Jet Propulsion Laboratory
California Institute of Technology
4800 Oak Grove Drive
Pasadena CA 91109-8099

Date: January 29, 2024

Attn: Perspective Proposers

Subject: JPL Request for Proposal (RFP) No. JL-2672-110923 for Exploring Mars Together: Commercial Service Studies

Reference: Attachments

The Jet Propulsion Laboratory (JPL) invites your organization to submit a written Fixed Price proposal in conformance with the instructions contained in this letter and its enclosures, which comprise the RFP for JPL's acquisition of the subject effort. A proposer may select one Design Reference Mission (DRM) area of study for a fixed $200K study award. If desired, though not required, a proposer may also select one (and only one) additional DRM for a fixed additional $100K. Each DRM proposal must be stand-alone and will be evaluated separately. JPL reserves the right to select only one proposal if a proposer selects to propose to two DRMs. JPL intends to award multiple Fixed Price Non-Research & Development study subcontracts, each with a total fixed price of $200,000 for one DRM, or a maximum of $300,000 for two DRMs.

The Mars Exploration Program (MEP) Draft Plan through the next two decades would utilize more frequent lower cost missions to achieve compelling science and exploration for a larger community. To realize the goals of the MEP plan, government and US industry would partner to leverage current and emerging Earth and lunar products and commercial services to substantially lower the overall cost and accelerate leadership in deep space exploration. This RFP for industry studies is a step along that path. NASA MEP intends, though has no obligation, to use the information from these resulting studies to inform one or more future service contracts. We welcome your proposal and look forward to engagement as we forge the future together.

Towards further engagement, commercial services guiding principles assumed for this RFP are:

- Leverage innovative, existing or soon-to-be-existing, commercial space systems (particularly those being developed for NASA's Moon-to-Mars initiatives) to accelerate Martian exploration
- Enable one or more missions per Mars launch opportunity, in profitable partnerships with US industry
- Substantially lower costs, while maintaining acceptable risk
- Empower leadership of U.S. industry in deep space
- Build toward a sustainable human-robotic presence at Mars

MEP foresees one or more government payloads per Mars opportunity for which transportation and payload hosting services would be paid. Note that launch is not included in these studies though could be included in future services at the discretion of NASA. MEP also could pay for continuous services at Mars like proximity and Earth communications and Mars imaging. Services could also be provided by the company to other commercial and international customers at the same time as MEP to help create a profitable Mars economy. Future scenarios for services as outlined in the Design Reference Missions (DRMs) in the Exhibits provide cost and program information important for the next steps of the MEP plan.

For these studies, services are defined as the full scope of what industry profitably provides including design, build, integration, test, and operations for the outlined DRMs. NASA MEP assumes that industry owns the assets and can

sell services to others besides NASA. The DRMs provide the MEP's best estimate for what is the highest priority. Other future services could be profitable and depend upon these basic services as outlined in the four DRMs. Industry services can rely on the government furnished services and capabilities as outlined in the Exhibits. MEP seeks to limit the extent of what government provides to maximize cost savings. MEP acknowledges there may be a period of public-private partnership (PPP) required to fully achieve services and to mutually reduce risk. MEP also acknowledges that Mars-specific services apply to deep space and welcomes leveraging services and products for broader science and exploration.

This RFP does not commit JPL or the Government of the United States to pay any costs incurred in submitting your proposal. Proposers participate in this RFP process solely at their own risk and expense. JPL reserves the right to cancel this RFP and to reject any or all proposals.

For small businesses participating in this RFP, the APEX Accelerators can provide guidance to small businesses in Government Contracting and other free services such as counseling, training, workshops, etc.

APEX website: www.apexaccelerators.us
An additional resource for small businesses is the Small Business Development Center (SBDC). The SBDC program is the SBA's largest small business development program and offer free services as well.

SBDC Website: https://pcrsbdc.org/

The North American Industry Classification System (NAICS) code and description for this acquisition is 541330 Engineering Services. The size standard for this NAICS code is $25.5M. Additional information can be found here: https://www.sba.gov/document/support-table-size-standards.

Provide your CAGE Code and the name of your cognizant Government Audit Agency (i.e. DCAA, etc.), if any, their phone number and point of contact, and a copy of the letter that indicates their approval of your organization's direct and indirect rates. Submit your proposal by email to the undersigned.

Please note that your proposal is due at JPL no later than February 27, 2024, 3:00 p.m. (Pacific Time).
Failure to provide any of the data requested in this RFP may render the proposal nonresponsive.

By no later than February 12, 2024, as a convenience to JPL, provide to the undersigned, an email statement that you do or do not intend to submit a proposal.

Should you have any questions, please address them to the undersigned by e mail.

Sincerely,

E-SIGNED by Jessica Luong
on 2024-01-29 17:52:54 GMT

Jessica Luong
Subcontracts Manager
Phone No.: (818) 928-9583
E-mail: Jessica.Luong@jpl.nasa.gov

Attachments: RFP consisting of:

- Cover Sheet and Table of Contents
- General Instructions
- Technical/Management Instructions
- Cost/Price Instructions
- RFP Attachments

Standard Subcontract consisting of:

- Standard Subcontract
- Referenced Exhibits
- Referenced GPs & AGPs
- Subcontract Form Set

GENERAL INFORMATION

Note to all Proposers:

Under the JPL/NASA Prime Contract the California Institute of Technology (Caltech) operates the Jet Propulsion Laboratory (JPL). JPL is a Federally Funded Research and Development Center (FFRDC) funded by NASA that conducts research and development in space science and other science areas specified or approved by NASA. See FAR 35.017 for description of FFRDC. JPL is also the name of an unincorporated subdivision of Caltech a private non-profit educational institution chartered under the laws of the State of California. JPL is not an agent of the Government.

In connection with research performed under JPL/NASA Prime Contract, JPL is frequently called upon to obtain and evaluate cost or pricing data submitted by subcontractors as required by FAR 15.402, 15.403-4(b) and 15.404-2(a). JPL is authorized to obtain proposal evaluations and rates and factors from either DCMA or the appropriate contract administrative/audit activities as necessary to evaluate a prospective subcontractor's proposal.

JET PROPULSION LABORATORY
CALIFORNIA INSTITUTE OF TECHNOLOGY

REQUEST FOR PROPOSAL

REQUEST FOR PROPOSAL NO.: JL-2672-110923

FOR:

Exploring Mars Together: Commercial Service Studies

PROPOSALS ARE TO BE RECEIVED AT JPL NO LATER THAN:

Date: February 27, 2024

3:00 p.m. Pacific Time

COMMUNICATIONS IN REFERENCE TO THIS RFP

Any communication in reference to this RFP must be via email and directed to:

Name: Jessica Luong
Title: Subcontracts Manager
Phone: (818) 928-9583
E-Mail Jessica.Luong@jpl.nasa.gov

California Institute of Technology
Jet Propulsion Laboratory
4800 Oak Grove Drive
Pasadena, CA 91109-8099

Date of Issuance: January 29, 2024

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RFP No.: JL-2672-110923

ATTACHMENTS TO THE SOLICITATION. See form JPL 2839 for a list of Attachments

- Group A Attachments must be completed and attached to your proposal.
- Group B Attachments consist of forms and documents for informational purposes only. Note that Group B Attachments are very important and may become requirements under the Subcontract.
- Both A and B Attachments can be found through the electronic address identified below as:

https://acquisition.jpl.nasa.gov/terms-conditions/

GENERAL INSTRUCTIONS

1.0 GENERAL REQUIREMENTS/INFORMATION

The effort to be performed will be in accordance with the Standard Subcontract. JPL reserves the right to retain all proposal information submitted in response to this RFP.

1.1 Proprietary Information

If the proposal contains Proprietary Information that is not to be disclosed, you must place the following wording on the cover sheet of each electronic file:

"*Proprietary Information contained in pages _____ of this proposal furnished in connection with RFP No.* JL-2672-110923 *shall not be used or disclosed, except for evaluation purposes, provided that if a subcontract is awarded to this offeror as a result of or in connection with the submission of this proposal, JPL and the Government shall have the right to use or disclose this Proprietary Information to the extent provided in the subcontract. This restriction does not limit JPL's right to use or disclose any Proprietary Information obtained from another source without restriction."*

1.2 Requests for Clarification/RFP Addenda

During the proposal preparation period, all requests for clarification and/or additional information must be submitted by e-mail to the Subcontracts Manager referenced on the RFP cover page. When appropriate, responses to requests, as well as any JPL initiated changes, will be provided to known prospective proposer(s) as addenda to the RFP.

