

**AWARD/CONTRACT** | 1. THIS CONTRACT IS A RATED ORDER UNCL DPAS (15 CFR 33D) | RATING | PAGE OF PAGE 1 | 21

2. CONTRACT (Proc. Inv. Memo) NO. HR0011-09-C-0054 | 3. EFFECTIVE DATE 14 Apr 2009 | 4. REQUISITION/PURCHASE REQUEST/PROJECT NO. Y14309

5. ISSUED BY CODE HR0011 | 6. ADMINISTERED BY (if other than Item 4) CODE 8387FA  
 DARPA  
 ONO  
 ATTN: CHRISTOPHER GLISTA  
 3701 N. FAIRFAX DR.  
 ARLINGTON VA 22208  
 DCMA AIRCRAFT PROPELLION OPERATIONS  
 ONE ENGINE  
 1009 WESTERN AVENUE  
 LYNN MA 01910-0445

7. NAME AND ADDRESS OF CONTRACTOR (Do not omit any company name and zip code)  
 GENERAL ELECTRIC COMPANY  
 1 MELBAHN WY  
 CINCINNATI OH 45215-1000  
 8. DELIVERY [ ] FOB ORIGIN [ X ] OTHER (See below)  
 9. DISCOUNT FOR PROMPT PAYMENT N/A  
 10. SUBMIT INVOICES 1 ITEM  
 (If number or date other than specified TO THE ADDRESS SHOWN ON SECTION G

CODE 07482 | FACILITY CODE  
 11. SHIP TO/MARK FOR CODE HR0011 | 12. PAYMENT WILL BE MADE BY CODE HC0857  
 DARPA  
 3701 NORTH FAIRFAX DRIVE  
 ARLINGTON VA 22208-1714  
 DCMA COLUMBUS CENTER  
 NORTH ENTITLEMENT OPERATIONS  
 P.O. BOX 182266  
 COLUMBUS OH 43218-2266

13. AUTHORITY FOR USING OTHER THAN FULL AND OPEN COMPETITION: [ ] 10 U.S.C. 2304(a)(2) [ ] 41 U.S.C. 253(c)(1) | 14. ACCOUNTING AND APPROPRIATION DATA See Schedule

15A. ITEM NO.	15B. SUPPLIES/ SERVICES	15C. QUANTITY	15D. UNIT	15E. UNIT PRICE	15F. AMOUNT
<b>SEE SCHEDULE</b>					

15G. TOTAL AMOUNT OF CONTRACT 23,984,008.00

16. TABLE OF CONTENTS

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CONTRACTING OFFICER WILL COMPLETE ITEM 17 OR 18 AS APPLICABLE

17. [ X ] CONTRACTOR'S NEGOTIATED AGREEMENT (Contractor is required to sign this form and attach it to the contract.) Contractor agrees to furnish and deliver all work or perform all the services set forth or otherwise identified above and on any continuation sheets for the contract and award funds. The rights and obligations of the parties to this contract shall be subject to and governed by the following documents: (a) this award document, (b) the solicitation, if any, and (c) such previous representations, certifications, and qualifications as are attached or incorporated by reference herein.

18. [ ] AWARD (Contractor is not required to sign this document.) Your offer on Solicitation Number \_\_\_\_\_ including the additions or changes made by you which additions or changes are set forth in full above, is hereby accepted as to the items listed above and on any continuation sheets. This award constitutes the contract which consists of the following documents: (a) the Government's solicitation and your offer, and (b) this award document. No further contractual documents are necessary.

19A. NAME AND TITLE OF CONTRACTING OFFICER  
 (b)(4)  
 20A. NAME OF CONTRACTING OFFICER  
 CHRISTOPHER L. GLISTA  
 TEL: (571) 318-4405 | EMAIL: christopher.glista@daron.mil  
 19C. DATE SIGNED  
 (b)(4) | april 10, 2009  
 20B. UNITED STATES OF AMERICA  
 (b)(6)  
 20C. DATE SIGNED  
 4/16/09

Section B - Supplies or Services and Prices

<u>CONTRACT LINE ITEM NO. (CLIN)</u>	<u>SUPPLIES/SERVICES</u>	<u>ESTIMATED COST</u>	<u>FIXED FEE</u>	<u>TOTAL ESTIMATED COST PLUS FIXED FEE</u>
0001	<p>The Contractor shall perform the Vulcan Program, Phase I in accordance with Attachment No. 1 - Statement of Work entitled, "Phase I - Vulcan System Concept Definition," and Section C-1 of the Contract. Technical data, reports, and other deliverables are not separately priced and shall be provided to the Government in accordance with Sections C-2, F-2, F-3, and Attachment No. 1 of the Contract.</p>	(b)(4)	(b)(4)	\$3,854,000.00
000101	<p>Funding for CLIN 0001 AO No. Y143/00 ACRN AA: \$3,854,000.00</p>			

Section C - Descriptions and Specifications

CLAUSES INCORPORATED BY FULL TEXT

C-1 Scope of Work

(a) The Contractor shall furnish the necessary personnel, materials, facilities and other services as may be required to perform Contract Line Item Number (CLIN) 0001 in accordance with the Statement of Work entitled, "Phase I - Vulcan System Concept Definition," in support of the Vulcan Program, Phase I. A copy of the Statement of Work is incorporated into the Contract as Attachment No. 1.

(b) Phase II: Prior to the expiration of the term of the Basic Contract, the Government shall evaluate both the research results of Phase I against a set of Government Go and No-Go Criteria for Phase II as stipulated in Attachment No. 2, and the Contractor's Phase II proposal described in Section C-2(a)(3), and determine whether research work shall continue into the next phase.

C-2 Reports and Other Deliverables

(a) The Contractor shall submit the following reports and other deliverables in accordance with the delivery schedule set forth in Section F. Reports and other deliverables shall be submitted in writing, as defined in FAR 2.101, or as specified below:

(1) R&D STATUS REPORT. This brief narrative, not to exceed five pages in length, shall contain the following:

- (i) For first report only; the date work actually started.
- (ii) Description of progress during the reporting period, supported by reasons for any change in approach reported previously
- (iii) Planned activities and milestones for the next reporting period.
- (iv) Description of any major items of experimental or special equipment purchased or constructed during the reporting period.
- (v) Notification of any changes in key personnel associated with the contract during the reporting period.
- (vi) Summary of substantive information derived from noteworthy trips, meetings, and special conferences held in connection with the contract during the reporting period.
- (vii) Summary of all problems or areas of concern.
- (viii) Related accomplishments since last report.
- (ix) Fiscal status, to include reporting of summary level financial data in the following format:

R&D STATUS REPORT  
PROGRAM FINANCIAL STATUS

Work Breakdown	Cumulative to Date			At Completion		
Structure or Task Element	Planned Expend	Actual Expend	% Budget Compl	At Compl	Latest Revised Estimate	Remarks
Subtotal: _____						
Management Reserve: _____						

Or  
Unallocated  
Resources: \_\_\_\_\_

TOTAL: \_\_\_\_\_

Note: Budget at completion changes only with the amount of any scope changes. (Not affected by underrun or overrun)

Based on currently authorized work:

Is current funding sufficient for the current fiscal year (FY)? (Explain in narrative if "NO")  
YES NO

What is the next FY funding requirement at current anticipated levels?  
\$ \_\_\_\_\_

Have you included in the report narrative any explanation of the above data and are they cross-referenced?  
YES NO

(2) FINAL TECHNICAL REPORT FOR PHASE I. This report shall document the results of the complete effort and should be delivered at the completion of the Contract. Title pages shall include a disclaimer worded substantially as follows:

"The views and conclusions contained in this document are those of the authors and should not be interpreted as representing the official policies, either expressly or implied, of the Defense Advanced Research Projects Agency or the U.S. Government."

The Final Technical Report summary shall include:

- Task Objectives
- Technical Problems
- General Methodology (i.e., literature review, laboratory experiments, surveys, etc.)
- Technical Results
- Important Findings and Conclusions
- Significant Hardware Development
- Special Comments
- Implications for Further Research
- Standard Form 298, August 1998

(3) PHASE II PROPOSAL. The Contractor shall prepare and deliver a full cost and technical proposal for Phase II seven (7) months after the award of the Contract for the Government's consideration. The Phase II proposal shall consist of the Phase I final review deliverables, an updated Phase II Statement of Work, integrated Master Schedule (IMS), and Cost Estimate to Work Breakdown Structure (WBS) level 4 detail. Additionally, an updated management and staffing plan shall be provided. Each test and demonstration must be a uniquely described and priced WBS element. The Phase II proposal shall use the same WBS established with the Phase I proposal and this WBS should be used to link the IMS and cost. The Contractor shall also include an update to the Phase III program plan to WBS level 3 and the Phase IV program plan to WBS level 2.

(4) **ADDITIONAL MISCELLANEOUS DATA DELIVERABLES.** The Contractor shall also deliver those items listed in the Contract Attachment No. 1 - Statement of Work, as applicable. The Contractor shall adhere to the schedule, as applicable, contained in the Statement of Work. Presentation materials (hard and softcopy) for all briefings given to the Government shall be provided in the Contractor's format.

(b) Reports delivered by the Contractor in the performance of the Contract shall be considered "Technical Data" as defined in Section I Contract clauses entitled "Rights in Technical Data - Noncommercial Items" and "Rights in Noncommercial Computer Software and Noncommercial Computer Software Documentation."

(c) Bulky Reports shall be mailed by other than first-class mail unless the urgency of submission requires use of first-class mail. In this situation, one copy shall be mailed first-class and the remaining copies forwarded by less than first-class.

(d) All papers and articles published as a result of DARPA sponsored research shall include a statement reflecting the sponsorship. In addition, a bibliography of the titles and authors of all such papers are to be included in the Final Technical Report

(1) The cover or title page of each of the above reports or publications prepared, will have the following citation:

Sponsored by  
Defense Advanced Research Projects Agency  
Tactical Technology Office (TTO)  
Program: Vulcan Program, Phase I  
Issued by DARPA/CMO under Contract No. HR0011-09-C-0054

(2) The title page shall include a disclaimer worded substantially as follows:

"The views and conclusions contained in this document are those of the authors and should not be interpreted as representing the official policies, either expressly or implied, of the Defense Advanced Research Projects Agency or the U.S. Government."

(3) All technical reports must (i) be prepared in accordance with American National Standards Institute (ANSI) Standard Z39.18; (ii) include a Standard Form 298, August 1998; and (iii) be marked with an appropriate Distribution Statement.

(4) Distribution Statement B applies. "Distribution authorized to U.S. Government agencies only due to the inclusion of proprietary information and to prevent Premature Dissemination of potentially critical technological information. Other requests for this document shall be referred to DARPA Technical Office via email at [tio@darpa.mil](mailto:tio@darpa.mil)."

**Section D - Packaging and Marking**

**CLAUSES INCORPORATED BY FULL TEXT**

**D-1 Packaging and Marking**

All items shall be preserved, packaged, packed and marked in accordance with best commercial practices to meet the packing requirements of the carrier, and to ensure safe delivery at destination.

Section E - Inspection and Acceptance

CLAUSES INCORPORATED BY REFERENCE

52.246-9	Inspection Of Research And Development (Short Form)	APR 1984
252.246-7000	Material Inspection And Receiving Report	MAR 2008

CLAUSES INCORPORATED BY FULL TEXT

E-1 Inspection and Acceptance

Supplies/services will be inspected/accepted at destination by the Contracting Officer's Representative identified in Section G herein.

Use of the DD 250 is required for submission of the Final Technical Report only.

## Section F - Deliveries or Performance

## CLAUSES INCORPORATED BY REFERENCE

52.247-34

F.O.B. Destination

NOV 1991

## CLAUSES INCORPORATED BY FULL TEXT

F-1 Term of Contract

The term of the Contract commences on April 14, 2009 and continues through December 13, 2009. \*

\* An Authorization to Incur Pre-Award Costs was issued to the Contractor on March 6, 2009 (see Attachment No. 6 - Advance Agreement to Incur Pre-Award Costs under Contract HR0011-09-C-0054).

