shall not exceed 120 degrees Celsius.

C.2.4.2 The generator controller components shall be designed to withstand a non-operational peak soak back temperature of 125 degrees Celsius, with an objective of 150 degrees Celsius.

C.2.4.3 The generator controller shall be compatible with an Ethylene Glycol Water (EGW) 50/50 mixture, and be capable of operating at a pressure of 100 PSIG.

C.2.4.4 The generator controller shall monitor critical cooling performance data, including at a minimum, inlet and outlet coolant temperatures, and critical heat rejection component temperatures (e.g. power conversion devices). Examples of Critical components include the components that will be first to suffer failure due to excessive heat rejection while under load conditions.

C.2.5 Space Claim

C.2.5.1 The generator controller shall have a (continuous) power density (power/volume) of at least 19.6 kW/liter with an objective of 35 kW/liter. The power used to compute the power density and specific power shall be the continuous electrical power of the generator controller. Continuous operation is defined as operation for 180 minutes at constant output power and stabilized conditions with coolant inlet temperatures of greater than or equal to 105 degrees Celsius inlet and a 150 degrees Celsius ambient temperature, while operating from 600 VDC Bus. The volume and weight used for the power density and specific power (power/weight) calculation is calculated with a rectangular box that includes the total generator controller enclosure and all components that are mechanically and permanently attached, including all generator controller hardware such as the power stage, gate drive/power supply, inductors, sensors, filters, and interfaces.

C.2.5.2 The generator controller shall have a (continuous) specific power (power/weight) of at least 10.5kW/kg and an objective of 25 kW/kg.

C.2.5.3 The generator controller shall use SiC modules for the primary switching components inside the controller.

C.2.5.4 The generator controller shall be designed to be mounted in any physical orientation and operate without degradation. The generator controller shall not exceed any of the following dimensions stated in millimeters (mm) (including connectors) 385mm (L) x 130 mm (H) x 280mm (D). The contractor shall deliver PRO-E compatible models of the exterior envelope of the generator controller IAW C.5.5.

C.2.5.5 The generator controller signal connectors shall be commercial off the shelf connectors, of an existing current military standard (e.g. MIL-DTL-38999L w/AMENDMENT 2, series III).

C.2.5.6 The generator controller shall have three (3) 600VDC output circuits with the following current ratings: (i) 300 amps, (ii) 75 amps, and (iii) 75 amps. The 600VDC circuits shall utilize solid state circuit breakers that are configured electrically as normally off (the device will not pass current without a gate signal). The circuits shall have a user adjustable current setting that allows for adjustments from 20% to 100% of its maximum current rating. The circuits shall have the ability to be disabled via a message from the CAN bus.

C.2.6 Graphical User Interface (GUI):

C.2.6.1 The contractor shall develop and deliver a GUI (C.5.6) for the generator controllers that functions with both CAN and serial communication interfaces, and that provides data acquisition capability for testing.

C.2.6.2 The GUI shall allow for the tuning of the ISG parameters in real-time, including hardware controlled and monitored current and voltage limits, control(s) system gain parameters, bus voltage control gains and limits, and any other parameters essential for HV Power production and HV Bus voltage regulation. The GUI shall have data logging and debugging functionality. The GUI shall allow user modification of CAN data frames, packing, bit rate, and all other configurable parameters without modifying source code.

C.2.6.3 The contractor shall develop and deliver a user manual for the GUI IAW CDRL A007 and C.5.7. The contractor shall also deliver the final version of firmware required for operation of the generator controller IAW CDRL A010 and C.5.2.

C.3 Testing, Integration and Training:

C.3.1 The contractor shall develop a test plan that when performed demonstrates that the generator controller meets the requirements

CONTINUATION SHEET	Reference No. of Document Being Continued	Page 10 of 12
	PIIN/SIIN W56HZV-13-C-0349	MOD/AMD P00001

Name of Offeror or Contractor: SCIENCE APPLICATIONS INTERNATIONAL CORPORATION

described in this statement of work as identified in Attachment 0005. The contractor shall submit the test plan IAW C.5.12, CDRL A008 and Attachment 0005.