1.3 Compliance with Export Control Laws and Regulations

In the performance of this RFP, JPL may exchange information or other technology which may be subject to the export control laws and regulations of the United States, including the International Traffic in Arms Regulations (ITAR), 22 C.F.R. 120-130 and the Export Administration Act Regulations (EAR), 15 C.F.R. 730-774. All proposing parties agree to fully comply with all such laws and regulations while participating in this RFP process.

1.4 Proposals via E-Mail Only

Proposals are to be submitted **only** as an attachment(s) to an e-mail, and must:

- Have a scanned signature or an e-signature.
- Provide files in the following format: Microsoft Office family, Adobe (text-searchable), or a compatible format. For cost/price data, the format should be Excel or compatible.
- **Not** be an ".exe" or encrypted file or have multiple file extensions (e.g., doc.pdf). JPL IT Security system may reject multiple file extensions for suspected malicious content.
- Be sent to the Subcontracts Manager referenced by "Attention:" on the RFP cover page.
- **BE 20MB OR LESS in total size for the entire e-mail (including all attachments, signatures, text contained in the body of the e-mail, company logos, etc.). If your email exceeds 20MB, the proposal must be sent in more than one e-mail.**
- Contact the Subcontracts Manager referenced on the RFP cover page to transfer information/data through JPL's preferred large file transfer tool.
- Notify the Subcontracts Manager referenced on the JPL RFP Cover Page if multiple e-mails are needed for a given volume of your proposal (e.g., Technical/Management, Cost, or Past Performance).

• If the submission of more than one email is required, then ALL emails must be received on the JPL email server by the time and date stated on the RFP cover sheet. Allow sufficient time for electronic submission.

2.0 LATE E-MAIL PROPOSALS:

Any proposal, portion of a proposal, or proposal revision received at JPL after the date and time specified on the cover page of this RFP may not be considered for evaluation and award, except under any of the following circumstances:

2.1 JPL determines that the proposal was late due solely to mishandling by JPL or infrastructure disruption at JPL after receipt at JPL, provided that the timely receipt at JPL is evidenced by JPL email server time stamp.

2.2 No acceptable proposals are received as of the proposal due date and time.

2.3 If an emergency or unanticipated event interrupts normal JPL operation thereby affecting timely receipt of proposals nor can an amendment to extend be issued, the time specified for receipt of proposal will be extended to the same time on the first workday of normal operations.

2.4 JPL may, at its sole discretion to enhance competition, extend the due date for proposals after the due date currently set forth in the RFP or in any extension thereto has passed.

3.0 RESERVED

4.0 RESERVED

5.0 RESERVED

6.0 SOURCE EVALUATION AND SELECTION PROCESS

NOTE: JPL, at its discretion, may waive minor informalities and minor irregularities in proposals received, and will not complete the initial evaluation of any proposal when it is determined that the proposal is unacceptable per NASA Far Supplement 1815.305-70.

Source selection is based on the following:

6.1 Proposal Evaluation

Proposals will be evaluated and scored according to the criteria described in the Technical/Management Proposal Instructions of the RFP.

- Although cost/price will not be scored, the proposed cost/price shall be a substantial factor in source selection and is of equal importance to the combined technical and management areas.
- The closer the proposers are in the qualitative (evaluated) technical and/or management areas, the more important cost/price can become.
- JPL may select a source whose qualitative merits are commensurate with providing best overall "value."

The proposal evaluation process is as follows:

6.1.1 Initial Evaluation: Proposals are evaluated against the pre-set areas of evaluation outlined in the Technical/Management Proposal instructions of the RFP. An analysis of the cost/price details (if applicable) is performed and proposed costs/prices are compared.

6.1.2 Cost/Price Proposal Adjustments: Cost/price proposals are reviewed for mathematical accuracy, rate application, omissions, and reasonableness. If the Buy American Act or rent-free use of Government-furnished property applies, the cost/price will be adjusted as required for the purpose of evaluation.

6.1.3 Pre-Competitive Range Communications: JPL may, at its discretion, conduct clarification communications with one or more proposer(s) for the purpose of determining whether the proposer(s) should be included in the competitive range. Such communications may be conducted to address:

(i) Ambiguities in the proposal or other concerns (e.g., errors, omissions or mistakes)

(ii) Information relating to relevant past performance.

6.1.4 Competitive Range Discussions: JPL may make source selection after the initial proposal evaluation or may conduct discussions with the proposers determined to be within the competitive range. The purpose of the discussions is to assist the evaluators in fully understanding each proposal by verifying strengths and weaknesses, discussing any omissions and ambiguities, verifying the validity of the proposed cost/price, assessing the proposed personnel and examining the proposer's capabilities for performing the work. JPL may also request cost/price proposal clarifications in order to correct errors, omissions, or ambiguities in the proposal. NOTE: Only those cost/price clarifications specifically requested by JPL will be accepted.

6.1.5 Cost Realism: JPL's final evaluation may include completing a thorough assessment of the cost/price realism of each proposal. In performing this assessment, JPL may develop a "probable cost" for each proposer. "Probable cost" is defined as JPL's best estimate of the cost/price of any subcontract that is most likely to result from the offeror's proposal.

6.1.6 Final Evaluation: Upon completion of the initial evaluation findings, any discussions, and any cost/price clarifications, a final evaluation is conducted resulting in subcontractor selection for negotiations or award.

7.0 RESTRICTIVE MARKINGS

7.1 JPL's Prime Contract with NASA contains important requirements regarding the protection and preservation of the Government's technical data rights. The attached Standard Subcontract may require the delivery of technical and/or confidential-proprietary data. Limited rights data can be used by the Government and JPL in furtherance of Government contract obligations.

7.2 In your proposal, include a list of any technical and/or confidential-proprietary data that you expect to deliver to JPL in performance of the Standard Subcontract that will be marked with restrictive markings per the General Provisions entitled "Rights in Data – General" and "Limitation on Restrictive Markings."

8.0 EXCEPTIONS/DECLINATIONS/ASSUMPTIONS

Any exceptions to either the RFP and/or Standard Subcontract (including its exhibits), or equivalent assumptions, or a declination to provide the rate information requested in the Cost/Price Instructions, may

make your proposal unacceptable for evaluation. **For each and every exception, declination or assumption you must provide a detailed explanation and associated full rationale. Additionally, for each exception taken, provide the alternative language proposed. Place all this information in a special section of your proposal entitled "Exceptions/Declinations/Assumptions."**

TECHNICAL/MANAGEMENT PROPOSAL INSTRUCTIONS

Present and organize your proposal in accordance with the following:

1.1 MANDATORY QUALIFICATION(s)

1.1 Proposers must meet the following mandatory qualifications in order to be considered a qualified source and thereby eligible for award. Include how you will meet these mandatory qualifications as a distinct section of your Technical/Management proposal.

- The Proposer must be a United States corporation, partnership, or other association created under the laws of the United States or of any State (including the District of Columbia or any commonwealth, territory, or possession of the United States).

2.0 OPTION EVALUATION

2.1 The Standard Subcontract does not contain an Option Article.

3.0 VOLUME I: TECHNICAL/MANAGEMENT PROPOSAL INSTRUCTIONS

INSTRUCTIONS

JPL will evaluate Volume I of your proposal based on the requested information in the table below and subsequent "Technical/Management Criteria and Factors," with respect to how your proposal meets the requirements of the Standard Subcontract. This evaluation may include any number of considerations as is appropriate for each area of evaluation:

- ***Suitability of the various areas of the technical/management approach;***
- ***Level of understanding of the requirements;***
- ***Extent of insight into the technical/management challenges and their solution;***
- ***Effectiveness of management structure; and,***
- ***Relevancy of corporate and/or personnel experience.***

Please submit your proposal in the order of each criterion and its related factors outlined in the table below.

Optionally, not as part of the proposal evaluation, provide a service cost target range and brief basis of estimate.