F-2 Reports and Other Deliverables

Delivery of all reports and other deliverables shall be made to the addressee specified in F-3 entitled "Report Distribution" in accordance with the following:

<u>CLIN</u>	<u>Description</u>	<u>Due Date</u>
0001	R&D Status Report	On a monthly basis, within fifteen (15) days after the end of the previous reporting month
0001	Final Technical Report for Phase I	Upon completion of Phase I
0001	Phase II Proposal	Seven (7) months after the award of the Contract
0001	Additional Miscellaneous Data Deliverables	See Attachment No. 1 - Statement of Work

F-3 Report Distribution

- (a) DARPA/Tactical Technology Office (TTO)  
ATTN: Dr. Thomas Bussing  
3701 North Fairfax Drive  
Arlington, VA 22203-1714  
Email: thomas.bussing@darpa.mil  
(one copy of every report and deliverable)
- (b) DARPA/Tactical Technology Office (TTO)  
ATTN: Assistant Director, Program Management (ADPM)  
3701 North Fairfax Drive  
Arlington, VA 22203-1714  
Email: adpm-tto@darpa.mil  
(one copy of the R&D Status Reports and Final Report)



- (c) Major David Hopper, Contracting Officer's Representative  
Turbine Engine Division (AFRL/RZT),  
1950 5th Street  
WPAFB OH 45433  
Email: david.hopper@us.af.mil  
(one copy of every report and deliverable)
- (d) DARPA/Library  
3701 North Fairfax Drive  
Arlington, VA 22203-1714  
(one copy of the Final Report)
- (e) Defense Technical Information Center
- (1) Email: TR@dtic.mil  
(one electronic copy of the Final Report, if unclassified)  
OR
- (2) Attn: DTIC-BCS  
8725 John J. Kingman Road, Suite 0944  
Fort Belvoir, VA 22060-0944  
(two hard copies of the Final Report, if unclassified)
- (f) DARPA/Contracts Management Office (CMO)  
ATTN: Christopher L. Glista  
3701 North Fairfax Drive  
Arlington, VA 22203-1714  
Email: reportscg@darpa.mil  
(one copy of the R&D Status Reports and Final Report)

Note 1: (a) through (f) – submissions of unclassified materials only. Submission of classified material shall be coordinated through DARPA SID and/or Dr. Thomas Bussing, DARPA Program Manager, in accordance with the DD 254, as applicable.

Note 2: For the Final Technical Report(s), the Contractor must also comply with the distribution requirements of DFARS 252-235-7011, as applicable.

F-4 Notice Regarding Late Delivery

In the event the Contractor anticipates difficulty in complying with the Contract delivery schedule, the Contractor shall immediately notify the Contracting Officer in writing, giving pertinent details, including the date by which it expects to make delivery; PROVIDED, however, that this date shall be informational only in character and the receipt thereof shall not be construed as a waiver by the Government of any contract delivery schedule, or any rights or remedies provided by law or under this Contract.

## Section G - Contract Administration Data

## ACCOUNTING AND APPROPRIATION DATA

**ACRN AA 9790400 1320 Y143 P9G10 2525 DPAC 9 5134 S12136 62702E \$3,854,000.00**  
 (ARPA Order No. Y143/00)

## CLAUSES INCORPORATED BY FULL TEXT

G-1 Procuring Office Representative/Contracting Officer

(a) The Procuring Office Representative/Contracting Officer is Christopher L. Glista, DARPA/CMO, 3701 North Fairfax Drive, Arlington, VA 22203-1714, telephone: (571) 218-4405, Email: christopher.glista@darpa.mil.

(b) Notwithstanding any other provision of this contract, the Contracting Officer is the only individual authorized to redirect the effort or in any way amend or modify any of the terms of this contract. If, as a result of technical discussions, it is desirable to alter contract obligations or statement of work, a modification must be issued in writing and signed by the Contracting Officer.

G-2 Electronic Submission of Payment Requests

(a) Invoices for goods received or services rendered under this contract shall be submitted electronically through Wide Area Work Flow – Receipt and Acceptance (WAWF):

(1) Vendors that have never used WAWF shall follow the directions in the WAWF Vendor Getting Started Guide available at the following website:

<http://www.dfas.mil/contractorpay/electroniccommerce/wideareaworkflow.html>

This website also contains links for Vendor training and practice. Additional support can be obtained by calling WAWF Customer Service at 866-618-5988.

(2) Back up documentation (such as timesheets, monthly status reports, etc.) can be included and attached to the invoice in WAWF. Attachments should be in PDF format, but Attachments created in any Microsoft Office product may be attached. Total limit for the size of files per invoice is 5 megabytes.

(b) The following information, regarding invoice routing DoDAAC's, must be entered for completion of the invoice in WAWF:

WAWF Invoice Type:	Select Cost Voucher for all Cost or T&M contracts or CLINs
Issuing Office DoDAAC	HR0011
Admin Office DoDAAC	S2207A
Service Approver DoDAAC (Cost Voucher)	S2207A
DCAA Office DoDAAC (Used on Cost Vouchers only)	HAA150
Paying Office DoDAAC	HQ0337

(c) Cost Vouchers from Contractors approved by DCAA for direct billing will be directly routed to DFAS. Cost Vouchers from Contractors not approved for direct billing will be routed to DCAA for approval before the Cost

Voucher is routed to DFAS. All Final Cost Voucher submissions will be routed to the Service Approver for approval. The DCAA office for this award is:

DCAA Indianapolis Branch Office  
8899 E. 56th Street  
Column 116-AA  
Indianapolis, IN 46249  
DoDAAC: HAA150  
E-mail: dcaa-fao1621@dcaa.mil

(d) For each invoice/cost voucher submitted for payment, the contractor shall also e-mail the WAWF automated invoice notice directly to the following points of contact:

Name	E-mail	Phone	Role
Major David Hopper	david.hopper@us.af.mil	(937) 255-7070	COR
Christopher L. Glista	christopher.glista@darpa.mil	(571) 218-4405	Contracting Officer

**G-3 Delegation of Authority for Contract Administration**

DCMA Aircraft Propulsion Operations GE Engines is hereby designated as the Contracting Officer's authorized representative for administering this contract in accordance with current directives.

**G-4 Contracting Officer's Representative (COR)**

(a) Performance of work under this contract shall be subject to the technical direction of Major David Hopper, Turbine Engine Division (AFRL/RZT), 1950 5th Street, WPAFB OH 45433, Telephone: (937) 255-7070, Email: david.hopper@us.af.mil. Such technical direction includes those instructions to the Contractor necessary to accomplish the Statement of Work. The COR is not otherwise authorized to make any representations or commitments of any kind on behalf of the Contracting Officer or the Government. The COR does not have the authority to alter the Contractor's obligations or to change the specifications of the contract.

(b) Technical direction shall not include any direction which:

- (1) Constitutes additional work outside the scope of work;
- (2) Constitutes a change as defined in Section I contract clause entitled "Changes";
- (3) In any manner causes an increase or decrease in the total estimated cost or the time required for contract performance; or
- (4) Changes any of the stated terms, conditions, or specifications of the contract.

(c) A copy of the Contracting Officer's Representative designation memorandum is incorporated into the Contract as Attachment No. 3.

**G-5 Instructions for Multiple Accounting Classification Citations**

Payments under contract line items funded by multiple accounting classification citations shall be made from the earliest available fiscal year funding sources. The earliest assigned ACRN must be fully disbursed before making disbursements from a succeeding ACRN.

G-6 Payment of Cost and Fee

(a) As consideration for the proper performance of work required under this contract, the Contractor shall be paid as follows:

(1) Costs, as provided for under Section I contract clause titled "Allowable Cost and Payment" not to exceed the amount set forth as "Total Estimated Cost" in Section B, and subject further to those Section I clauses entitled "Limitation of Cost" or "Limitation of Funds".

(2) A fixed fee in the amount set forth as "Fixed Fee" in Section B, in accordance with the Section I contract clause entitled "Fixed Fee". The Contractor may bill on each invoice the amount of the fixed fee bearing the same percentage to the total fixed fee as the amount of cost billed bears to the total estimated cost.

## Section H - Special Contract Requirements

## CLAUSES INCORPORATED BY FULL TEXT

H-1 Type of Contract

This is a Cost-Plus-Fixed-Fee, Completion Contract.

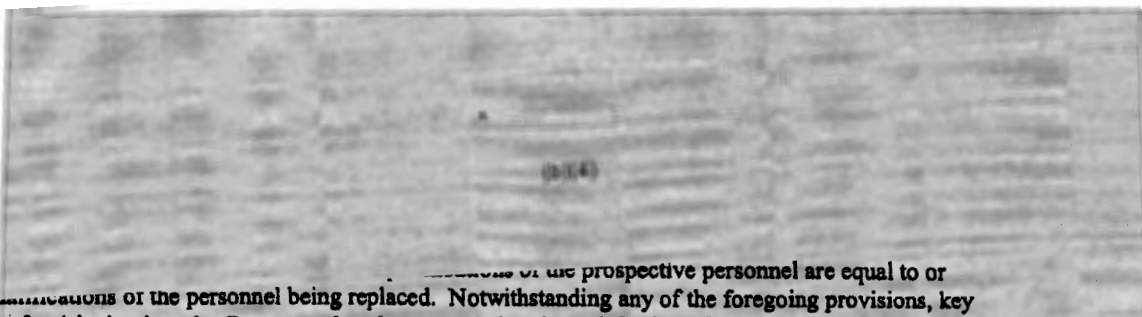
H-2 Public Release or Dissemination of Information

(a) There shall be no dissemination or publication, except within and between the Contractor and any subcontractors, of information developed under this contract or contained in the reports to be furnished pursuant to this contract without prior written approval of the DARPA Technical Information Officer (DARPA/TIO). All technical reports will be given proper review by appropriate authority to determine which Distribution Statement is to be applied prior to the initial distribution of these reports by the Contractor. Papers resulting from unclassified contracted fundamental research are exempt from prepublication controls and this review requirement, pursuant to DoD Instruction 5230.27 dated October 6, 1987.

(b) When submitting material for written approval for open publication as described in subparagraph (a) above, the Contractor must submit a request for public release request to the DARPA TIO and include the following information: 1) Document Information: document title, document author, short plain-language description of technology discussed in the material (approx 30 words), number of pages (or minutes of video) and document type (briefing, report, abstract, article, or paper); 2) Event Information: event type (conference, principle investigator meeting, article or paper), event date, desired date for DARPA's approval; 3) DARPA Sponsor: DARPA Program Manager, DARPA office, and contract number; and 4) Contractor's Information: POC name, e-mail and phone. Allow four weeks for processing; due dates under four weeks require a justification. Unusual electronic file formats may require additional processing time. Requests can be sent either via e-mail to [tio@darpa.mil](mailto:tio@darpa.mil) or via 3701 North Fairfax Drive, Arlington VA 22203-1714, telephone (571) 218-4235. Refer to [www.darpa.mil/tio](http://www.darpa.mil/tio) for information about DARPA's public release process.

H-3 Key Personnel

(a) The Contractor shall notify the Contracting Officer prior to making any change in key personnel. Key personnel are defined as follows:



...of the prospective personnel are equal to or better than the qualifications of the personnel being replaced. Notwithstanding any of the foregoing provisions, key personnel shall be furnished unless the Contractor has demonstrated to the satisfaction of the COR that the qualifications of the proposed substitute personnel are equal to or better than the qualifications of the personnel being replaced.