C.3.2 The contractor shall complete all preliminary testing required by Attachment 0005 and summarize the data in a test report IAW CDRL A009. The preliminary test data report shall be delivered IAW C.5.13. If the TARDEC labs are used for preliminary testing IAW Section H.1., any fixturing, test loads, and tooling required to run the tests at the TARDEC lab, beyond what is owned by the government in the TARDEC labs, shall be a deliverable under this contract IAW C.5.9.

C.3.3 After COR concurrence of a successful test readiness review as required by C.4.5, the contractor shall integrate one generator controller into the TARDEC Systems Integration Lab (SIL) for use in optimization and use training of TARDEC personnel.

C.3.4 The contractor shall provide one day of training for up to 15 TARDEC personnel at TARDEC on the use and optimization of the ISG operation no later than 18.5 months after contract award. The contractor shall develop a Training Plan IAW CDRL A011. The Training Plan shall be delivered IAW C.5.14. An existing government owned ISG will be utilized for the training. The contractor shall coordinate the specific dates for the integration of the generator controller unit and training with COR no less than ten (10) calendar days in advance.

C.4 Meetings

C.4.1 Start of Work Meeting: The contractor shall plan and conduct a one (1) day start of work meeting at a mutually agreed upon location, which shall be the contractors facility, or teleconference within seven (7) calendar days after contract award. The date and time of the start of work meeting shall be mutually agreed to between the COR and contractor. The contractor shall coordinate this meeting with the COR and at a minimum invite the COR, the Contract Specialist shown on page one of the contract and the Administrative Contracting Officer shown in Section G of the contract. The contractor shall prepare presentation materials IAW CDRL A003. The presentation materials shall be delivered to the COR no later than one (1) calendar day prior to the scheduled meeting. The contractor shall prepare minutes from the Start of Work meeting IAW CDRL A004. The minutes shall be delivered IAW C.5.11.

C.4.2. Preliminary Design Review (PDR): The contractor shall plan and conduct a PDR at a mutually agreed upon location, which shall be the contractors facility or teleconference no later than two (2) months after contract award. The date and time shall be mutually agreed to between the COR and contractor. The contractor shall prepare presentation materials IAW CDRL A003, and preliminary functional diagrams, schematics and PRO-E compatible models of the exterior envelope IAW CDRL A006. The presentation materials, preliminary functional diagrams, schematics, and PRO-E compatible models shall be delivered IAW C.5.4, C.5.5 and C.5.10. The contractor shall prepare minutes from the PDR IAW CDRL A004. The minutes shall be delivered IAW C.5.11.

C.4.3 Critical Design Review (CDR): The contractor shall plan and conduct a CDR at a mutually agreed upon location, which shall be the contractors facility or teleconference no later than 31 January 2014. The date and time shall be mutually agreed to between the COR and contractor. The contractor shall prepare presentation materials IAW CDRL A003, and the revised functional diagrams and schematics and PRO-E compatible models of the exterior envelope IAW CDRL A006. The presentation materials, revised functional diagrams, schematics, and PRO-E compatible models shall be delivered IAW C.5.4, C.5.5 and C.5.10. The contractor shall prepare minutes from the CDR IAW CDRL A004. The minutes shall be delivered IAW C.5.11.

C.4.4 Final Design Review (FDR): The contractor shall plan and conduct a FDR at a mutually agreed upon location, which shall be the contractors facility or teleconference no later than 15 May 2014. The date and time shall be mutually agreed to between the COR and contractor. The contractor shall prepare presentation materials IAW CDRL A003 and the final functional diagrams and schematics and PRO-E compatible models of the exterior envelope IAW CDRL A006. The presentation materials, final functional diagrams, schematics, and PRO-E compatible models shall be delivered IAW C.5.4, C.5.5 and C.5.10. The contractor shall prepare minutes from the FDR IAW CDRL A004. The minutes shall be delivered IAW C.5.11.