VOLUME I - TECHNICAL/MANAGEMENT EVALUATION CRITERIA AND ORGANIZATION				
TECHNICAL/MANAGEMENT CRITERIA AND THEIR WEIGHTING		PROPOSAL ORGANIZATION		
Criteria	Weighting	✓	Maximum Page Limit* 15	Required
TECHNICAL CRITERIA				
Criterion T-1: Study Approach The degree to which the proposed approach demonstrates the ability to formulate and carry out a study that addresses the requirements of the Standard Subcontract and Exhibits. • Factor 1: Study Implementation Approach • Factor 2: Risk Methodology • Factor 3: Cost Methodology	250			
Criterion T-2: Design Approach The degree to which the proposed initial service concept will meet the functional requirements of the Design Reference Mission. . • Factor 4: Conceptual Design Approach • Factor 5: Effective Use of Existing or Developing Products • Factor 6: Unique Advantages of Approach	400			

MANAGEMENT CRITERIA		
Criterion M-1: Personnel and Schedule The degree to which the proposed personnel and schedule are appropriate to perform the effort as described in the standard subcontract. • Factor 7: Study Personnel • Factor 8: Study Plan	150	
Criterion M-2: Related Experience The degree to which the proposer's related organizational experience will enhance the proposer's ability to perform this study and develop a service concept capable of satisfying the specifications of the selected Design Reference Mission. • Factor 9: Relevant Organizational Experience	200	
Total Score Possible:	1,000	

*If "Page Limit" is checked: Any required page limitations included in an RFP shall be strictly enforced. A page size is defined as 8 ½" x 11" each; any drawings/photos are included; single spacing minimum; font size not less than 10; all margins ½" or greater. For graphics and tables, font size 8 is acceptable. If there is a "Required" page limit, no pages beyond the number specified will be evaluated. Unless requested, mockups, models, samples, hardware, or software of any kind must not be furnished and will not be considered. JPL forms/attachments, such as A-1, A-15, and A-21 will not to be included in the Maximum Page Limit.

TECHNICAL/MANAGEMENT CRITERIA AND FACTORS

Factors are not assigned weightings. All factors for a given criteria are accounted for when scoring that criteria:

1.0 Criterion T-1: Study Approach

The degree to which the proposed approach demonstrates the ability to formulate and carry out a study that addresses the requirements of the Standard Subcontract and Exhibits.

Factor 1: Study Implementation Approach

Describe how the study will produce a service concept consistent with the specifications of the selected Design Reference Mission. Include a description of how conceptual studies are performed in your organization.

Factor 2: Risk Methodology

Describe how the study team will identify any technical, programmatic (including business case), or schedule risks in your service concept and how study activities would allow further definition and mitigation of those risks/uncertainties.

Factor 3: Cost Methodology

Describe your costing methodology and what will be used as a basis of estimate for service costs associated with your selected Design Reference Mission.

2.0 Criterion T-2: Design Approach

The degree to which the proposed initial service concept will meet the functional requirements of the Design Reference Mission.

Factor 4: Conceptual Design Approach

Discuss your preliminary service concept for the selected Design Reference Mission, including a description of the architecture. Identify the key trades and risks along with the analyses, mitigations, and design activities that would be performed. Specifically include what trades you will explore to minimize cost and cost risk.

Factor 5: Effective Use of Existing or Developing Products

Describe any applicable current or developing products and their proposed adaptation to meet the needs of the selected Design Reference Mission. Include descriptions of design changes, testing, and verification/validation that would be needed to meet the unique challenges of a mission to Mars.

Factor 6: Unique Advantages of Approach

Identify and describe unique or novel aspects of the proposed service concept that will bolster its success. Discuss the aspects of your service model that are likely to result in significant cost reductions relative to prior Mars mission implementations. Include any other potential advantage of your company (e.g. products, experience, or competency) that would lead to a successful execution of the selected Design Reference Mission.

3.0 Criterion M-1: Personnel and Schedule

The degree to which the proposed personnel and schedule are appropriate to perform the effort as described in the standard subcontract.

Factor 7: Study Personnel

List key personnel by name, role, and organization who have the required skills and experience to address the activities included in this study. Include a description of their respective positions within your organization, and area of responsibility. Discuss the relevant past experience of these key personnel that qualifies them for this task. Describe your company's diversity, equity, and inclusion vision and how this study and future potential service models fit into the theme of "Exploring Mars Together" (MEP 2024-2044 Plan).

Factor 8: Study Plan

Provide a summary schedule for the study. Identify and describe key tasks and milestones, meeting the objectives of this study. State whether or not any support is needed from MEP to complete the study, if so describe.

4.0 Criterion M-2: Related Experience

The degree to which the proposer's related organizational experience will enhance the proposer's ability to perform this study and develop a service concept capable of satisfying the specifications of the selected Design Reference Mission.

Factor 9: Relevant Organizational Experience

Provide a discussion of related institutional experience in development and system integration of hardware and software for deep space applications that would be extensible to a Mars service paradigm. Also include:

- Specific experience with service-based paradigms, public-private partnerships (PPP), etc.
- Any previous experience in adapting current or proposed product lines necessary to meet new and unique requirements, specifically as they might be applicable to the selected Design Reference Mission.

VOLUME II: COST/PRICE INSTRUCTIONS
Fixed Price Subcontract excluding Fixed Price with Progress Payments

Failure to provide the cost or pricing data requested below may render the proposal nonresponsive

1.0 DATA SUBMITTAL

1.1 Provide a proposal cover sheet, signed by the proposer's authorized representative, stating the proposed cost, profit or fee, and total price.

1.2 Provide the pricing and business data requested in paragraphs 2.0 and 3.0 below.

1.3 Provide the supplemental business information requested in paragraph 7.0 below.

2.0 PROPOSAL PRICING

Provide the cost/price information requested below in accordance with Attachment A-15, "*Cost Element Breakdown*".

2.1 Attachment A-15 shall be provided in an Excel or Excel-compatible format, including the following worksheets as applicable. Proposers may use their own template as long as all the data required in Attachment A-15 is included.

Tab 1 – Cost Element Breakdown Total by Year
Tab 2 – Cost Element Breakdown Total by Month
Tab 3 – Travel & Relocation Cost Detail
Tab 4 – Material Cost Detail
Tab 5 – Subcontract Cost Detail
Tab 6 – Cost Element Breakdown by WBS by Month

2.2 Show all formulas used within a worksheet cell. For the application of indirect rates and factors, the rate or factor, the corresponding base cost, and the resulting total shall each be identifiable.

2.3 Provide the cost/price information by Work Breakdown Structure (WBS) Level # 2, as defined below. If selected for negotiations, proposer may be required to provide cost/price information at a lower level in the WBS structure for all, or a selected number of tasks or work packages.

WBS Level 1 – Total Effort
WBS Level 2 – Phase, Deliverable, Milestone, etc. (proposer's discretion)

2.3.1 For WBS Level 2 or lower in the WBS structure, duplicate Tab 6 WBS X.X as needed based on the number of WBS items proposed. In labeling each WBS Tab revise X.X to state the WBS item number.

2.3.2 The format of Tab 6 is identical to the format of Tab 2, with Tab 2 containing the amounts proposed by month for the total effort (at WBS Level 1), and Tab 6 containing the amounts proposed by month for the stated WBS item number (at WBS Level 2 or lower). If paragraph 2.3 requires cost/price information at WBS Level 1 only, Tab 6 is not needed.

2.4 JPL reserves the right to evaluate the reasonableness of the proposed cost/price. JPL may request and examine, at any time before award, all records or documents directly pertinent to the information requested or submitted. *Submission of the proposal constitutes agreement to provide the pertinent data as stated herein.*

3.0 COST ELEMENTS SUPPORTING DATA

All basis-of-estimate information requested below, shall be submitted in PDF, Microsoft Word, or a compatible format, with fully searchable text (i.e. no text images).

3.1 Direct Labor – Reference Attachment A-15 Tabs 1 (by year) and 2 (by month). **Failure to provide the direct labor rate data requested below may render the proposal nonresponsive**.

3.1.1 Labor shall be proposed by work-hour (not work-month). If selected for subcontract award, a Full Time Equivalent (FTE) labor profile by month may be required.

3.1.2 Explain the basis of the labor-hour estimates by labor classification. Show all calculations in detail, including the development of any factored hours and the base to which the factor is applied.

3.1.3 Explain the development of the labor rates, including all escalation factors. State whether the proposed direct labor rates are averages, or are the specific rates of the workforce proposed.

3.1.4 Provide a summary labor rate table, by labor classification, and lowest fiscal period (e.g. by quarter if rates change quarterly).

3.1.5 If available, provide evidence of Government approval of direct labor rates for each labor classification

3.2 Travel & Relocation – Reference Attachment A-15 Tabs 1, 2, and 3

3.2.1 Travel – Within Tabs 1 and 2 include the total travel cost by year (Tab 1) and by month (Tab 2). Within Tab 3 provide the following.

3.2.1.1 State the destination and purpose of each trip proposed.

3.2.1.2 Provide the per trip travel cost breakdown including, but not limited to, the following as applicable; number of travelers, number of nights, number of rental cars, airfare, mileage, lodging, meals & incidental expenses, and rental car expense.

3.2.1.3 Provide current company policy regarding the reimbursement of travel expenses and the accounting of such costs as a direct or indirect expense.

3.2.2 Relocation – Within Tabs 1 and 2 include the total relocation cost by year (Tab 1) and by month (Tab 2). Within Tab 3 provide the following.