**H-4 Restrictions on Printing**

Unless otherwise authorized in writing by the Contracting Officer, reports, data, or other written material produced using funds provided by this contract and submitted hereunder shall be reproduced only by duplicating processes and shall not exceed 5,000 single page reports or a total of 25,000 pages of a multiple-page report. These restrictions do not preclude the writing, editing, preparation of manuscript or reproducible copy of related illustrative materials if required as part of this contract, or incidental printing such as forms or materials necessary to be used by the Contractor to respond to the terms of the contract.

**H-5 Invention Disclosure and Reports**

All written communications required by DFARS clause 252.227-7038, "Patent Rights - Ownership by the Contractor (Large Business)" (DEC 2007) shall be submitted to the Administrative Contracting Officer (ACO). All required reporting shall be accomplished using the i-Edison.gov reporting website: <https://s-edison.info.nih.gov/iEdison/>.

**H-6 Contractor Representations and Certifications**

The Contractor's Representations and Certifications dated January 8, 2009 and a copy of the Contractor's Online Representations and Certifications (ORCA) effective from September 10, 2008 through September 10, 2009 are incorporated herein by reference.

**H-7 Insurance Schedule**

The Contractor shall maintain the types of insurance listed in FAR 28.307-2 (a), (b) and (c), with the minimum amounts of liability indicated therein. The types of insurance coverage listed in paragraphs (d) and (e) shall also be maintained when applicable.

**H-8 Travel**

(a) Reimbursement for travel-related expenses shall be in accordance with the Contractor's approved travel policy. The Federal Travel Regulations, Joint Travel Regulations (JTR), and Standardized Regulations as stated in FAR 31.205-46 will be used as a guide in determining reasonableness of per diem costs. Costs for travel shall be allowable subject to the provisions of FAR 31.205-46.

(b) In connection with direct charge to the contract of travel-related expenses, the Contractor shall hold travel to the minimum required to meet the objectives of the contract, and substantial deviations from the amount of travel agreed to during contract negotiation shall not be made without the authorization of the Contracting Officer.

When applicable, the Contractor shall notify the COR of proposed travel of an employee beyond that agreed to during negotiations.

(c) Approval of the Contracting Officer shall be obtained in advance for attendance by personnel at training courses, seminars, and other meetings not directly related to contract performance if the costs for the courses, seminars, and other meetings are charged to the contract.

(d) All foreign travel shall be authorized and approved in advance, in writing, by the Contracting Officer. Request for such travel must be submitted to the Contracting Officer at least thirty (30) days in advance of traveler's anticipated departure date, and shall include traveler's itinerary of United States Flag Air Carriers.

**H-9 Metric System**

(a) The Defense Advanced Research Projects Agency (DARPA) will consider the use of the metric system in all of its activities consistent with operational, economical, technical and safety requirements.

(b) The metric system will be considered for use in all new designs. When it is deemed not to be in the best interest of the DoD to provide metric design, justification shall be provided.

(c) Physical and operational interfaces between metric items and U.S. customary items will be designed to assure that interchangeability and interoperability will not be affected.

(d) Existing designs dimensioned in U.S. customary units will be converted to metric units only if determined to be necessary or advantageous. Unnecessary retrofit of existing systems with new metric components will be avoided where both the new metric and existing units are interchangeable and interoperable. Normally, the system of measurement in which an item is originally designed will be retained for the life of the item.

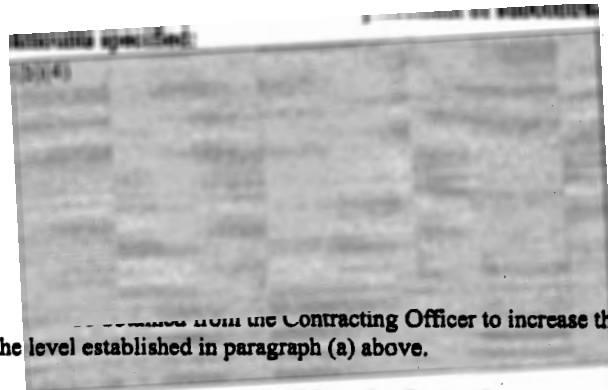
(e) During the metric transition phase hybrid metric and U.S. customary designs will be necessary and acceptable. Material components, parts, subassemblies, and semi-fabricated material, which are of adequate or when it is otherwise specifically determined to be in the best interest of the Department of Defense. Bulk materials will be specified and accepted in metric units when it is expedient or economical to do so.

(f) Technical reports, studies, and position papers, (except those pertaining to items dimensioned in U.S. customary units) will include metric units of measurement in addition to or in lieu of U.S. customary units. With respect to existing contracts, this requirement applies only if such documentation can be obtained without an increase in contract costs.

(g) Use of the dual dimensions (i.e., both metric and U.S. customary dimensions) on drawings will be avoided unless it is determined in specific instances that such usage will be beneficial. However, the use of tables on the document to translate dimensions from one system of measurement to the other is acceptable.

**H-10 Consent to Subcontract**

(a) Pursuant to the clause of the General Provisions entitled "Subcontracts (JUN 2007)," FAR 52.244-2(j), the Contracting Officer hereby consents to the placement of subcontract(s) with the following firm(s)/consultant(s) at the ceiling



(b) [Redacted] from the Contracting Officer to increase the use or number of subcontractors from the level established in paragraph (a) above.

**H-11 Small Business Subcontracting Plan and Goals**

The Contractor's Comprehensive Small Business Subcontracting Plan for Fiscal Year 2009 approved on September 30, 2008 is incorporated herein and made a part of the Contract by reference.

**H-12 Proprietary Technical Data and Computer Software**

Any deliverable technical data or computer software developed or generated at private expense and considered to be proprietary by the Contractor or subcontractors shall be delivered in accordance with DFARS 252.227-7013 and 252.227-7014. A list of such data and/or software is incorporated into the Contract as Attachment No. 4.

**H-13 Export Control Clause**

(a) The contractor shall comply with all U. S. export control laws and regulations, including the International Traffic in Arms Regulations (ITAR), 22 CFR Parts 120 through 130, and the Export Administration Regulations (EAR), 15 CFR Parts 730 through 799, in the performance of this contract. In the absence of available license exemptions/exceptions, the Contractor shall be responsible for obtaining the appropriate licenses or other approvals, if required, for exports of (including deemed exports) hardware, technical data, and software, or for the provision of technical assistance.

(b) The Contractor shall be responsible for obtaining export licenses, if required, before utilizing foreign persons in the performance of this contract, including instances where the work is to be performed on-site at any Government installation (whether in or outside the United States), where the foreign person will have access to export-controlled technical data or software.

(c) The Contractor shall be responsible for all regulatory record keeping requirements associated with the use of licenses and license exemptions/exceptions.

(d) The Contractor shall be responsible for ensuring that the provisions of this clause apply to its subcontractors.

**H-14 Military Security Classification**

Military security requirements in the performance of the Contract shall be maintained in accordance with the DD Form 254, Contract Security Classification Specification, contained in Section J, Attachment No. 5.

**H-15 Pre-Contract Costs**

The extent of allowability of costs incurred by the Contractor prior to the effective date of the Contract shall be governed by the Advance Agreement to Authorize Incurrence of Pre-Award Costs dated March 6, 2009, a copy of which is incorporated into the Contract as Attachment No. 6 under Section J.



## Section I - Contract Clauses

## CLAUSES INCORPORATED BY REFERENCE

52.202-1	Definitions	JUL 2004
52.203-3	Gratuities	APR 1984
52.203-5	Covenant Against Contingent Fees	APR 1984
52.203-6	Restrictions On Subcontractor Sales To The Government	SEP 2006
52.203-7	Anti-Kickback Procedures	JUL 1995
52.203-8	Cancellation, Rescission, and Recovery of Funds for Illegal or Improper Activity	JAN 1997
52.203-10	Price Or Fee Adjustment For Illegal Or Improper Activity	JAN 1997
52.203-12	Limitation On Payments To Influence Certain Federal Transactions	SEP 2007
52.204-2	Security Requirements	AUG 1996
52.204-4	Printed or Copied Double-Sided on Recycled Paper	AUG 2000
52.204-7	Central Contractor Registration	APR 2008
52.209-6	Protecting the Government's Interest When Subcontracting With Contractors Debarred, Suspended, or Proposed for Debarment	SEP 2006
52.215-2	Audit and Records--Negotiation	JUN 1999
52.215-8	Order of Precedence--Uniform Contract Format	OCT 1997
52.215-10	Price Reduction for Defective Cost or Pricing Data	OCT 1997
52.215-12	Subcontractor Cost or Pricing Data	OCT 1997
52.215-14 Alt I	Integrity of Unit Prices (Oct 1997) - Alternate I	OCT 1997
52.215-15	Pension Adjustments and Asset Reversions	OCT 2004
52.215-16	Facilities Capital Cost of Money	JUN 2003
52.215-18	Reversion or Adjustment of Plans for Postretirement Benefits (PRB) Other than Pensions	JUL 2005
52.215-21	Requirements for Cost or Pricing Data or Information Other Than Cost or Pricing Data--Modifications	OCT 1997
52.216-7	Allowable Cost And Payment	DEC 2002
52.216-8	Fixed Fee	MAR 1997
52.219-8	Utilization of Small Business Concerns	MAY 2004
52.219-28	Post-Award Small Business Program Rerepresentation	JUN 2007
52.222-2	Payment For Overtime Premiums	JUL 1990
52.222-3	Convict Labor	JUN 2003
52.222-21	Prohibition Of Segregated Facilities	FEB 1999
52.222-26	Equal Opportunity	MAR 2007
52.222-35	Equal Opportunity For Special Disabled Veterans, Veterans of the Vietnam Era, and Other Eligible Veterans	SEP 2006
52.222-36	Affirmative Action For Workers With Disabilities	JUN 1998
52.222-37	Employment Reports On Special Disabled Veterans, Veterans Of The Vietnam Era, and Other Eligible Veterans	SEP 2006
52.222-39	Notification of Employee Rights Concerning Payment of Union Dues or Fees	DEC 2004
52.222-50	Combating Trafficking in Persons	FEB 2009
52.223-14	Toxic Chemical Release Reporting	AUG 2003
52.225-13	Restrictions on Certain Foreign Purchases	JUN 2008
52.226-1	Utilization Of Indian Organizations And Indian-Owned Economic Enterprises	JUN 2000
52.227-1 Alt I	Authorization And Consent (Dec 2007) - Alternate I	APR 1984