C.4.5 Test Readiness Review (TRR): The contractor shall plan and conduct a TRR at a mutually agreed upon location, which shall be the contractors facility or teleconference. The contractor shall schedule and coordinate the TRR no later than eighteen (18) months after contract award. The date and time shall be mutually agreed to between the COR and contractor. The purpose of the review is to assess the contractors readiness to ship the generator controller Units for integration into the TARDEC SIL for optimization and use training, and for Government acceptance testing. The TRR shall review the Performance Specification and Interface Control Document (CDRL A005 and C.5.3), the GUI software user manual (CDRL A007 and C.5.7), the Preliminary Test Data Report (CDRL A009 and C.5.13), and the Training Plan (CDRL A011 and C.5.14). The contractor shall prepare presentation materials for the TRR IAW CDRL A003. Delivery of the presentation materials shall be IAW C.5.10. The contractor shall prepare minutes from the TRR IAW CDRL A004. The minutes shall be delivered IAW C.5.11.

C.5 Deliverables

C.5.1 Bi-Monthly Reports: The contractor shall submit bi-monthly (every two months) progress reports for the duration of this contract IAW CDRL A001. The first report shall be due 60 days after contract award. Subsequent reports are due every 60 days thereafter.

C.5.2 SiC Generator Controller Units: The Contractor shall deliver two (2) identical, functioning SiC generator controllers that meet

Name of Offeror or Contractor: SCIENCE APPLICATIONS INTERNATIONAL CORPORATION

the requirements specified above no later than 18.5 months after contract award. The two controllers shall be delivered to the physical address stated in F.1.1. The contractor shall also deliver the final version of firmware required for operation of the generator controller IAW CDRL A010 no later than 18.5 months after contract award to the physical address stated in F.1.1. of the contract.

C.5.3 Performance Specification and Interface Control Document: The Contractor shall develop and deliver a non-proprietary, public releasable Performance Specification and Interface Control Document (ICD) that will allow for competitive future procurement and integration into an electrical power system. The contractor shall deliver the Performance Specification and ICD to the COR IAW CDRL A005 within 18 months of contract award. The contractor shall provide a draft of the Performance Specification and ICD to the COR no later than 17 months after award. The COR will concur or comment within 15 calendar days of each design review. Any revisions required to obtain COR approval shall be made and resubmitted to the COR for approval within 15 calendar days of receipt of COR comments.

C.5.4 Functional Diagrams and Schematics: The Contractor shall deliver functional diagrams and schematics IAW CDRL A006 to describe the operation of the controller for the generator controller hardware and software developed and delivered under this contract. The contractor shall deliver Preliminary, Revised, Final, and As-Built functional diagrams and schematics IAW CDRL A006. The preliminaries shall be delivered no later than seven (7) calendar days prior to PDR (C.4.2). The revised shall be delivered no later than seven (7) calendar days prior to CDR (C.4.3). The finals shall be due no later than seven (7) calendar days prior to the FDR (C.4.4). The As-Built Finals shall be delivered no later than 23 months after award. The contractor shall obtain COR approval of each design iteration prior to proceeding with the effort. The COR will concur or comment within 15 calendar days of each design review. Any revisions required to obtain COR approval shall be made and resubmitted to the COR for approval within 15 calendar days of receipt of COR comments.

C.5.5 PRO-E Compatible Models of Exterior Envelope: The Contractor shall deliver the electronic version of the PRO-E compatible models of the exterior envelope, with connections and mounting points, for the generator controller IAW CDRL A006. The contractor shall deliver Preliminary, Revised, Final, and As-Built PRO-E compatible models of the exterior envelop IAW CDRL A006. The preliminaries shall be delivered no later than seven (7) calendar days prior to PDR (C.4.2). The revised shall be delivered no later than seven (7) calendar days prior to CDR (C.4.3). The finals shall be due no later than seven (7) calendar days prior to the FDR (C.4.4). The As-Built shall be delivered no later than 23 months after award. The contractor shall obtain COR approval of each design iteration prior to proceeding with the effort. The COR will concur or comment within 15 calendar days of each design review. Any revisions required to obtain COR approval shall be made and resubmitted to the COR for approval within 15 calendar days of receipt of COR comments.