3.2.2.1 State the origin and destination locations for each individual relocation.

3.2.2.2 State the basis for requiring each individual relocation.

3.2.2.3 Provide a detail relocation cost breakdown including, but not limited to, allowances for subsistence, transportation, and moving expenses.

3.2.2.4 Provide current company policy regarding the reimbursement of relocation expenses and the accounting of such costs as a direct or indirect expense.

3.3 Material – Reference Attachment A-15 Tabs 1, 2, and 4. Within Tabs 1 and 2 include the total material cost by year (Tab 1) and by month (Tab 2). Within Tab 4 provide the following.

3.3.1 A detail Bill of Material listing all raw materials and purchased parts, including: part number, description, quantity, unit price, extended price, lead time, supplier, and basis-of-estimate. Include, and separately identify, all applied mark-up amounts unique to material cost.

3.3.2 "Raw Mat'l Mark-up" shall include only those mark-up amounts unique to raw material cost, e.g. material handling, freight-in, scrap, etc.

3.3.3 Basis of Estimate "Source Document" includes (but is not limited to) purchase order (current or historical), catalog price, and engineering estimate.

3.3.4 Basis of Estimate "Reference" shall cite the specific Source Document, i.e. Purchase Order number and date, catalog publication and date, engineering estimate back-up, etc.

3.4 Subcontract Detail – Reference Attachment A-15 Tabs 1, 2, and 5. Within Tabs 1 and 2 include the total subcontract cost by year (Tab 1) and by month (Tab 2). Within Tab 5 provide the following.

3.4.1 Provide the subcontractor's name, location, description of subcontract, subcontract type (i.e. Cost Reimbursable, Fixed Price, etc.), basis of estimate, and proposed amount by year.

3.4.2 Provide the basis-of-estimate for each subcontract, including the process utilized to determine the reasonableness of each subcontractor's proposed price. Explain any adjustment made to the subcontractor's proposed price.

3.5 Other Direct Cost – Reference Attachment A-15 Tabs 1 (by year) and 2 (by month)

3.5.1 Computer Usage

Describe the proposed computer usage, extent of usage, rate, and the total cost. Explain the development of each rate.

3.5.2 Consultants

Indicate the specific task requiring consultant services. Identify each proposed consultant, state the proposed hourly/daily rate, the estimated number of hours/days, and any associated costs (e.g. travel expense). State whether the consultant has been compensated at the quoted rate for similar services performed in connection with Government contracts.

3.5.3 Licensing and Royalty Information

Provide a description, supporting cost data, and corresponding cost, for each licensing and royalty expense item proposed.

3.5.4 Other

Provide a description, supporting cost data, and corresponding cost, for each additional other direct cost item proposed.

3.6 Indirect Cost - Attachment A-15 Tabs 1 (by year) and 2 (by month). **Failure to provide the indirect rate data requested below may render the proposal nonresponsive**.

3.6.1 Explain the development of each proposed indirect expense rate (e.g., labor overhead, material overhead, off-site burden, general and administrative).

3.6.2 Specifically identify the cost elements included in the base to which each indirect rate is applied. List the indirect expense rates experienced for the past two years.

3.6.3 Explain any significant variance between the experienced and the proposed indirect rates.

3.6.4 Provide evidence of Government approval of each indirect rate, if available.

4.0 PROGRESS PAYMENTS

Progress payments will not be allowed under this Fixed Price subcontract

5.0 PROVISIONAL MILESTONE/PARTIAL PAYMENTS

Provisional Milestone/Partial payments will not be allowed under this Fixed Price subcontract.

6.0 RESERVED

7.0 SUPPLEMENTAL BUSINESS/COST INFORMATION

Provide the following supplemental business information with the proposal

7.1 Financial Statement/Financial Responsibility

Demonstrate that the proposer has sufficient financial resources to handle a subcontract of the dollar value anticipated.

7.1.1 Provide a copy of the proposer's annual financial statements for the last three years, and any information regarding additional financial resources required to perform the proposed effort (e.g. bank account statements, or a letter of credit from the proposer's bank which includes the amount of credit initially granted and the current available balance).

7.1.2 Identify any third parties who may have security liens on the proposer's intellectual property, personal property, or general intangibles. Identify the nature of the liens and the source of the liens (e.g. court judgment, security agreement, factor agreement, etc.)

7.2 Accounting Calendar

Provide a copy of the proposer's fiscal accounting calendar for each year in which work is anticipated.

7.3 Attachments

The Section of this RFP entitled "Attachments" consists of those forms and documents containing information applicable to this RFP. Group A Attachments must be completed and attached to the cost proposal. Group B Attachments consist of forms and documents for informational purposes, which may be required as part of the proposal submittal. Note that the Group B Attachments are very important and may be required under the Subcontract.

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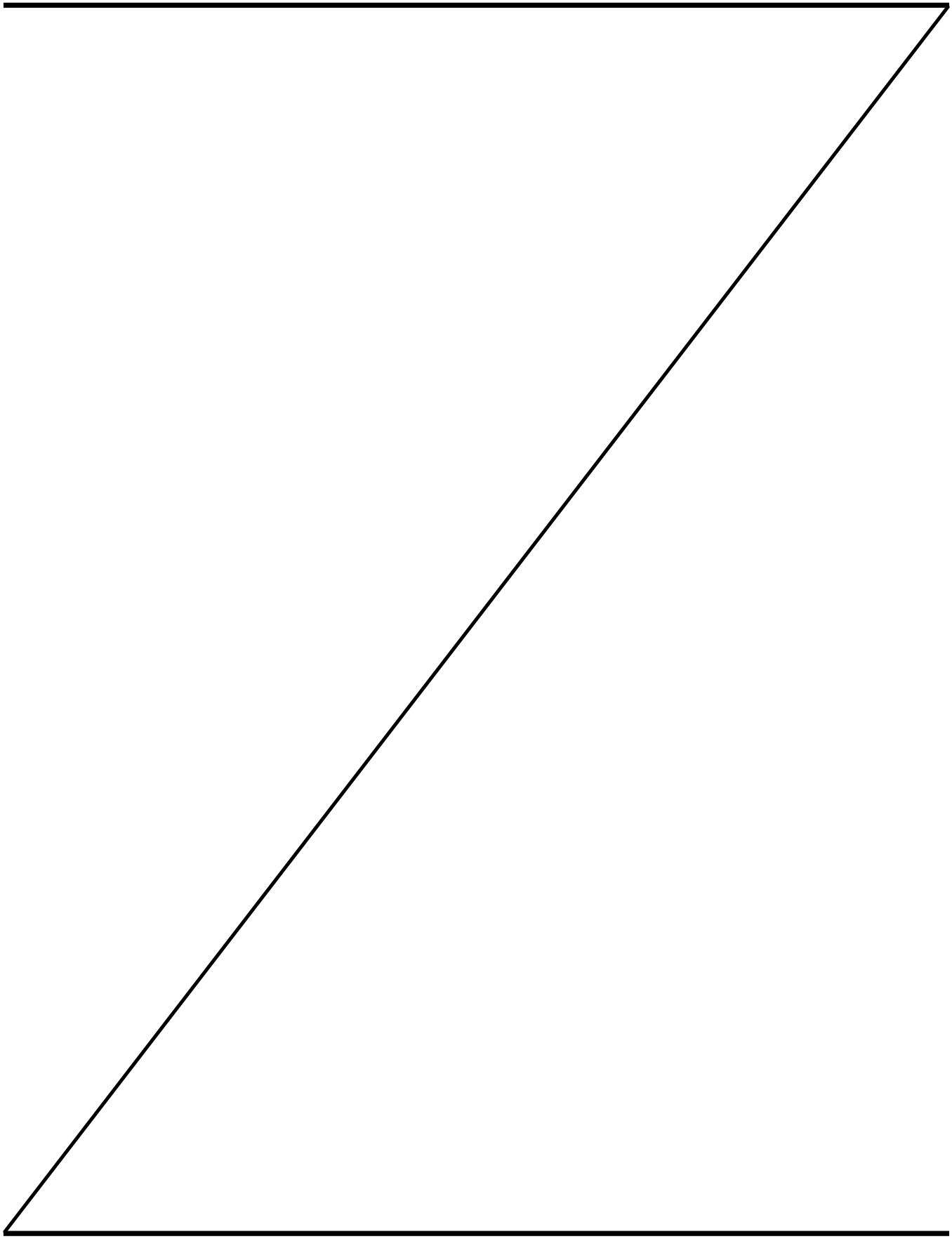
Attachments to the Solicitation *(unless otherwise indicated, below forms are found at: http://acquisition.jpl.nasa.gov/terms-conditions/)*	
GROUP A – Complete and return as part of your quotation/proposal those marked with an "X"	
Non-Construction and Construction Solicitation Types:	
[X]A-1	Acknowledgment (Form JPL 2384-A1)
[ ]A-2	Cost Accounting Standards (CAS) Notice and Certification (Form JPL 2455-A2)
[ ]A-3	Government Property (Form JPL 0544-A3)
[ ]A-4	Commercial Items or Services (Form JPL 2384-A4)
[ ]A-5	Acknowledgment of CREI/FPEI (Form JPL 2384-A5)
[ ]A-6	Notice of Small Business Set-Aside (Form JPL 4022-A6)
[ ]A-7	Notice of Small Business Set-Aside – Modified (Form JPL 4022-A7)
[ ]A-8	Acknowledgment of RSA Subcontract (Form JPL 2384-A8)
[ ]A-9	Use of Lower-Tier Subcontractors, Outside Associates and Consultants (Form JPL 7497-A9)
[ ]A-10	Hourly Billing Rate Breakdown (This is an excel document. Add this as a separate file to the RFP since it will not print into a word/PDF format of the RFP) (Form JPL 7497-A10)
[ ]A-14	Past Performance (Form JPL 0358-A14)
[X]A-15	Cost Element Breakdown (Form JPL 0549-A15)
[ ]A-16	Determination of Lowest Overall Price (Form JPL 0359-A16)
[ ]A-17	Accounting System and CAS Disclosure Statement Information (Form JPL 0549-A17)
[ ]A-20	Evidence of Adequacy of Accounting System (Form JPL 7370-A20)
[X]A-21	Supplier Information Request (Form JPL 7255-A21)
Construction Solicitation Type Only:	
[ ]A-30	Bid Form (Form JPL 3107-A30) NOTE: This Attachment is found in the Solicitation/Bid Package sent to you
[ ]A-31	Bid Bond (Form JPL 1825-A31)
[ ]A-33	Experience Modification Rate (EMR), Recordable Incident Rate, Lost Time Incident Rate (JPL 7245-A33)
GROUP B – Those marked with an "X" are for use in preparing your quotation/proposal:	
Non-Construction and Construction Solicitation Types:	
[ ]B-1	Waiver of Rights to Inventions (Form JPL 62-301-B1)
[ ]B-2	Summary Work Breakdown Structure (Form 7496-B2)
[ ]B-4	° Instructions for Patent Agreement for Use in Support Service Subcontracts (Form JPL 2844-B4)
	° Patent and Copyright Agreement (Form JPL 1929-B4)
[ ]B-5	Notice of Requirement of Pre-award On-Site Equal Opportunity Compliance Review (Form JPL 3553-B5)