52.227-2	Notice And Assistance Regarding Patent And Copyright Infringement	DEC 2007
52.227-10	Filing Of Patent Applications--Classified Subject Matter	DEC 2007
52.228-7	Insurance--Liability To Third Persons	MAR 1996
52.230-3	Disclosure And Consistency Of Cost Accounting Practices	OCT 2008
52.230-6	Administration of Cost Accounting Standards	MAR 2008
52.232-9	Limitation On Withholding Of Payments	APR 1984
52.232-17	Interest	OCT 2008
52.232-20	Limitation Of Cost	APR 1984
52.232-23 Alt I	Assignment of Claims (Jan 1986) - Alternate I	APR 1984
52.232-25	Prompt Payment	OCT 2008
52.232-33	Payment by Electronic Funds Transfer--Central Contractor Registration	OCT 2003
52.233-1	Disputes	JUL 2002
52.233-3 Alt I	Protest After Award (Aug 1996) - Alternate I	JUN 1985
52.233-4	Applicable Law for Breach of Contract Claim	OCT 2004
52.242-1	Notice of Intent to Disallow Costs	APR 1984
52.242-3	Penalties for Unallowable Costs	MAY 2001
52.242-4	Certification of Final Indirect Costs	JAN 1997
52.242-13	Bankruptcy	JUL 1995
52.242-15 Alt I	Stop-Work Order (Aug 1989) - Alternate I	APR 1984
52.243-2 Alt V	Changes--Cost-Reimbursement (Aug 1987) - Alternate V	APR 1984
52.244-2	Subcontracts	JUN 2007
52.244-5	Competition In Subcontracting	DEC 1996
52.244-6	Subcontracts for Commercial Items	MAR 2009
52.245-1 (Dev)	Government Property (June 2007)	JUN 2007
52.245-9	Use And Charges	JUN 2007
52.246-23	Limitation Of Liability	FEB 1997
52.247-63	Preference For U.S. Flag Air Carriers	JUN 2003
52.249-6	Termination (Cost Reimbursement)	MAY 2004
52.249-14	Excusable Delays	APR 1984
52.253-1	Computer Generated Forms	JAN 1991
252.201-7000	Contracting Officer's Representative	DEC 1991
252.203-7001	Prohibition On Persons Convicted of Fraud or Other Defense-Contract-Related Felonies	DEC 2008
252.204-7000	Disclosure Of Information	DEC 1991
252.204-7003	Control Of Government Personnel Work Product	APR 1992
252.204-7004 Alt A	Central Contractor Registration (52.204-7) Alternate A	SEP 2007
252.204-7008	Requirements for Contracts Involving Export-Controlled Items	JUL 2008
252.205-7000	Provision Of Information To Cooperative Agreement Holders	DEC 1991
252.209-7004	Subcontracting With Firms That Are Owned or Controlled By The Government of a Terrorist Country	DEC 2006
252.211-7003	Item Identification and Valuation	AUG 2008
252.211-7007	Reporting of Government-Furnished Equipment in the DoD Item Unique Identification (IUID) Registry	NOV 2008
252.215-7000	Pricing Adjustments	DEC 1991
252.215-7002	Cost Estimating System Requirements	DEC 2006
252.215-7004 Alt I	Excessive Pass-Through Charges - Alternate I	MAY 2008
252.219-7004	Small Business Subcontracting Plan (Test Program)	AUG 2008
252.225-7006	Quarterly Reporting of Actual Contract Performance Outside the United States	MAY 2007
252.225-7012	Preference For Certain Domestic Commodities	DEC 2008

252.226-7001	Utilization of Indian Organizations and Indian-Owned Economic Enterprises, and Native Hawaiian Small Business Concerns	SEP 2004
252.227-7013	Rights in Technical Data--Noncommercial Items	NOV 1995
252.227-7014	Rights in Noncommercial Computer Software and Noncommercial Computer Software Documentation	JUN 1995
252.227-7015	Technical Data--Commercial Items	NOV 1995
252.227-7016	Rights in Bid or Proposal Information	JUN 1995
252.227-7019	Validation of Asserted Restrictions--Computer Software	JUN 1995
252.227-7025	Limitations on the Use or Disclosure of Government-Furnished Information Marked with Restrictive Legends	JUN 1995
252.227-7027	Deferred Ordering Of Technical Data Or Computer Software	APR 1988
252.227-7030	Technical Data--Withholding Of Payment	MAR 2000
252.227-7037	Validation of Restrictive Markings on Technical Data	SEP 1999
252.227-7038	Patent Rights--Ownership by the Contractor (Large Business)	DEC 2007
252.231-7000	Supplemental Cost Principles	DEC 1991
252.232-7003	Electronic Submission of Payment Requests and Receiving Reports	MAR 2008
252.232-7010	Levies on Contract Payments	DEC 2006
252.235-7011	Final Scientific or Technical Report	NOV 2004
252.242-7004	Material Management And Accounting System	NOV 2005
252.243-7002	Requests for Equitable Adjustment	MAR 1998
252.244-7000	Subcontracts for Commercial Items and Commercial Components (DoD Contracts)	JAN 2009
252.247-7023	Transportation of Supplies by Sea	MAY 2002
252.247-7024	Notification Of Transportation Of Supplies By Sea	MAR 2000

**Remarks:**

At FAR 52.222-2, insert the word, "zero," in spaces marked with an asterisk (\*)  
 At DFARS 252.211-7003, insert "N/A" under subparagraph (c)(1)(ii)

**CLAUSES INCORPORATED BY FULL TEXT****52.215-19 NOTIFICATION OF OWNERSHIP CHANGES (OCT 1997)**

(a) The Contractor shall make the following notifications in writing:

(1) When the Contractor becomes aware that a change in its ownership has occurred, or is certain to occur, that could result in changes in the valuation of its capitalized assets in the accounting records, the Contractor shall notify the Administrative Contracting Officer (ACO) within 30 days.

(2) The Contractor shall also notify the ACO within 30 days whenever changes to asset valuations or any other cost changes have occurred or are certain to occur as a result of a change in ownership.

(b) The Contractor shall--

(1) Maintain current, accurate, and complete inventory records of assets and their costs;

(2) Provide the ACO or designated representative ready access to the records upon request;

(3) Ensure that all individual and grouped assets, their capitalized values, accumulated depreciation or amortization,

and remaining useful lives are identified accurately before and after each of the Contractor's ownership changes; and

(4) Retain and continue to maintain depreciation and amortization schedules based on the asset records maintained before each Contractor ownership change.

The Contractor shall include the substance of this clause in all subcontracts under this contract that meet the applicability requirement of FAR 15.408(k).

#### 52.247-1 COMMERCIAL BILL OF LADING NOTATIONS (FEB 2006)

When the Contracting Officer authorizes supplies to be shipped on a commercial bill of lading and the Contractor will be reimbursed these transportation costs as direct allowable costs, the Contractor shall ensure before shipment is made that the commercial shipping documents are annotated with either of the following notations, as appropriate:

(a) If the Government is shown as the consignor or the consignee, the annotation shall be:

"Transportation is for the authorized contract supplies and the actual total transportation charges paid to the carrier(s) by the consignor or consignee are assignable to, and shall be reimbursed by, the Government."

(b) If the Government is not shown as the consignor or the consignee, the annotation shall be:

"Transportation is for the authorized contract supplies and the actual total transportation charges paid to the carrier(s) by the consignor or consignee shall be reimbursed by the Government, pursuant to cost-reimbursement contract no. HR0011-09-C-0054. This may be confirmed by contacting Christopher L. Glista at telephone no. (571) 218-4405."

#### 52.252-2 CLAUSES INCORPORATED BY REFERENCE (FEB 1998)

This contract incorporates one or more clauses by reference, with the same force and effect as if they were given in full text. Upon request, the Contracting Officer will make their full text available. Also, the full text of a clause may be accessed electronically at this/these address(es): <http://www.arnet.gov> and [http://farsite.hill.af.mil/farsite\\_script.html](http://farsite.hill.af.mil/farsite_script.html)

#### 52.252-6 AUTHORIZED DEVIATIONS IN CLAUSES (APR 1984)

(a) The use in this solicitation or contract of any Federal Acquisition Regulation (48 CFR Chapter 1) clause with an authorized deviation is indicated by the addition of "(DEVIATION)" after the date of the clause.

(b) The use in this solicitation or contract of any Defense Federal Acquisition Regulation (48 CFR Chapter 2) clause with an authorized deviation is indicated by the addition of "(DEVIATION)" after the name of the regulation.

#### 252.204-7006 BILLING INSTRUCTIONS (OCT 2005)

When submitting a request for payment, the Contractor shall--

(a) Identify the contract line item(s) on the payment request that reasonably reflect contract work performance; and

(b) Separately identify a payment amount for each contract line item included in the payment request.

**252.235-7010 Acknowledgment of Support and Disclaimer. (MAY 1995)**

(a) The Contractor shall include an acknowledgment of the Government's support in the publication of any material based on or developed under this contract, stated in the following terms: This material is based upon work supported by the Defense Advanced Research Projects Agency under Contract No. HR0011-09-C-0054.

(b) All material, except scientific articles or papers published in scientific journals, must, in addition to any notices or disclaimers by the Contractor, also contain the following disclaimer: Any opinions, findings and conclusions or recommendations expressed in this material are those of the author(s) and do not necessarily reflect the views of the Defense Advanced Research Projects Agency.

**Section J - List of Documents, Exhibits and Other Attachments**

- Attachment No. 1 - Statement of Work entitled, "Phase I - Vulcan System Concept Definition" (3 pages)
- Attachment No. 2 - Go and No-Go Criteria for Vulcan Program Phase II (2 pages)
- Attachment No. 3 - Contracting Officer's Representative (COR) Designation Memorandum (3 pages)
- Attachment No. 4 - Identification and Assertion of Restrictions on the Government's Use, Release, or Disclosure of Technical Data or Computer Software, dated March 10, 2009 (7 pages)
- Attachment No. 5 - Contract Security Classification Specification, DD Form 254, dated January 22, 2009
- Attachment No. 6 - Advance Agreement to Incur Pre-Award Costs, dated March 6, 2009 (2 pages)

**STATEMENT OF WORK  
FOR  
VULCAN PROGRAM  
PHASE I - VULCAN SYSTEM CONCEPT DEFINITION**

**Task 1 Vulcan Program:** The Contractor shall perform phase I of the Vulcan program.

**Task 1.1 Propulsion System:** The Contractor shall perform the tasks described below.

**Task 1.1.1 Turbine Engine:** No work planned in phase I.

**Task 1.1.2 CVC Engine:** The Contractor shall perform the tasks described below in furtherance of Phase I design of the CVC engine.

**Task 1.1.2.1 CVC Combustor:** The Contractor shall perform trade studies to develop a CVC combustor design to meet Vulcan Program requirements. Subtasks include conceptual design and both aero and thermal/mechanical design of the CVC combustor. This design will be consistent with the conceptual design and requirements developed under tasks 1.1.4.3, 1.1.4.4, & 1.1.4.5. A critical technology development plan will be developed for each component.

**Task 1.1.2.2 CVC Controls:** The Contractor shall perform trade studies to develop fuel system definition, air valve definition, ignition system and CVC engine control concepts that meet requirements developed by the Vulcan system conceptual design. A critical technology development plan will be developed for each component.

**Task 1.1.3 Airframe Integration:** The Contractor shall perform the sub-tasks described below in furtherance of enabling engine airframe integration to a generic mach 4 airframe.

**Task 1.1.3.1 Flow Management System:** The Contractor shall perform trade studies and conceptual design of the Vulcan engine flow management system. Critical technology will be identified and a plan to develop critical technology for the Vulcan engine test will be formulated.

**Task 1.1.3.2 Transition Duct and Exhaust:** The Contractor shall perform trade studies necessary to develop a conceptual design for the Vulcan engine transition duct and exhaust. The subtasks include development of airframe interfaces, concept development and modeling to provide nozzle performance data.

**Task 1.1.3.3 Turbine Engine Cocooning:** The Contractor shall perform trade studies, conceptual design development, and technology assessments. Enabling technology will be identified and a development plan formulated. Cocooning of turbine engine concepts shall be developed for both a flight system and a test article to protect engine from damage during testing.

**Task 1.1.3.4 Energy Management:** The Contractor shall perform trade studies in cooperation with the airframer to identify vehicle and engine active cooling requirements, thermal management requirements, vehicle power extraction requirements and fuel heat sink requirements. Enabling technology development plans will be developed for each area.

**Task 1.1.3.5 Mounts and vehicle interfaces:** No activity planned in this area in phase I.

**Task 1.1.3.6 Vulcan Engine Controls.** The Contractor will develop conceptual designs of the Vulcan engine control system, electrical system and logic system. Enabling technology development plans will be developed for each area.

**Task 1.1.4 Systems & Engineering Management:** The Contractor shall perform the systems and engineering management subtasks to complete the program.

**Task 1.1.4.1 Technical Program management:** The Contractor shall manage the technical, cost, and schedule risks of the program and provide timely status updates to the Government. The Contractor shall document in detail the conduct and results of this effort in accordance with Section C of the Contract. Included in this effort is the preparation and planning of the Vulcan phase II program plan and proposal.