C.5.6 GUI Software: The Contractor shall deliver the GUI software to the COR IAW CDRL A007 within 18.5 months of contract award.

C.5.7 GUI Software User Manual: The contractor shall deliver the user manual for the GUI software IAW CDRL A007 within 18 months of contract award. A draft of the GUI software user manual shall be delivered to the COR no later than 17 months after award. The COR will review and approve or comment on the user manual within 15 calendar days of receipt. The contractor shall revise and resubmit the Final GUI software manual within 15 calendar days of receipt of COR comments

C.5.8 Final Report: The contractor shall deliver a Final Report IAW CDRL A002 no later than 24 months after award. This report shall include all data collected during tests and the test results, source code developed under this effort, recommendations for future improvements, and lessons learned. A draft of the final report shall be delivered to the COR no later than 23 months after award. The COR will review and provide comments within 15 calendar days after receipt. The contractor shall incorporate COR comments and submit the Final Report within 15 calendar days after receipt of COR comments.

C.5.9 The contractor shall deliver the generator controllers, any fixturing, test loads, and tooling required for performance of the generator controllers in the TARDEC labs, and the GUI to the physical address stated in F.1.1. of the contract.

C.5.10 Presentation Materials: The contractor shall deliver presentation materials IAW CDRL A003. All presentation materials shall include an agenda and program plan. Presentation materials shall be provided to the COR no later than seven (7) calendar days prior to the applicable meeting or review unless otherwise stated in the statement of work. The contractor shall obtain COR approval of the program plan and any subsequent update thereto prior to proceeding with the effort. The COR will concur or comment on the program plan within 15 calendar days after each meeting and review. Any revisions required to obtain COR approval shall be made and resubmitted to the COR for approval within 15 calendar days of receipt of COR comments.

C.5.11 Meeting Minutes: The contractor shall deliver conference minutes (meeting minutes) IAW CDRL A004. All meeting minutes shall be provided to the COR no later seven (7) calendar days after each meeting.

C.5.12 Test Plan: The contractor shall deliver a test plan IAW CDRL A008 to the COR no later than four (4) months after contract award. The contractor shall provide a draft of the test plan no later than three (3) months after contract award. The COR will comment or concur within 15 calendar days after receipt. The contractor shall submit any requested revisions to the test plan within 15 calendar days after receipt of COR comments.

C.5.13 Preliminary Test Data Report: The contractor shall deliver the preliminary test data report IAW CDRL A009. The preliminary test data report shall be delivered to the COR no later than seven (7) calendar days prior to the Test Readiness Review IAW C.4.5. The COR will concur or comment within 15 calendar days after receipt. Any revisions required to obtain COR approval shall be made and resubmitted to the COR for approval within 15 calendar days of receipt of COR comments.

CONTINUATION SHEET	Reference No. of Document Being Continued PIIN/SIIN W56HZV-13-C-0349 MOD/AMD P00001	Page 12 of 12
---------------------------	---	----------------------

Name of Offeror or Contractor: SCIENCE APPLICATIONS INTERNATIONAL CORPORATION

C.5.14 Training Plan: The contractor shall deliver a training plan IAW CDRL A011 no later than 18 months after award. The contractor shall provide a draft of the training plan to the COR no later than 17 months after award. The COR will review and approve or comment on the training plan within 15 calendar days of receipt. The contractor shall revise and resubmit within 15 calendar days of receipt of COR comments. Any fixturing, test loads, tooling, cables, or connectors required to conduct the training at the TARDEC lab beyond what is owned by the government in the TARDEC labs, shall be a deliverable under this contract IAW C.5.9.

C.6 Security: The contractor shall adhere to the security requirements as stated in Section H.2 for any activity conducted on-site at the Detroit Arsenal as described in the statement of work above.

*** END OF NARRATIVE C0001 ***