[ ]B-6	Subcontracting Plan Requirements (Form JPL 0294-B6)
[ ]B-7	Security Requirement for a Classified Subcontract (Form JPL 2891-B7)
[ ]B-9	Notice to Prospective Subcontractors of Req. for an Environ. Audit of the Lease Facilities JPL 2896-B9)
[ ]B-10	Certificate of Current Cost or Pricing Data (Form JPL 2496-B10)
[ ]B-11	Stds of Conduct & Proc. for Handling Subcontr. Personnel Problems, Discipline, & Separation (JPL 4412-B11)
[ ]B-12	Unescorted Access - Subcontractor Badging Instructions and Reqs (during time of solicitation) (7394-B12)
[ ]B-13	Claims for Exceptions to Cost or Pricing Data (Form JPL 2703-B13)
B-17	[ ]JPL Subcontractor Environmental, Safety, and Health Plan Requirements (Form JPL 2885) [ ] The Jet Propulsion Laboratory (JPL)/Goldstone Deep Space Communications Complex (GDSCC) Subcontractor Environmental, Health and Safety Plan Requirements (Form JPL 2885-G) [ ] JPL Environmental, Safety and Health Plan Requirements – For Flight Projects Form 2885-F
[ ]B-18	Experience Modification Rate (EMR) / Recordable Incident Rate / Lost Time Incident Rate (JPL 7245-B18)
[ ]B-21	Business Reporting Funding (JPL 7500-B21)
Construction Solicitation Type Only:	
[ ]B-31	Notice to Offerors (Form JPL 2843-B31)
[ ]B-32	Payment Bond (Form JPL 1826-B32)
[ ]B-33	Performance Bond (Form JPL 1827-B33)
[ ]B-34	Notice of Award (letter) (Form JPL 0141-B34)
[ ]B-35	Notice to Proceed (Form JPL 0474-B35)



RFP No.: JL-2672-110923
January 29,2024

FIXED PRICE NON-RESEARCH & DEVELOPMENT SUBCONTRACT

STANDARD SUBCONTRACT

Subcontract No. TBD

BETWEEN

CALIFORNIA INSTITUTE OF TECHNOLOGY
JET PROPULSION LABORATORY
4800 OAK GROVE DRIVE
PASADENA, CALIFORNIA 91109-8099
(hereinafter known as "JPL;"
a corporation existing under the laws of the State of California)

AND

TBD
TBD

TBD, TBD, TBD
(hereinafter known as the "Subcontractor;"
a corporation existing under the laws of the State of TBD)

THIS SUBCONTRACT IS FOR
Exploring Mars Together: Commercial Service Studies

AND IS A
SUBCONTRACT UNDER JPL's NASA PRIME CONTRACT

CONTENTS

SCHEDULE

ARTICLES

SUBCONTRACT PROVISIONS AND FORMS SET

The following document set are incorporated into and made a material part of this Subcontract, and can be found at JPL Acquisition's external website:
https://acquisition.jpl.nasa.gov/terms-conditions/ under "Terms and Conditions"

GENERAL PROVISIONS (GPs) SET FOR FIXED PRICE NON-RESEARCH AND DEVELOPMENT SUBCONTRACTS, dated 7/19.

ADDITIONAL GENERAL PROVISIONS (AGPs) SET, dated **7/19**. *Note: Only the AGPs listed below are incorporated into this Subcontract:*

- Preventing Personal Conflicts of Interest

SUBCONTRACT FORMS SET, dated 01/23.

ARTICLE 1. STATEMENT OF WORK AND DELIVERY/MILESTONE SCHEDULE

1.0 The Subcontractor shall provide the necessary personnel, labor, and facilities to provide a study that shall meet the requirements of Exhibit I-DRM 1, Exhibit II-DRM 2, Exhibit III–DRM 3, or Exhibit IV-DRM 4. In the performance of this effort, the Subcontractor shall:

1.1 Executive Summary

1.1.1 Include an executive summary that summarizes your technical concept including space vehicle architecture, launch assumptions, mission profile, and key events. Provide an overview of key heritage advantages that reduce implementation risk. Outline details that build confidence in flight performance. Briefly cite examples of past experiences by your organization that lend credibility to your ability to execute this study. This section provides you an opportunity to inform the Mars Exploration Program (MEP) the major themes your organization will be communicating.

1.1.2 Provide a minimum of one expanded key graphic containing executive summary text, graphical models, and summary tables of key vehicle resource and performance metrics.

1.2 Service Cost and Basis of Estimate

1.2.1 Provide a description of a service-based cost model and assumptions, including funding milestones and payment schedule.

1.2.2 Provide a description of costing Basis of Estimate (BOE) and assumptions, including what government services or infrastructure you are relying on, for all elements and services provided: cost to build, deliver, operate the spacecraft and/or payloads at Mars, and options for extended services. Provide information on your experience and lessons learned with similar service elements, if applicable.

1.2.3 Supply a brief narrative on past programs successfully executed by your organization that increase confidence in your ability to successfully deliver the relevant services at the proposed cost and schedule. MEP is interested in both technical success and the ability to execute within schedule and cost constraints.

1.3 Programmatic Considerations

1.3.1 Discuss whether your proposed service(s) is sufficiently mature to support a FAR-based procurement at this time, or if a public-private partnerships (PPP) phase would be required to achieve that level of maturity. If the latter, describe what contributions would be needed from NASA or any external source in the context of your assumed model and basis of estimate.

1.3.2 Describe any In-house/Internal Research and Development (IRAD) contributions to the development of the service beyond a PPP.

1.4 Technical Design

1.4.1 Describe the system concept that meets service requirements for Subcontractor's selected Design Reference Mission (DRM).

1.4.2 Describe all major element subsystems as listed below:

1.4.2.1 Propulsion
1.4.2.2 Power
1.4.2.3 Avionics and Flight Software
1.4.2.4 Guidance, Navigation, and Control
1.4.2.5 Telecommunications
1.4.2.6 Thermal Control
1.4.2.7 Hosted Payload Interfaces (DRM 1 and 2 only)
1.4.2.8 Deployed Payload Interfaces (DRM 1 and 2 only)
1.4.2.9 Electro-Optical Payload (DRM 3 only)
1.4.2.10 Relay Telecommunications (DRM 4 only)

Include key performance metrics and major operating modes.