The Contractor will support up to 2 Weapon System Contractor teams (WSC) for engine/airframe integration studies and for continued mission trade-off analyses for the Vulcan engine. The Contractor will also provide support to up to 2 WSC teams for engine-airframe integration, flow management, power and thermal management systems studies. Delivery Items: ii (Monthly Technical Reports), viii, ix, x

**Task 1.1.4.2 Program Financial Management:** The Contractor shall provide timely financial reports to the government including monthly reports, a quarterly report, and a final report. Delivery Item: ii (Monthly R&D Status Reports)

**Task 1.1.4.3 Vulcan System Conceptual Design and Performance Model:** The Contractor shall perform design trade studies to develop a Vulcan Engine conceptual design to meet Vulcan Program requirements. Technology tradeoffs, airframe integration issues, system layout, and turbine engine choices shall be studied to determine propulsion system configuration. Performance metrics shall be allocated to engine systems.

The Contractor shall develop a performance model and cycle deck for the proposed Vulcan Engine in Task 1. The model shall be used to allocate performance metrics requirements to Vulcan Engine subcomponents. Delivery Items: i, vi, vii

**Task 1.1.4.4 Vulcan Systems Requirement Development:** The Contractor shall allocate requirements to all engine subsystems based on the selected conceptual design. These requirements shall provide the basis of the technology development plans to be executed in later phases of the program. Delivery Items: iii, iv

**Task 1.1.4.5 CVC Engine Systems Requirement:** The Contractor shall allocate requirements for the CVC Engine subsystems based on the selected conceptual design. These requirements will provide the basis for technology development to support the Phase III engine testing. Delivery Item: iv

**Task 1.1.4.6 Critical Technology Development Planning:** The Contractor shall identify the critical technologies necessary to complete Vulcan Engine development. The Contractor shall determine TRL level of the technologies and develop a plan to advance the technologies to TRL 6. Delivery Item: v

#### **Deliverables:**

**Item 0 - Kickoff Meeting (within 1 month after Authorization To Proceed (ATP\*))**  
A Kickoff Meeting shall be held and the kickoff review package shall be delivered.

**Item I - Interim Design Review (IDR) (3 months after ATP).**  
The IDR package to include all deliverables due at the IDR shall be delivered at the meeting. Progress on trade studies and system design will be reported along with an update to the CTDTP shall be a part of the IDR package.

#### **Item ii - Monthly R&D Status Reports**

The contractor shall submit monthly R&D status reports in accordance with Section C-2 of the Contract. Additionally, the Contractor will participate in a monthly status telecom with the DARPA Program Manager/Contracting Officer's Representative (COR).

**Item iii. - System Requirements Review of Vulcan System (6 months after ATP)**  
A Conceptual Design (CoD) of the Vulcan Engine shall be generated. Based on the CoD of the Vulcan Engine the Contractor will use systems engineering to flow design, requirements, and functions necessary to achieve the predicted Vulcan system performance. A CoD and Systems Requirement Document (SRD) shall be delivered at a Conceptual Design Review/System Requirements Review (CoDR/SRR) to be held 6 months after ATP.

A SRD for the Vulcan Engine Demonstration System (at a minimum to include the CVC, Turbine, and appropriate inlet and nozzle for the down selected configuration) shall be delivered at the CoDR/SRR.

**Item iv. - System Requirements Review (SRR) Phase III Demonstration System (6 months after ATP)**

A SRD for the Vulcan Engine Phase III demonstration system shall be delivered at the CoDR/SRR. At a minimum, the SRR will include the CVC and the appropriate inlet and nozzle for the down selected configuration.

**Item v. - Final CTDP (6 months after ATP)**

A final CTDP that includes a risk assessment, risk management and mitigation plans, system and segment risk waterfalls, test and demonstration quantifiable success metrics, a Master Testing Schedule, and results of trade studies (item i) shall be delivered at the CoDR/SRR.

**Item vi. - Engine Performance Model (6 months after ATP)**

The Vulcan Engine Performance Model shall be developed based on the Vulcan Engine CoD and include the CVC, Turbine and the appropriate inlet and nozzle for the down selected configuration. The model will be used to model the performance of the Vulcan Engine and shall provide information to characterize its origin, methodology, development, validation, and extension to systems engineering processes. The Vulcan Engine Performance Model shall be delivered at the CoDR/SRR.

A pure ramjet performance model shall be provided as a baseline for comparison and shall be delivered at the CoDR/SRR to be held six months after ATP.

**Item vii. - Vulcan Models (6 months after ATP)**

The Contractor shall provide computer animation of the notional operation of the Vulcan engine to include the transition from turbine only to simultaneous turbine/CVC and CVC only across the trajectory from Mach 0 to 4+.

The contractor shall provide four sets of SLA scale models of the Vulcan Engine.

**Item viii. - Phase II Program Plan (6 months after ATP)**

The Phase II program plan will be delivered as part of the CoDR/SRR that occurs six months after ATP. This program plan should include ROM costing to at least a WBS level three with each test, demonstration or risk reduction event. Should also include a Phase II organization chart.

The CoDR/SRR package to include all deliverables (items iii, iv, v, vi, vii and viii) due at the CoDR/SRR will be delivered six months after ATP.

**Item ix. - Phase II Proposal (7 months after ATP)**

The Contractor shall submit an updated Phase II cost proposal including an updated Phase II SOW now broken down to a Level 4 WBS, with an updated management and staffing plan. The contractor shall provide the cost proposal, SOW and Integrated Master Schedule (IMS) that use the same WBS. An updated ROM cost and plan for Phase III to WBS Level 3 and a Phase IV program plan to WBS level II shall be submitted with this proposal.

**Item x. - Final Technical Report For Phase 1 (8 months after ATP)**

A final technical report documenting the Phase I effort in accordance with Section C-2 of the Contract will be delivered eight months after ATP.

~ End ~

\* Authorization to Proceed



## GO AND NO-GO CRITERIA FOR VULCAN PROGRAM PHASE II

In order for the Government to evaluate the effectiveness of proposed solutions in achieving the stated program objectives, Go and No-Go criteria have been established to measure whether program objectives have been met. These Go and No-Go criteria along with Phase II proposal content will serve as the basis for determining whether satisfactory progress is being made to warrant continued performance into the next phase. As the design of the Vulcan engine and its subsystems mature, additional quantifiable metrics will be defined for the follow-on phases.

The Go and No-Go requirements for Phase II and all follow-on phases shall be based upon meeting the non-tradable requirements, listed below, at the Vulcan engine system level. The way in which these criteria must be met will have increasing fidelity as the design matures.

### PHASE II GO/NO GO CRITERIA

- Final Phase IV Demonstration System Design meets the demonstration objectives and required performance curves in Figure 1 and 2 by simulation or analysis.
- Final CTDIP identifies all Phase II-IV risk reduction activities and includes quantifiable success metrics for each test/demonstration
- Initial Vulcan engine performance model that can be used to generate engine performance adequate to meet the performance objectives.

### NON-TRADABLE REQUIREMENTS FOR THE VULCAN SYSTEM

- A CVC engine(s) will be developed as an element of the Vulcan engine
- An existing production Turbine Engine will be another element of the Vulcan engine
  - Must use an existing, production engine from the following list: the F100-229, F110-129, F119 or F414. A Government provided, General State-of-the-Art Generic Engine Description may be used.
- Notional uninstalled thrust for the hypersonic vehicle is to be provided by one or more Vulcan engines and must be greater than the values outlined in Figure 1
- Notional vehicle flight path to be met or exceeded on a trajectory to Mach 4 is outlined in Figure 2
- CVC engine must be able to operate on fuel qualified for the turbine engine and must at least be capable of throttling between half and full power
- Design must include a Turbine Engine cocooning architecture and restart capability
- Full scale Vulcan engine must be capable of:
  - Demonstrating in three modes with continuous operation between Mach 0 to 4+: Turbine only, Turbine & CVC engine, and CVC engine only
  - Demonstrating an efficient combined inlet architecture
  - Demonstrating an efficient combined nozzle architecture

Mach Number	Vulcan Uninstalled Thrust (lbs)	Turbine Uninstalled Thrust (lbs)	CVC Uninstalled Thrust (lbs)
0	80,000	80,000	-
1.5	90,000	80,000	10,000
2.0	70,000	60,000	10,000
3.0	50,000	-	50,000
4.0	50,000	-	50,000

Figure 1. Total Uninstalled Thrust Curve for Notional Hypersonic Vehicle

### Trajectory

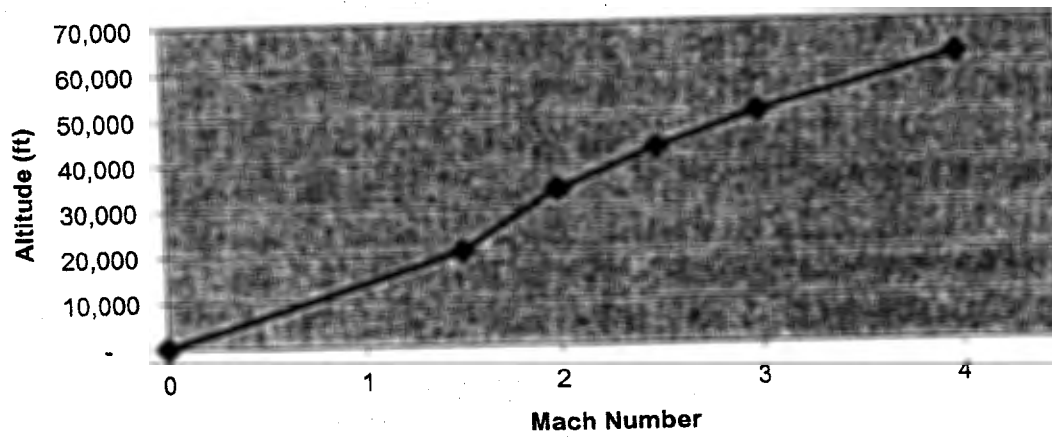


Figure 2. Flight Trajectory of Notional Vehicle to maintain ( $Q = 1,500 \text{ lb/ft}^2$ )

~ End ~



**DEFENSE ADVANCED RESEARCH PROJECTS AGENCY**  
3701 NORTH FAIRFAX DRIVE  
ARLINGTON, VA 22203-1714

January 5, 2009

**MEMORANDUM FOR CONTRACTING OFFICER'S REPRESENTATIVE**

**FROM:** DARPA, Contracts Management Office

**TO:** Major David Hopper, Deputy Chief, Turbine Engine Division (AFRL/RZT),  
1950 5th Street, WPAFB OH 45433; Email: david.hopper@us.af.mil

**SUBJECT:** Appointment as Contracting Officer's Representative (COR)

1. You are hereby appointed as the Contracting Officer's Representative for:

Contract Number: HR0011-09-C-0054  
Contractor: GE Aviation  
Project Description: Vulcan System Concept Definition

2. This appointment authorizes and designates you to perform the following duties and/or responsibilities as specified herein:

- a. Furnish plans, schedules, specifications, descriptions, and other documents to the contractor as required by the contract.
- b. Assist the contractor in interpreting technical aspects of the contract specifications/statement of work. Differences of opinion and interpretations which could affect the terms and conditions of the contract will be referred to the contracting officer for resolution.
- c. Provide Government recommendations/approvals to the contractor promptly in all cases where the contract calls for technical approval.
- d. Observe, monitor, and assess the contractor's performance under the terms of the contract. This includes reporting promptly to the contracting officer any failures, delays, or significant deviations of performance, quality, costs, or other actions which might jeopardize contract performance.