Discuss the subsystem philosophy for redundancy and/or loss of functionality mitigation. Describe any life limiting factors of the architecture/spacecraft.

1.4.3 Provide a Mass Equipment List (MEL) table summarizing the mass breakdown. Include both basic and not-to-exceed dry mass estimates for all subsystems of each major element. Also include allocations for any hosted payload(s), propellant load, other consumables, and non-subsystem mass sources such as harness and ballast.

Margins should be listed for each subsystem against the not-to-exceed estimates and for the entire vehicle against the launch allocation. Margins should be calculated as (allocation – basic)/ basic.

1.4.4 Describe your concept of operations.

1.4.5 Provide a Power Equipment List (PEL) table summarizing the power utilization of the space vehicle for different mission phases.

1.4.6 Discuss the adaptation of existing sub-systems, including avionics and software, for a mission to and in the environment of the Martian system.

1.4.7 Describe the mission design and spacecraft delta-v budget, margin, and any scalability of the propulsion capability. Describe the assumptions for the launch period, associated C3, and the Earth-Mars transfer trajectory. Describe the Mars orbit insertion phase and delivery to final orbit. Also discuss how the concept can be adapted to different launch opportunity.

1.4.8 Describe the overall concept for required command, telemetry, and radio metric tracking functions throughout each of the various mission subphases. Describe the schedule of required tracking support from the NASA Deep Space Network (DSN), the assumed Mars Relay Network (MRN), and/or any other ground-tracking assets.

1.4.9 Describe the interface and chosen standard for hosted payloads. Include the number of interfaces, maximum payload mass, and volume capabilities. Discuss pointing considerations and challenges.

Note: This paragraph applies to DRM 1 and DRM 2 only.

1.4.10 Describe the deployed payload interface and specification. Include the number and type of mounting interfaces. Describe the deployed payload mass and volume capability, the deployment hardware, and the deployment notional timeline.

Describe the timeline of events from initiation of the deployment sequence to the final release of the secondary spacecraft. Focus on enumerating key intermediate states and the mechanical process that effects state transition

Note: This paragraph applies to DRM 1 and DRM 2 only.

1.4.11 Describe the imaging sensor selection basis and assumptions. Describe the imaging concept of operations, resolution and quality basis, estimates

of coverage over life of the mission, and plan for acquisition of data products to produce three-dimensional Digital Terrain Models (DTMs).

Note: This paragraph applies to DRM 3 only.

1.4.12 Describe the relay node orbit selection basis and assumptions. Describe the relay telecommunications architecture and performance characteristics such as maximum data throughput, number of simultaneous users, and strategy for replenishment.

Note: This paragraph applies to DRM 4 only.

1.4.13 Describe the concept for implementation and satisfaction of planetary protection requirements.

1.4.14 Describe key trade-space exploration data at both architectural and sub-system levels. Provide basis for systems selection such as telecom, storage, software, propulsion, and avionics, including any heritage considerations.

1.4.15 Provide technology development plan inputs for elements that are at less than Technology Readiness Level (TRL) 6, including at least the TRL assessment rationale; the TRL maturation plan to TRL 6; a rough order estimate (ROM) of cost to mature the technology to TRL 6; and the way in which this plan affects the basis of estimate.

1.4.16 Describe the approach for the identification, tracking, and management of top programmatic and technical risks. List the top programmatic and technical risks and include your planned risk-mitigation measures.

1.4.17 Provide any other information needed to describe the service.

1.5 Meetings and Reviews

Conduct the following study meetings and reviews through virtual teleconference.

Events	**Timeline** *(dates TBD)*
Kick-off meeting	Week 1
Bi-Weekly interchange meetings	Recurring
Interim Presentation of Study	Week 8
Final Presentation of Study and Publicly Releasable Summary	Week 12

1.6 Deliverables

1.6.1 Deliver Interim Study in PowerPoint format with notes, including, but not limited to, items discussed in paragraphs 1.1 to 1.4 above.

- Due: 8 Weeks After Date of Subcontract (ADOS)

1.6.2 Deliver Final Study in PowerPoint format with notes, including, but not limited to, items discussed in paragraphs 1.1 to 1.4 above.

- Due: 12 Weeks ADOS

1.6.3 Deliver publicly releasable Study Summary in PowerPoint format.

- Due: 12 Weeks ADOS

1.7 Delivery Requirements

1.7.1 Time is of the essence in the performance of this Subcontract.

1.7.2 Except as otherwise provided in this Subcontract, the point of acceptance and delivery of all deliverables under this Subcontract shall be the Jet Propulsion Laboratory, 4800 Oak Grove Drive, Pasadena, California 91109.

2.0 JPL will:

2.1 Provide assumptions and constraints for the Subcontractor's work.

2.2 Coordinate at least bi-weekly to ensure progress and provide access to Subject Matter Experts (SMEs) as necessary

3.0 Exhibits

The following exhibits are hereby incorporated into and made a material part of this Subcontract:

3.1 Exhibit I, DRM 1 – Small Payload Delivery and Hosting Services, Dated 01/24/2024.

3.2 Exhibit II, DRM 2 – Large Payload Delivery and Hosting Services, Dated 01/24/2024.

3.3 Exhibit III, DRM 3 – Electro-Optical (Imaging) Services, Dated 01/24/2024.

3.4 Exhibit IV, DRM 4 – Next-Generation Relay Services, Dated 01/24/2024.

3.5 Exhibit V, Reference Documents List, Dated 01/24/2024.

ARTICLE 2 PAYMENT PROVISIONS

1.0 Total Fixed Price: $TBD

2.0 Reserved

3.0 Billing Instructions:

Detailed billing instructions, including sample invoices, can be found at the following link: https://acquisition.jpl.nasa.gov/invoice-services/

4.0 Tax Reporting and Withholding

In accordance with the "Notice of Potential Tax Withholding" contained in this Subcontract's "Subcontract Forms Set," the Subcontractor shall comply with any applicable Federal and State Income Tax reporting and withholding regulations; certain kinds of payments are subject to United States Federal or California State income tax reporting and withholding.

SIGNATURE PAGE

IN WITNESS WHEREOF, the parties hereto have executed this Subcontract as of the below "JPL Signature Date."

SUBCONTRACTOR NAME

Signature & Date: _____

Type/Print Name: _____

Type/Print Title: _____

JET PROPULSION LABORATORY

Signature & Date:* _____

Type/Print Name: _____

Type/Print Title: _____

***JPL Signature Date**: *The JPL Signature Date is the effective date of the subcontract.*

NOTE: Pursuant to the Subcontract's General Provisions entitled *"Authority of JPL Representatives"* and *"Technical Direction" the following applies:*

- Only the following or their Designated Alternates can authorize Subcontract changes, in writing, via JPL-issued modifications to the Subcontract: JPL Subcontracts Manager, Acquisition Management, JPL's Director/Deputy Director/Chief Financial Officer.

- Minor technical changes not affecting the scope or cost of the Subcontract may be made by the JPL Cognizant Technical Manager (or Designated Alternate), but only in writing via the *"Technical Direction Memorandum"* (Form JPL 2084).

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Design Reference Mission (DRM) 1 – Smaller Payload(s) Delivery and Hosting Services

A. General Description

Carry and deliver MEP-provided payloads, including possible deployed cubesats, and operate in Mars orbit. Any excess capacity is owned by the operator.

DRAFT MARKET MODEL FOR STUDY PURPOSE:
Every other Mars launch opportunity (~ every 52 months, alternating with DRM 2 opportunities), provide, deliver, and operate a bus/platform that hosts MEP-provided payload(s) in low-Mars polar orbit.

B. Reference Parameters and Specifications

BUS/PLATFORM & PAYLOAD	
BUS/PLATFORM CAPABILITIES	Provide mechanical, electrical, and data standard interfaces to one or more hosted payloads. Potential payloads could include: scientific instruments, relay communications equipment, deployable CubeSats (including deployment hardware), etc.
PAYLOAD MASS	Up to 20 kg total payload (hosted and/or deployed)
PAYLOAD MECHANICAL INTERFACE	Provide a standard mechanical interface sufficiently robust to minimize or eliminate launch load analyses. NASA desires to utilize current and establish future standards for Mars services.
PAYLOAD POWER	Up to 100 W peak on orbit total to all Payloads combined Bus/platform provides minimum 5W per Payload keep-alive power during cruise
PAYLOAD SHIELDING	Payloads self-shield from interplanetary/Mars environment Bus/platform provides full reset signal over the data interface so Payloads can reset to guard against permanent latchup due to events like Single Event Upset (SEU) from solar flares.
PAYLOAD POINTING	0.5 deg; Payload utilizes available bus/platform pointing capabilities for stability and jitter.
DELIVERY/OPERATIONS	
LIFETIME	Earth-to-Mars Cruise (up to ~2.5 years launch through orbit) + 1 Mars year in orbit

LAUNCH	Assume a Launch C_3 up to 20 km^2/sec^2. Note this allows for launch periods for Mars opportunities over 2026-2040 for chemical propulsion systems. SEP systems may be able to assume a lower C_3, depending upon spacecraft performance and lifetime.
MARS ORBIT INSERTION	Assume arrival velocities consistent with any launch opportunity over 2026-2040. Direct propulsive capture, low-thrust spiral, aerobraking, or other capture means may be used.
DELIVERY ORBIT	Baseline: Similar to Mars Reconnaissance Orbiter - Sun-synchronous, low-Mars polar orbit (~300km) - RAAN: 0° - 360° - Any released CubeSats would be to same orbit
CON OPS	≥ 8hr/day nadir-oriented observations for hosted payload + ≥ 8hr/day DSN communications
MISSION OPERATIONS	Bus provider will operate and command S/C over lifetime. Provide mechanism for payload operators to send commands and receive data
TELECOMMUNICATIONS	
DIRECT-TO-EARTH (DTE) COMMUNICATIONS	Bus/platform will communicate with Earth via Direct-To-Earth (DTE)/Direct-From-Earth (DFE) links with the Deep Space Network (DSN). Payload data rate: ~100 kbps at 1.5AU to 34m DSN

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Design Reference Mission (DRM) 2 – Larger Payload(s) Delivery and Hosting Services

A. General Description

Carry and deliver to Mars orbit one or more separable spacecraft, and optionally provide services for one or more hosted payloads, for an aggregate customer mass (combined mass of separable spacecraft and optional hosted payload[s]) of 1250 kg.

DRAFT MARKET MODEL FOR STUDY PURPOSE:
Every other Mars launch opportunity (~ every 52 months, alternating with DRM 1 opportunities), carry and deliver, one or more separable MEP-provided spacecraft and optionally hosted payloads to low-Mars polar orbit.

B. Reference Parameters and Specifications

PAYLOAD(S)	
BUS/PLATFORM CAPABILITIES	Provide mechanical, electrical, and data standard interfaces to delivered spacecraft and optional hosted payloads; see also SUPPORTABLE CONFIGURATIONS below
PAYLOAD MASS	Up to 1250 kg total (see SUPPORTABLE CONFIGURATIONS)
HOSTED PAYLOAD MECHANICAL INTERFACE	Provide a standard mechanical interface sufficiently robust to minimize or eliminate launch load analyses. NASA desires to utilize current and establish future standards for Mars services.
PAYLOAD POWER	Bus/platform provides keep-alive (15W per Payload) during cruise. For optional hosted Payloads on orbit: 100W - 1kW
PAYLOAD SHIELDING	Payloads self-shield from interplanetary/Mars environment. Bus/platform provides full reset signal over the data interface so Payloads can reset to guard against permanent latchup due to events like Single Event Upset (SEU) from solar flares.
DELIVERY SYSTEM	
MODULAR APPROACH	Ability to scale the system based on different needs at different opportunities (e.g., modular with multiple ports, variable power) Service Provider owns excess capacity
INTERFACE	Utilize ESPA-like standard interfaces (15”/24” separation ring, etc.)

SUPPORTABLE CONFIGURATIONS	1. Single large spacecraft up to 1250 kg 2. One medium spacecraft (500-1000 kg) plus secondary spacecrafts up to 1250 kg total 3. Multiple spacecraft 5 - 450 kg each, totaling up to 1250 kg Option for additional hosted payloads, post-delivery, within overall 1250 kg total mass constraint
SERVICES & OPERATIONS	
FULL SERVICE	Baseline: Deliver spacecraft - Includes integration, cruise, and orbital delivery; Provide DTE telecom during cruise Option: After delivery, host and operate one or more NASA-provided PAYLOAD(s) on orbit (this is part of the 1250 kg total mass).
LIFETIME	Baseline: Cruise through delivery to orbit(s) (up to 2.5 years) Option: + 1 Mars year in orbit for hosted payload(s)
CRUISE SERVICES	Periodic telemetry for each hosted platform through separation
LAUNCH	Assume a Launch C_3 up to 20 km^2/sec^2. Note this allows for launch periods for Mars opportunities over 2026-2040 for chemical propulsion systems. SEP systems may be able to assume a lower C_3, depending upon spacecraft performance and lifetime.
MARS ORBIT INSERTION	Assume arrival velocities consistent with any launch opportunity over 2026-2040. Direct propulsive capture, low-thrust spiral, aerobraking, or other capture means may be used.
DELIVERY ORBIT	Baseline: Similar to Mars Reconnaissance Orbiter - Sun-synchronous, low-Mars polar orbit (~300km) - RAAN: 0° - 360°
MISSION ARCHITECTURE	Open (SEP vs. Chemical vs. hybrid, direct MOI vs. aerobrake, etc.)

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Design Reference Mission (DRM) 3 – Electro-Optical (Imaging) Services

A. General Description

Provide sensor and orbital spacecraft platform(s) for imaging services at Mars. Imaging would be used in support of observational science investigations, landing site selection and hazard assessment, change detection, and monitoring and planning for surface assets.

Imaging platform(s) are assumed be delivered to operational orbit and provide imaging services for one Mars year. Total coverage is determined by the assumed data return rate over the life of the mission.

DRAFT MARKET MODEL FOR THE STUDY RFP:
Provide sensors + spacecraft platform; assume MEP funding for 1 Mars Year (~2 Earth Years) of on-orbit imaging services, with option for extended services through 2044.

B. Reference Parameters and Specifications

IMAGING SYSTEM	
RESOLUTION	High-resolution, targetable passive or active imaging capable of identifying surface features (e.g., rocks, gullies, slopes) at a scale of ~1-2 m or better
COVERAGE	Capable of imaging latitudes up to ± 85°. Total surface coverage will be determined by the data rates specified in the TELECOMMUNICATIONS section (below) over the life of the mission.
STEREO CAPABILITY	The ability to generate precision 3-D Digital Terrain Models (DTMs) from sets of imaging products. (Processing by a third party)
ORBIT AND MISSION PARAMETERS	
ORBIT	Similar to Mars Reconnaissance Orbiter - Sun-synchronous, low-Mars polar orbit (~300km) - For VIS/NIR/FIR/TIR assume 3 PM LST ascending node Alternate orbits must meet all other mission objectives
DELIVERY	Launched and delivered to operational orbit via separate service or government asset.
MISSION OPERATIONS	Bus provider will own, operate, and command the Spacecraft over lifetime. Provide mechanism for data users to request and receive data
LIFETIME	Delivery (up to 2.5 years) + prime mission (1 Mars year)

TELECOMMUNICATIONS	
PROVIDED RELAY	Baseline: None; use a Direct-to-Earth (DTE) link to a DSN 34m antenna Option: Use the Next-Gen Mars Relay Network (MRN, see below option End-to-End Data Return description)
END-TO-END DATA RETURN	Baseline: ≥ 15 Gb/day imaging data products to MEP at an Earth-Mars distance of 1.5 AU returned via Direct-to-Earth link. Assume 8 hr/day DSN 34m antenna Option: 500 Gb/day imaging data products an Earth-Mars distance of 1.5 AU through the Next-Gen Mars Relay Network. The Next-Gen MRN could offer high-rate proximity link telecom services via directional X-band proximity links with rates of ≥ 10 Mb/s for orbital users equipped with an approximately 30-cm/15-W (RF power) X-band telecom capability Any excess capability is owned by service provider

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Design Reference Mission (DRM) 4 – Next-Generation Relay Services

A. General Description

Provide communications relay services between Mars and Earth for surface and orbital assets.

DRAFT MARKET MODEL:
Provide high-volume data relay from Mars to Earth; assume MEP funding for relay services for 2 Mars Years (~4 Earth Years) with option for sustained long-term services through 2044. Any excess capacity is owned by the service provider.

B. Reference Parameters and Specifications

ANTICIPATED FUTURE USERS	

• Fixed or mobile surface users with small to medium data-return needs in low-to-mid latitudes.
• Orbiting science missions with small to large data return
  - Imaging orbiting mission could require highest data return in polar to midlatitude orbits.
  - Other non-NASA customers are encouraged.
• Several users require data relay services at any given time.
• Special low-data latency and critical-event coverage for single, infrequent events.	