3. In the performance of the duties delegated to you in this letter, you are cautioned that you could be held personally liable for actions taken or directions given by you to the contractor that are beyond the authorities given to you in this letter. The duties or authorities in this letter are not delegable; therefore, you must advise the Contracting Officer or the Contract Administrator/Specialist immediately when you are unable to perform these duties.
4. In your dealings with the contractor you must not give technical direction as though the contractor's employees are Government employees. You must maintain a formal, arms-length relationship with the contractor in order to avoid even an appearance that the contract is one for personal services. If the contractor's performance takes place in a Government facility, then to the maximum extent practicable, the contractor's work area should be physically separated from areas in which Government employees work, and communication with the contractor's employees on contractual matters should be only through that contractor employee(s) designated by the contractor to supervise them. You must not give any direction to the contractor that is not authorized by the statement of work because it is not the intent of the Government that a contractor be required to do anything that is not included in the contract.
5. You are responsible for providing prompt notification to the contracting officer any significant deficiencies with respect to contractor performance or other actions which might jeopardize contract performance.
6. You are not authorized by this letter to take any action, either directly or indirectly, that could result in a change in the pricing, quantity, quality, place of performance, delivery schedule or any other terms and conditions of the basic contract, or to direct the accomplishment of effort which would exceed the scope of the basic contract. You must be especially cautious in providing interpretation of the specifications/ statement of work. The agreement reached or technical direction given must be formalized in writing with copies to the contracting officer. You shall also inform the contractor that if he believes that the COR's interpretation is erroneous, the contractor must notify the contracting officer in writing concerning the details of his position.
7. Specific duties in addition to those above are as follows:
  - a. Control all government technical interfaces with the contractor.
  - b. Ensure that copies of government technical correspondence are forwarded to the contracting officer for placement in the contract file.
  - c. Promptly furnish documentation on any requests for change, deviation, or waiver (whether generated by the Government or the contractor) to the contracting officer for appropriate action.
  - d. Review and, if required (i.e., Fixed Price Payments), accept invoices submitted through WAWF as stipulated in Section G of the Contract.

- e. Provide required review of Patent/Invention Disclosures made in I-Edison (<http://www.iedison.gov>).
  - f. The COR must maintain a separate file for each contract for which he/she acts as COR. The file should serve as a repository and record of all documents and communications between the contractor and the COR. At a minimum, the file must include a copy of the contract and all modifications as well as the COR appointment letter. Examples of other file documentation may include:
    - Reports required per the contract, e.g. interim and final technical or patent reports
    - Memoranda for Record documenting important contract discussions
    - Records of formal meetings, e.g. post award conference, program reviews, etc.
  - g. Assist ACO and/or PCO, as requested, with closeout activities at completion of contract period of performance.
8. If this is your first appointment as a COR or if you have not performed COR duties within the last two years, and in order to comply with DFARS 201.6-2, you must complete COR training immediately so that you can properly execute your responsibilities under this contract. A good source of COR training is available via a web-based module, CLC 106, "Contracting Officer Representative with a Mission Focus" at [www.dau.mil](http://www.dau.mil).
9. Your appointment as COR for this effort expires upon final disposition of the contract.
10. Your good judgment in performing your duties under the contract will have an important effect on the value of the performance obtained by the Government.

(b)(6)

Christopher L. Ollista  
Contracting Officer

1/5/09  
Date

  
Major David Hopper  
Contracting Officer's Representative

9 Jan 09  
Date

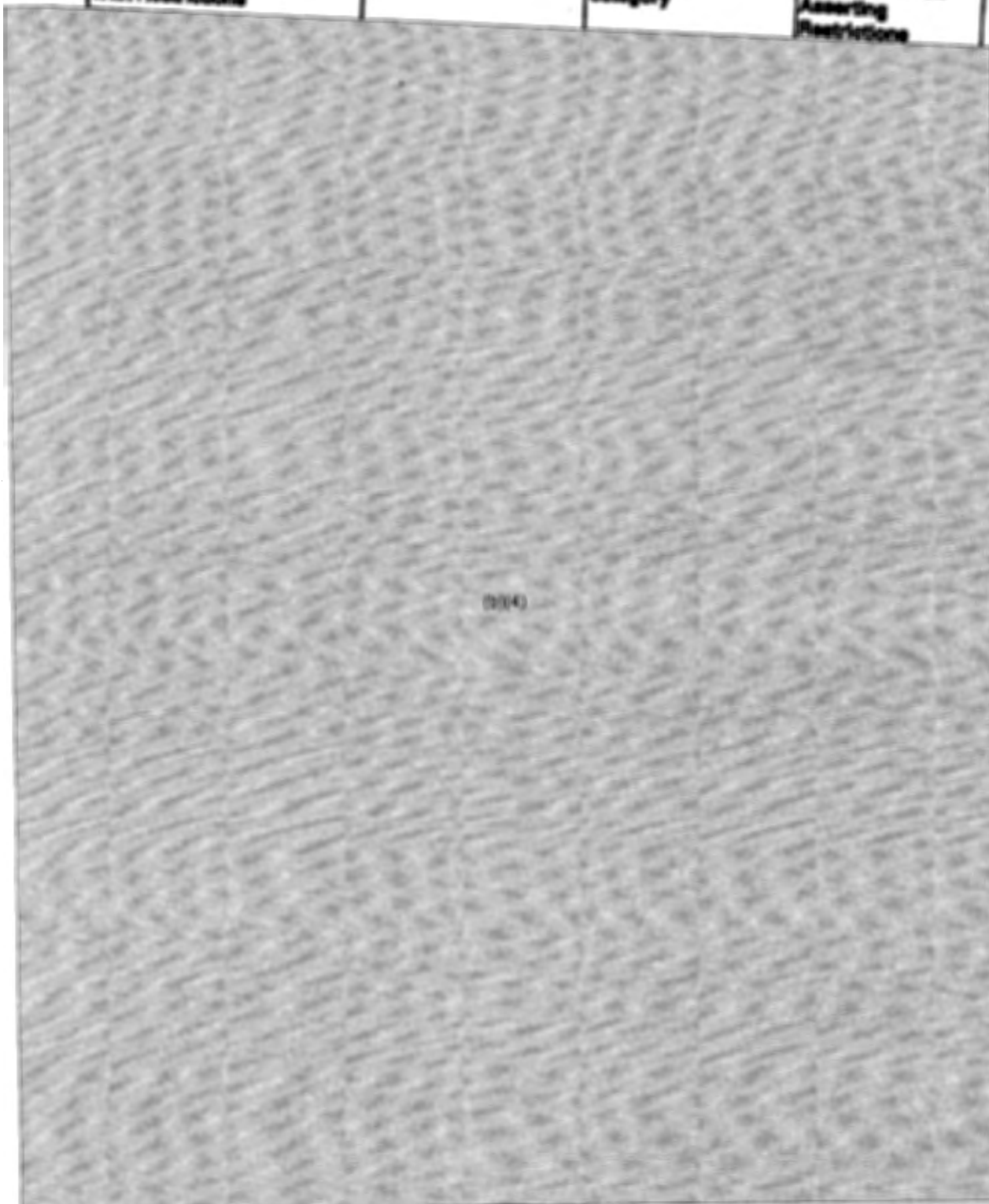
**Identification and Assertion of Restrictions on the Government's Use, Release, or Disclosure of Technical Data or Computer Software**

In accordance with DFARS 252.227-7017, the Contractor asserts for itself, or the persons identified below, that the Government's rights to use, release, or disclose the following technical data or computer software should be restricted:

Technical Data Computer Software To be Furnished With Restrictions	Basis for Assertion	Asserted Rights Category	Name of Person Asserting Restrictions
(b)(4)			

Technical Data Computer Software To be Furnished With Restrictions	Basis for Assertion	Asserted Rights Category	Name of Person Asserting Restrictions
(b)(4)			

Technical Data Computer Software To be Furnished With Restrictions	Basis for Assertion	Asserted Rights Category	Name of Person Asserting Restrictions
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(b)(4)



Technical Data Computer Software To be Furnished With Restrictions	Basis for Assertion	Asserted Rights Category	Name of Person Asserting Restrictions
(S)(4)			

Technical Data Computer Software To be Furnished With Restrictions	Basis for Assertion	Asserted Rights Category	Name of Person Asserting Restrictions
(b)(4)			

Technical Data Computer Software To be Furnished With Restrictions	Basis for Assertion	Asserted Rights Category	Name of Person Asserting Restrictions
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(b)(4)			
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Technical Data Computer Software To be Furnished With Restrictions	Basis for Assertion	Asserted Rights Category	Name of Person Asserting Restrictions
(b)(4)			

DATE:

3/10/09

PRINTED NAME AND TITLE:

Gary North, Vulcan Program Mgr.

SIGNATURE:

Gary North

ATTACHMENT 5

DD 254 DOD CONTRACT SECURITY CLASSIFICATION SPECIFICATION

4 PAGES WITHHELD

B(2) HIGH



**DEFENSE ADVANCED RESEARCH PROJECTS AGENCY**  
3701 NORTH FAIRFAX DRIVE  
ARLINGTON, VA 22203-1714

General Electric Company  
1 Neumann Way  
Cincinnati, OH 45215-1988

**REFERENCE:** General Electric Company's Proposal for Vulcan Program, Phase I

**SUBJECT:** AUTHORIZATION TO INCUR PRE-AWARD COSTS

The Defense Advanced Research Projects Agency (DARPA), Contracts Management Office (CMO), has received a valid and properly funded procurement request, in support of performance of the referenced proposal. DARPA anticipates awarding a contract (cost-plus-fixed-fee) to General Electric Company for this effort.

Since the DARPA Contracting Officer has determined that incurrence of costs prior to the effective date of the anticipated contract is necessary to ensure compliance with the proposed schedule, the Government and the Contractor agree as follows:

**FIRST:** In the event a contract is awarded, pre-award costs, not to exceed \$500,000 shall be allowable under the Contract, provided that the individual costs therein shall be:

- (a) otherwise allowable, reasonable, and allocable;
- (b) incurred during the period March 9, 2009 through May 8, 2009; and,
- (c) incurred specifically and exclusively to accomplish the effort described in the referenced proposal.

**SECOND:** Contract specifications and price shall be agreed to by the earlier of:

- (a) May 8, 2009; or
- (b) the date on which the amount of funds obligated, committed or expended under this Advance Agreement is equal to no more than \$500,000.

**THIRD AND FINALLY:** It is the intention of the Government to award a contract to the Contractor, subject to final agreement on contract terms, specifications and price, which contract shall incorporate this Advance Agreement. It is understood and agreed by both parties that this Agreement concerns the treatment of pre-award costs in the event of award of a contract. This Agreement does not require the Contractor to incur any such costs, and any costs incurred are at the risk of the Contractor, pending the award of a contract.

**For the Contractor:**  
[Redacted] (b)(6)  
(Signature)  
[Redacted] (b)(6)

March 6, 2009  
Date

**For the Government:**

[Redacted] (b)(6)  
**Christopher L. Glista**  
**Contracting Officer**

3/6/09  
Date

<b>AMENDMENT OF SOLICITATION/MODIFICATION OF CONTRACT</b>			1. CONTRACT ID CODE	PAGE OF PAGES 1   2	
2. AMENDMENT/MODIFICATION NO. P00001	3. EFFECTIVE DATE 24-Apr-2009	4. REQUISITION/PURCHASE REQ. NO.		5. PROJECT NO.(if applicable)	
6. ISSUED BY DARPA CMO ATTN: CHRISTOPHER GLISTA 3701 N. FAIRFAX DR. ARLINGTON VA 22203	CODE HR0011	7. ADMINISTERED BY (If other than item 6) DCMA AIRCRAFT PROPULSION OPERATIONS GE ENGINES 1000 WESTERN AVENUE LYNN MA 01910-0448		CODE S2207A	
8. NAME AND ADDRESS OF CONTRACTOR (No., Street, County, State and Zip Code) GENERAL ELECTRIC COMPANY 1 MELBAHAY WAY CINCINNATI OH 45216-1006			9A. AMENDMENT OF SOLICITATION NO.		
			9B. DATED (SEE ITEM 11)		
			X	10A. MOD. OF CONTRACT/ORDER NO. HR0011-09-C-0064	
			X	10B. DATED (SEE ITEM 13) 14-Apr-2009	
CODE 07482	FACILITY CODE				
11. THIS ITEM ONLY APPLIES TO AMENDMENTS OF SOLICITATIONS					
<input type="checkbox"/> The above numbered solicitation is amended as set forth in Item 14. The hour and date specified for receipt of Offer <input type="checkbox"/> is extended, <input type="checkbox"/> is not extended. Offer 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 amendment; (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)					
13. THIS ITEM APPLIES ONLY TO MODIFICATIONS OF CONTRACTS/ORDERS. IT MODIFIES THE CONTRACT/ORDER NO. AS DESCRIBED IN ITEM 14.					
A. THIS CHANGE ORDER IS ISSUED PURSUANT TO: (Specify authority) 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 offices, appropriation data, etc.) SET FORTH IN ITEM 14, PURSUANT TO THE AUTHORITY OF FAR 43.103(B).					
X C. THIS SUPPLEMENTAL AGREEMENT IS ENTERED INTO PURSUANT TO AUTHORITY OF: Section H-10 of the Contract					
D. OTHER (Specify type of modification and authority)					
E. IMPORTANT: Contractor <input type="checkbox"/> is not, <input checked="" type="checkbox"/> is required to sign this document and return <u>1</u> copies to the issuing office.					
14. DESCRIPTION OF AMENDMENT/MODIFICATION (Organized by UCF section headings, including solicitation/contract subject matter where feasible.) Modification Control Number: jyoung09652  (See Page 2)					
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.					
(b)(4)		16A. NAME AND TITLE OF CONTRACTING OFFICER (Type or print) MICHAEL D. BLACKSTONE TEL: (571) 218-4804 EMAIL: michael.blackstone@darpa.mil			
(b)(4)		13C. DATE SIGNED April 23, 2009	16B. BY (b)(6)	16C. DATE SIGNED 4/23/09	

EXCEPTION TO SF 30 APPROVED BY OIRM 11-94

30-105-04

STANDARD FORM 30 (Rev. 10-83) Prescribed by GSA FAR (48 CFR) 53.243



HR0011-09-C-0054  
P00001  
Page 2 of 2

**SECTION SF 30 BLOCK 14 CONTINUATION PAGE**

**SUMMARY OF CHANGES**

The purpose of the modification is to revise the estimated costs of two subcontractors, The Boeing Company and Northrop Grumman, under Section H-10 within the originally negotiated total cost ceiling for the subcontractors. The total cost plus fixed fee of the Contract remains unchanged. Accordingly, revise the Contract as follows:

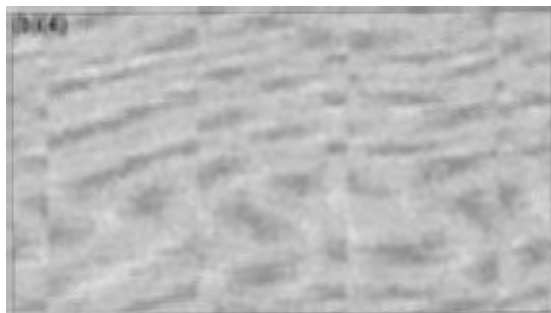
**SECTION H - SPECIAL CONTRACT REQUIREMENTS**

Revise the estimated costs of the subcontractors, The Boeing Company and Northrop Grumman, as follows:

<u>Subcontractor</u>	<u>From</u>	<u>Estimated Cost</u>	<u>To</u>
		<u>By</u>	
(b)(4)	(b)(4)	(b)(4)	(b)(4)

Therefore, at Section H-10 - Consent to Subcontract, revise paragraph (a) to read as follows:

(a) Pursuant to the clause of the General Provisions entitled "Subcontracts (JUN 2007)," FAR 52.244-2(j), the Contracting Officer hereby consents to the placement of subcontract(s) with the following firm(s)/consultant(s) at the ceiling amounts specified:



~ End ~

AMENDMENT OF SOLICITATION/MODIFICATION OF CONTRACT			1. CONTRACT ID CODE	PAGE OF PAGES
				1   4
2. AMENDMENT/MODIFICATION NO. P00002	3. EFFECTIVE DATE 28-Jul-2009	4. REQUISITION/PURCHASE REQ. NO.		5. PROJECT NO.(If applicable)
6. ISSUED BY DARPA CNO ATTN: CHRISTOPHER GLISTA 3701 N. FAIRFAX DR. ARLINGTON VA 22203	CODE HR0011	7. ADMINISTERED BY (If other than item 6) DCMA AIRCRAFT PROPULSION OPERATIONS OE ENGINES 1000 WEBSTER AVENUE LYNN MA 01910-0448		CODE S2207A
8. NAME AND ADDRESS OF CONTRACTOR (No., Street, County, State and Zip Code) GENERAL ELECTRIC COMPANY 1 NEUMANN WAY CINCINNATI OH 45215-1988			9A. AMENDMENT OF SOLICITATION NO.	
			9B. DATED (SEE ITEM 11)	
			X 10A. MOD. OF CONTRACT/ORDER NO. HR0011-09-C-0084	
			X 10B. DATED (SEE ITEM 13) 14-Apr-2009	
CODE 07482			FACILITY CODE	
11. THIS ITEM ONLY APPLIES TO AMENDMENTS OF SOLICITATIONS				
<input type="checkbox"/> The above numbered solicitation is amended as set forth in item 14. The hour and date specified for receipt of Offer <input type="checkbox"/> is extended, <input type="checkbox"/> is not extended.				
Offer 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 amendment; (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)				
13. THIS ITEM APPLIES ONLY TO MODIFICATIONS OF CONTRACTS/ORDERS. IT MODIFIES THE CONTRACT/ORDER NO. AS DESCRIBED IN ITEM 14.				
A. THIS CHANGE ORDER IS ISSUED PURSUANT TO: (Specify authority) 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).				
X C. THIS SUPPLEMENTAL AGREEMENT IS ENTERED INTO PURSUANT TO AUTHORITY OF: Mutual Agreement of the Parties				
D. OTHER (Specify type of modification and authority)				
E. IMPORTANT: Contractor <input type="checkbox"/> is not, <input checked="" type="checkbox"/> is required to sign this document and return <u>1</u> copies to the issuing office.				
14. DESCRIPTION OF AMENDMENT/MODIFICATION (Organized by UCF section headings, including solicitation/contract subject matter where feasible.) Modification Control Number: jyoung09896  (See Pages 2 through 4)				
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) (b)(4)			16A. NAME AND TITLE OF CONTRACTING OFFICER (Type or print) CHRISTOPHER L. GLISTA TEL: (571) 218-4405 EMAIL: christopher.glista@darpa.mil	
(b)(4)			15C. DATE SIGNED July 28, 2009	16B. UNITED STATES OF AMERICA BY (b)(6) (Signature of Contracting Officer)
				16C. DATE SIGNED 7/29/09

EXCEPTION TO SF 30  
APPROVED BY OIRM 11-84

30-105-04

STANDARD FORM 30 (Rev. 10-83)  
Prescribed by GSA  
FAR (48 CFR) 53.243

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P00002  
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## SECTION SF 30 BLOCK 14 CONTINUATION PAGE

### SUMMARY OF CHANGES

The purpose of the modification is to:

- (a) change the go and no-go criteria for Vulcan Program Phase II to Vulcan Engine System Level Requirements,
- (b) provide additional detail for the SLA model deliverable requirement,
- (c) delete Phase II program plan and Phase II proposal deliverable requirements,
- (d) extend the term of the Contract from December 13, 2009 by nine (9) months to September 13, 2010, and
- (e) revise the key personnel under Section H-3 of the Contract.

The changes listed in (a) through (e) above shall be accomplished at no additional cost to the Government. Accordingly, make the following revisions to the Contract:

### SECTION C - DESCRIPTIONS AND SPECIFICATIONS

- At Section C-1 - Scope of Work:

Revise paragraph (a) to read as follows:

(a) The Contractor shall furnish the necessary personnel, materials, facilities and other services as may be required to perform Contract Line Item Number (CLIN) 0001 in accordance with Attachment No. 1 - Statement of Work (Revision 1) entitled, "Phase I - Vulcan System Concept Definition," and Attachment No. 2 - Vulcan Engine System Level Requirements, in support of the Vulcan Program, Phase I.

Delete paragraph (b) in its entirety.

- At Section C-2 - Reports and Other Deliverables, delete Phase II Proposal deliverable requirement. Paragraph (a)(3) is deleted in its entirety and indicated as "Reserved."

### SECTION F - DELIVERIES OR PERFORMANCE

- The term of the Contract is extended from December 13, 2009 to September 13, 2010. Section F-1 - Term of Contract - is revised to read as follows:

The term of the Contract commences on April 14, 2009 and continues through September 13, 2010. \*

\* An Authorization to Incur Pre-Award Costs was issued to the Contractor on March 6, 2009 (see Attachment No. 6 - Advance Agreement to Incur Pre-Award Costs under Contract HR0011-09-C-0054).

- At Section F-2 - Reports and Other Deliverables:

- Delete the following:

<u>CLIN</u>	<u>Description</u>	<u>Due Date</u>
0001	Phase II Proposal	Seven (7) months after the award of the Contract

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P00002  
Page 3 of 4

- Revise the due date for the Final Technical Report for Phase I as follows:

CLIN	Description	Due Date
0001	Final Technical Report for Phase I	At the end of the eighth (8th) month after contract award

**SECTION H - SPECIAL CONTRACT REQUIREMENTS**

- At Section H-3 - Key Personnel, under paragraph (a), delete [REDACTED]

**SECTION J - LIST OF DOCUMENTS, EXHIBITS AND OTHER ATTACHMENTS**

- A revised Attachment No. 1 and a revised Attachment No. 2 are included in this Modification P00002. The description of Attachment No. 1 and Attachment No. 2 is changed to read as follows:

Attachment No. 1	-	Statement of Work (Revision 1) entitled, "Phase I - Vulcan System Concept Definition" (3 pages)
Attachment No. 2	-	Vulcan Engine System Level Requirements (2 pages)

**ATTACHMENT NO. 1**

- Under Task 1.1.4.1 (Technical Program Management), delete the following sentence:  
"Included in this effort is the preparation and planning of the Vulcan Phase II plan and proposal."
- Items vii, viii, and ix under "Deliverables" are revised to read as follows:

Item vii. - Vulcan Models (6 months after ATP)  
The Contractor shall provide computer animation of the notional operation of the Vulcan engine to include the transition from turbine only to simultaneous turbine/CVC and CVC only across the trajectory from Mach 0 to 4+.

The Contractor shall provide two (2) sets of SLA scale models of the Vulcan Engine. The appropriately detailed SLA models must be sized such that each model will fit in a drawer with the following dimensions: 10 1/4" height x 15 1/4" width x 24 3/4" depth.

The CoDR/SRR package to include all deliverables (items iii, iv, v, vi, and vii) due at the CoDR/SRR will be delivered six months after ATP.

Item viii. - Reserved.

Item ix. - Reserved.

**ATTACHMENT NO. 2**

- Revise the title, "Go and No-Go Criteria for Vulcan Program Phase II," to "Vulcan Engine System Level Requirements."

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P00002  
Page 4 of 4

- Delete the following paragraphs:

In order for the Government to evaluate the effectiveness of proposed solutions in achieving the stated program objectives, Go and No-Go criteria have been established to measure whether program objectives have been met. These Go and No-Go criteria along with Phase II proposal content will serve as the basis for determining whether satisfactory progress is being made to warrant continued performance into the next phase. As the design of the Vulcan engine and its subsystems mature, additional quantifiable metrics will be defined for the follow-on phases.

The Go and No-Go requirements for Phase II and all follow-on phases shall be based upon meeting the non-tradable requirements, listed below, at the Vulcan engine system level. The way in which these criteria must be met will have increasing fidelity as the design matures.

- Delete the title, "PHASE II GO/NO GO CRITERIA."