SERVICE CHARACTERISTICS	
SERVICE PROVISION	• Flexibility to provide communications and navigation services to a wide range of small, medium, and large orbital and surface missions over multiple Mars years preferred. • Service could be provided during or after other services such as payload hosting/delivery.
DELIVERY	Launched and delivered to operational orbit via separate service or government asset.
MARS ORBIT	Baseline: Any orbit that provides high-volume end-to-end data return, low latency, and long-life reliable service. Option: Increased relay coverage and contact time with surface and orbital users, via a high-altitude orbit - Load-sharing capability across other high-altitude relay orbiters

DIRECT-TO-EARTH (DTE)	DATA RATE: High-performance DTE link capable of supporting ≥ 4 Mb/s data rate (with a goal of 10 Mb/s) to a DSN 34m antenna at an Earth-Mars distance of 1.5 AU (and scaling as $1/R^2$ for other EarthMars distances) STANDARDS: Utilize NASA Deep Space Network (DSN). DSN standard CCSDS protocols required BAND: Ka band for compatibility with future DSN Assume up to 24hrs DSN availability
PROXIMITY RELAY - STANDARD	• Directional proximity links at X-band (forward and return, options for S-, Ku, K-band, or optical could be explored in addition to Xband) supporting data rates of ≥ 10 Mb/s to minimize user telecom subsystem mass/power • Capability to acquire range, Doppler, and timing observables on the proximity link in support of in situ Position, Navigation, and Timing (PNT) services *Note: other service support frequency and antenna options possible*
PROXIMITY RELAY - LEGACY	• Legacy UHF link capability compatible with current Mars Relay Network • UHF omnidirectional that does not require pointing or high power from users • If from higher altitude orbit, lower data rates are acceptable due to larger slant range
LATENCY	User uplink/downlink latency < 6 hrs
SCHEDULING SERVICES	Assume that MEP provides support for scheduling DSN time as needed to support the DWE link, and for scheduling relay services as requested by relay service users
ONBOARD STORAGE	Minimum capability to support daily store-and-forward relay operations and up to 10-day DTE link outages. Potential upgrade to larger data volume storage capability could allow onboard buffering of user data collected at large Earth-Mars distances for higher rate downlink during periods of low Earth-Mars distance.

STUDY SCENARIOS	
SCENARIO 1	• 2 surface users – one or more contacts/sol (1 Gb/sol each) • 2 orbital users in Low Mars Orbit (10 Gb/sol each) • Aggregate: 22 Gb/sol total
SCENARIO 2	• 5 surface users – one or more contacts/sol (10 Gb/sol each) • 5 orbital users in mix of low and high orbits (30 Gb/sol each) • Aggregate: 200 Gb/sol total

Applicable/Reference Documents List

The documents listed herein constitute the Reference Documents List to the extent specified within the Statement of Work, Exhibits or other applicable documents of this Subcontract. The reference documents for the Design Reference Mission (DRM) Conceptual Studies do not contain any requirements but are provided for context and further understanding.

I. "Exploring Mars Together. DRAFT Plan for a Sustainable Future for Science at Mars 2023 – 2043," Pages: 27. URL: https://mars.nasa.gov/files/mep/Mars_Exploration_Program_Future_Plan.pdf

II. "NASA SMD Launch Vehicle Secondary Payload Adapter Rideshare Users Guide with Do No Harm", Dated Oct. 2021, Pages: 33. URL: https://explorers.larc.nasa.gov/2021APMIDEX/pdf_files/SMD%20SPA%20RUG%20with%20DNH_APD_MIDEX_Final_20211015.pdf

III. "GEVS GENERAL ENVIRONMENTAL VERIFICATION STANDARD (GEVS) For GSFC Flight Programs and Projects," (GSFC-STD-7000A). Dates 4/22/2019. Pages: 203. URL: https://explorers.larc.nasa.gov/2019APSMEX/MO/pdf_files/gsfc-std-7000a_final_3-28-18.pdf

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XV. Glossary

General Applicability:

Num.	Document	General	DRM 1	DRM 2	DRM 3	DRM 4
I	Mars Plan	X				
II	SPA RUG		X	X		
III	GEVS		X	X		
IV	P-POD		X			
V	Mars Env.	X				
VI	MARS-GRAM	X			X	
VII	MD Handbook		X	X		
VIII	DSN Link		X	X	X	X
IX	Mars Relay		X	X	X	X
X	IOAG MBC				X	X
XI	Deep Space Tele.				X	X
XII	LunaNet					X
XIII	PP Req.	X				
XIV	PP Robotic	X				

Glossary

Avionics: The electronic systems used in spacecraft, including communication, navigation, and control systems.

Basis of Estimate (BOE): The underlying rationale and assumptions used to develop cost estimates for various elements and services, including the cost to build, deliver, and operate spacecraft and payloads at Mars.

Characteristic Energy (C3): Essentially the excess energy an object has above and beyond what is needed to escape Earth's gravitational influence. Equal to V-infinity squared. It is commonly expressed in units of km^2/s^2.

Consultative Committee for Space Data Systems (CCSDS): a multi-national forum for the development of communications & data systems standards for spaceflight.

Command, Telemetry, and Tracking (CTT): The overall concept for managing communication functions, including commands sent to the spacecraft, telemetry received, and radiometric tracking throughout different mission phases.

Concept of Operations (ConOps): A document that describes how a system, in this case, a spacecraft, will be operated throughout its mission, including the roles and responsibilities of different components.

Deep Space Network (DSN): A network of antennas and communication facilities used by space agencies, including NASA, for tracking and communicating with spacecraft in deep space.

Delta-V Budget: The allocation of the total change in velocity (ΔV) available to a spacecraft to perform various maneuvers during its mission.

Design Reference Mission (DRM): A predefined mission scenario used as a reference for designing and evaluating the technical and programmatic aspects of a space mission.

Deployed Payload: Spacecraft that will be carried by the service and later deployed in space during the mission.

Digital Terrain Model (DTM): A multi-dimensional representation of the Martian surface created from electro-optical data, providing information about the topography.

EELV Secondary Payload Adapter (ESPA): An adapter standard for launching secondary payloads on orbital launch vehicles.

Electro-Optical Payload: Payloads that capture and process electromagnetic radiation in the optical range, often used for remote and active sensing.

Federal Acquisition Regulation (FAR): A set of rules and guidelines established by the U.S. government to govern the acquisition process for federal agencies, ensuring fair and transparent procurement practices.

Flight Software: Software specifically designed to control the various functions of a spacecraft during its mission, including guidance, navigation, and other critical operations.

Guidance, Navigation, and Control (GNC): The subsystem responsible for guiding a spacecraft, determining its position, and controlling its orientation and trajectory.

Hosted Payload: Payload that will be carried by the service, to remain hosted and potentially operated throughout the mission.

Internal Research and Development (IRAD): Investments made by an organization in its own research and development activities to enhance capabilities or address technological challenges.

Low-Mars Orbit (LMO): The family of near circular orbits with apses between 250-1000 km above the surface.

Mars Relay Network (MRN): A proposed network of communication relays in orbit around Mars, facilitating communication between Mars-bound spacecraft and Earth.

Mass Equipment List (MEL): A table summarizing the mass breakdown of a space vehicle, providing estimates for each major subsystem and element, including margins against not-to-exceed estimates.

Planetary Protection Requirements: Measures and protocols implemented to prevent contamination of celestial bodies with Earth organisms and to protect against potential backward contamination.

Power Equipment List (PEL): A detailed list or table summarizing the power requirements and utilization of a spacecraft during different mission phases.

Proximity Link: Telecommunication link between Mars orbital assets or from landed Mars asset to orbital asset.

Public-Private Partnership (PPP): A collaborative arrangement between a government agency (such as NASA) and a private entity for the development and execution of space missions, often involving cost-sharing and resource contributions.

Risk Mitigation: Strategies and actions planned to minimize or eliminate potential programmatic and technical risks associated with the space mission.

Technology Development Plan: A detailed roadmap outlining the steps and resources required to mature a technology from its current readiness level to TRL 6, including cost estimates and assessment rationale.

Technology Readiness Level (TRL): A scale from 1 to 9 used to assess the maturity of a technology, with TRL 6 indicating that a technology is ready for integration into a system or prototype.

Telecommunications: The technology and systems involved in the transmission of information between spacecraft and ground stations or other spacecraft.

Thermal Control: The methods and systems used to regulate and manage the temperature of spacecraft components and systems to ensure they operate within specified temperature ranges.

Trade-space Exploration: The systematic exploration and evaluation of various design options and trade-offs at both architectural and subsystem levels to optimize mission objectives.