~ End ~

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Attachment No. 1

Page 1 of 3

**STATEMENT OF WORK (REVISION 1)  
FOR  
VULCAN PROGRAM  
PHASE I - VULCAN SYSTEM CONCEPT DEFINITION**

**Task 1 Vulcan Program:** The Contractor shall perform phase I of the Vulcan program.

**Task 1.1 Propulsion System:** The Contractor shall perform the tasks described below.

**Task 1.1.1 Turbine Engine:** No work planned in phase I.

**Task 1.1.2 CVC Engine:** The Contractor shall perform the tasks described below in furtherance of Phase I design of the CVC engine.

**Task 1.1.2.1 CVC Combustor:** The Contractor shall perform trade studies to develop a CVC combustor design to meet Vulcan Program requirements. Subtasks include conceptual design and both aero and thermal/mechanical design of the CVC combustor. This design will be consistent with the conceptual design and requirements developed under tasks 1.1.4.3, 1.1.4.4, & 1.1.4.5. A critical technology development plan will be developed for each component.

**Task 1.1.2.2 CVC Controls:** The Contractor shall perform trade studies to develop fuel system definition, air valve definition, ignition system and CVC engine control concepts that meet requirements developed by the Vulcan system conceptual design. A critical technology development plan will be developed for each component.

**Task 1.1.3 Airframe Integration:** The Contractor shall perform the sub-tasks described below in furtherance of enabling engine airframe integration to a generic mach 4 airframe.

**Task 1.1.3.1 Flow Management System:** The Contractor shall perform trade studies and conceptual design of the Vulcan engine flow management system. Critical technology will be identified and a plan to develop critical technology for the Vulcan engine test will be formulated.

**Task 1.1.3.2 Transition Duct and Exhaust:** The Contractor shall perform trade studies necessary to develop a conceptual design for the Vulcan engine transition duct and exhaust. The subtasks include development of airframe interfaces, concept development and modeling to provide nozzle performance data.

**Task 1.1.3.3 Turbine Engine Cocooning:** The Contractor shall perform trade studies, conceptual design development, and technology assessments. Enabling technology will be identified and a development plan formulated. Cocooning of turbine engine concepts shall be developed for both a flight system and a test article to protect engine from damage during testing.

**Task 1.1.3.4 Energy Management:** The Contractor shall perform trade studies in cooperation with the airframer to identify vehicle and engine active cooling requirements, thermal management requirements, vehicle power extraction requirements and fuel heat sink requirements. Enabling technology development plans will be developed for each area.

**Task 1.1.3.5 Mounts and vehicle interfaces:** No activity planned in this area in phase I.

**Task 1.1.3.6 Vulcan Engine Controls:** The Contractor will develop conceptual designs of the Vulcan engine control system, electrical system and logic system. Enabling technology development plans will be developed for each area.

**Task 1.1.4 Systems & Engineering Management:** The Contractor shall perform the systems and engineering management subtasks to complete the program.

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Attachment No. 1

Page 2 of 3

**Task 1.1.4.1 Technical Program management:** The Contractor shall manage the technical, cost, and schedule risks of the program and provide timely status updates to the Government. The Contractor shall document in detail the conduct and results of this effort in accordance with Section C of the Contract.

The Contractor will support up to 2 Weapon System Contractor teams (WSC) for engine/airframe integration studies and for continued mission trade-off analyses for the Vulcan engine. The Contractor will also provide support to up to 2 WSC teams for engine-airframe integration, flow management, power and thermal management systems studies. Delivery Items: ii (Monthly Technical Reports), viii, ix, x

**Task 1.1.4.2 Program Financial Management:** The Contractor shall provide timely financial reports to the government including monthly reports, a quarterly report, and a final report. Delivery Item: ii (Monthly R&D Status Reports)

**Task 1.1.4.3 Vulcan System Conceptual Design and Performance Model:** The Contractor shall perform design trade studies to develop a Vulcan Engine conceptual design to meet Vulcan Program requirements. Technology tradeoffs, airframe integration issues, system layout, and turbine engine choices shall be studied to determine propulsion system configuration. Performance metrics shall be allocated to engine systems.

The Contractor shall develop a performance model and cycle deck for the proposed Vulcan Engine in Task 1. The model shall be used to allocate performance metrics requirements to Vulcan Engine subcomponents. Delivery Items: i, vi, vii

**Task 1.1.4.4 Vulcan Systems Requirement Development:** The Contractor shall allocate requirements to all engine subsystems based on the selected conceptual design. These requirements shall provide the basis of the technology development plans to be executed in later phases of the program. Delivery Items: iii, iv

**Task 1.1.4.5 CVC Engine Systems Requirement:** The Contractor shall allocate requirements for the CVC Engine subsystems based on the selected conceptual design. These requirements will provide the basis for technology development to support the Phase III engine testing. Delivery Item: iv

**Task 1.1.4.6 Critical Technology Development Planning:** The Contractor shall identify the critical technologies necessary to complete Vulcan Engine development. The Contractor shall determine TRL level of the technologies and develop a plan to advance the technologies to TRL 6. Delivery Item: v

#### **Deliverables:**

**Item e - Kickoff Meeting (within 1 month after Authorization To Proceed (ATP\*))**  
A Kickoff Meeting shall be held and the kickoff review package shall be delivered.

**Item i - Interim Design Review (IDR) (3 months after ATP).**  
The IDR package to include all deliverables due at the IDR shall be delivered at the meeting. Progress on trade studies and system design will be reported along with an update to the CTDP shall be a part of the IDR package.

#### **Item ii - Monthly R&D Status Reports**

The contractor shall submit monthly R&D status reports in accordance with Section C-2 of the Contract. Additionally, the Contractor will participate in a monthly status telecom with the DARPA Program Manager/Contracting Officer's Representative (COR).

**Item iii - System Requirements Review of Vulcan System (6 months after ATP)**  
A Conceptual Design (CoD) of the Vulcan Engine shall be generated. Based on the CoD of the Vulcan Engine the Contractor will use systems engineering to flow design, requirements, and functions necessary to achieve the predicted Vulcan system performance. A CoD and Systems Requirement Document (SRD) shall be delivered at a Conceptual Design Review/System Requirements Review (CoDR/SRR) to be held 6 months after ATP.

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Attachment No. 1

Page 3 of 3

A SRD for the Vulcan Engine Demonstration System (at a minimum to include the CVC, Turbine, and appropriate inlet and nozzle for the down selected configuration) shall be delivered at the CoDR/SRR.

**Item iv. - System Requirements Review (SRR) Phase III Demonstration System (6 months after ATP)**

A SRD for the Vulcan Engine Phase III demonstration system shall be delivered at the CoDR/SRR. At a minimum, the SRR will include the CVC and the appropriate inlet and nozzle for the down selected configuration.

**Item v. - Final CTDP (6 months after ATP)**

A final CTDP that includes a risk assessment, risk management and mitigation plans, system and segment risk waterfalls, test and demonstration quantifiable success metrics, a Master Testing Schedule, and results of trade studies (item i) shall be delivered at the CoDR/SRR.

**Item vi. - Engine Performance Model (6 months after ATP)**

The Vulcan Engine Performance Model shall be developed based on the Vulcan Engine CoD and include the CVC, Turbine and the appropriate inlet and nozzle for the down selected configuration. The model will be used to model the performance of the Vulcan Engine and shall provide information to characterize its origin, methodology, development, validation, and extension to systems engineering processes. The Vulcan Engine Performance Model shall be delivered at the CoDR/SRR.

A pure ramjet performance model shall be provided as a baseline for comparison and shall be delivered at the CoDR/SRR to be held six months after ATP

**Item vii. - Vulcan Models (6 months after ATP)**

The Contractor shall provide computer animation of the notional operation of the Vulcan engine to include the transition from turbine only to simultaneous turbine/CVC and CVC only across the trajectory from Mach 0 to 4+.

The contractor shall provide two (2) sets of SLA scale models of the Vulcan Engine. The appropriately detailed SLA models must be sized such that each model will fit in a drawer with the following dimensions: 10 1/4" height x 15 1/4" width x 24 3/4" depth.

The CoDR/SRR package to include all deliverables (items iii, iv, v, vi, and vii) due at the CoDR/SRR will be delivered six months after ATP.

**Item viii. - Reserved.**

**Item ix. - Reserved.**

**Item x. - Final Technical Report For Phase I (8 months after ATP)**

A final technical report documenting the Phase I effort in accordance with Section C-2 of the Contract will be delivered eight months after ATP.

- End -

\* Authorization to Proceed



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Attachment No. 2

Page 1 of 2

## VULCAN ENGINE SYSTEM LEVEL REQUIREMENTS

Final Phase IV Demonstration System Design meets the demonstration objectives and required performance curves in Figure 1 and 2 by simulation or analysis.

Final CTDP identifies all Phase II-IV risk reduction activities and includes quantifiable success metrics for each test/demonstration

Initial Vulcan engine performance model that can be used to generate engine performance adequate to meet the performance objectives.

### NON-TRADABLE REQUIREMENTS FOR THE VULCAN SYSTEM

- A CVC engine(s) will be developed as an element of the Vulcan engine
- An existing production Turbine Engine will be another element of the Vulcan engine
  - Must use an existing, production engine from the following list: the F100-229, F110-129, F119 or F414. A Government provided, General State-of-the-Art Generic Engine Description may be used.
- Notional uninstalled thrust for the hypersonic vehicle is to be provided by one or more Vulcan engines and must be greater than the values outlined in Figure 1
- Notional vehicle flight path to be met or exceeded on a trajectory to Mach 4 is outlined in Figure 2
- CVC engine must be able to operate on fuel qualified for the turbine engine and must at least be capable of throttling between half and full power
- Design must include a Turbine Engine cocooning architecture and restart capability
- Full scale Vulcan engine must be capable of:
  - Demonstrating in three modes with continuous operation between Mach 0 to 4+: Turbine only, Turbine & CVC engine, and CVC engine only
  - Demonstrating an efficient combined inlet architecture
  - Demonstrating an efficient combined nozzle architecture

Mach Number	Vulcan Uninstalled Thrust (lbs)	Turbine Uninstalled Thrust (lbs)	CVC Uninstalled Thrust (lbs)
0	80,000	80,000	-
1.5	90,000	80,000	10,000
2.0	70,000	60,000	10,000
3.0	50,000	-	50,000
4.0	50,000	-	50,000

Figure 1. Total Uninstalled Thrust Curve for Notional Hypersonic Vehicle

### Trajectory

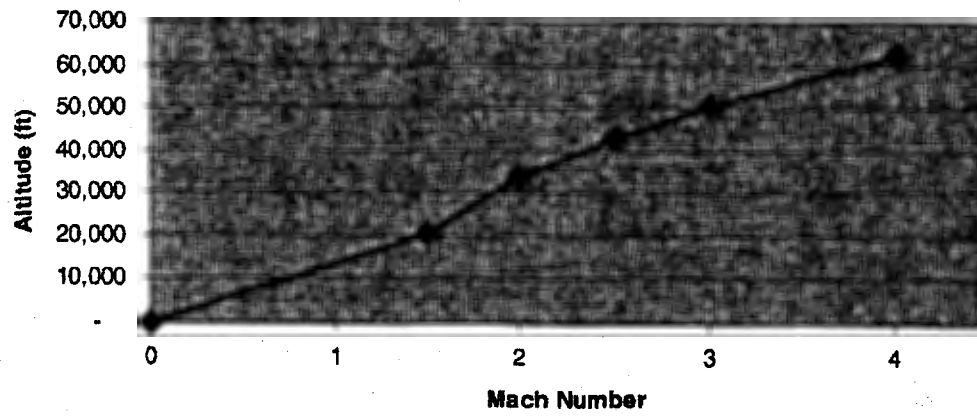


Figure 2. Flight Trajectory of Notional Vehicle to maintain ( $Q = 1,500 \text{ lb/ft}^2$ )

~ End ~