Marshall Space Flight Center
Engineering, Science & Technical Services

JACOBS ESTS Group

Task Order Plan (TOP)

Contract Number: *NNM05AB50C*
TO Title: *Systems Integration and Analysis Support*
TO Number: *43-030303* **Revision:** *11*

Period of Performance: *10/2/2010* to *9/30/2011*

MSFC Initiator: *Dan O'Neil*

(b)(4)

Emergency: *No*

Revision -11: The purpose of this revision is to extend this task into Contract Year 6 of the NNM05AB50C ESTS contract. This revision defines and estimates work for the period October 2, 2010 through September 30, 2011. Additionally, the Schedule, Performance Plan and Risk Assessment have been revised to reflect changes in task activities for the new period of performance. This revision affects support to the VP33 Systems Integration and Analysis Project.

Sub-element suffix	PROGRAM	WBS					
00	VP33 Systems Integration and Analysis	825855.01.01.08					

Revision -10: The purpose of revision -10 is to adjust estimated resources to accomplish the scope of work defined by the Customer; specifically:

1. Decrease labor resources due to the customer determination that they will delay work on the Solar Concentrator System until customer's new technology focuses are defined in FY11.

Funding for this task is provided per WBS: 825855.01.01.08

Revision -09: The purpose of revision -09 is to adjust estimated resources to accomplish the scope of work defined by the Customer; specifically:

1. Increase material resources due to milestones moved to Contract Year 5 (CY5).

Funding for this task is provided per WBS: 825855.01.01.08

Revision -08: The purpose of this revision is to extend this task into Contract Year 5 of the NNM05AB50C ESTS contract. This revision defines and estimates work for the period October 3, 2009 through October 14, 2010. Additionally, the Schedule, Performance Plan and Risk Assessment have been revised to reflect changes in task activities for the new period of performance. This revision affects support to the VP33 Systems Integration and Analysis Project.

Funding for this task is provided per WBS: 825855.01.01.08

Revision -07: The purpose of revision -07 is to adjust estimated resources to accomplish the scope of work defined by the Customer; specifically:

2. Decrease of labor hours due to milestones moved to Contract Year 5 (CY5), data needed for the Systems Analysis Task will not be available until CY5.

Revision 06: The purpose of this revision is to extend this task into Contract Year 4 of the NNM05AB50C ESTS contract. This revision defines and estimates work for the period September 27, 2008 through October 2, 2009. Additionally, the Schedule, Performance Plan and Risk Assessment have been revised to reflect changes in task activities for the new period of performance.

The purpose of Revision 05 is as follows:

1. Add (b)(4) for the acquisition of (b)(4) (b)(4)
2. Add (b)(4) for the (b)(4) (b)(4) to support the (b)(4) (b)(4)

The purpose of Revision 04 is as follows:

1. Change the (b)(4)
2. Add (b)(4)
3. Add (b)(4) (b)(4)

Additionally, the Schedule and Performance Plan have been revised to reflect the laboratory demonstration of proposed lunar processes to support the verification and validation of system models.

The purpose of Revision 03 is to extend this task into Contract Year 3 of the NNM05AB50C ESTS contract. This revision defines and estimates work for the period 29 September 2007 through 28 September 2008. Additionally, the Schedule, Performance Plan and Risk Assessment have been revised to reflect changes in task activities for the new period of performance. Funding for this task is provided per MSFC PR 4200209204

The purpose of Revision 02 is to adjust direct support labor resources to better define actual task activities; specifically:

1. Remove (b)(4)
2. Add (b)(4)
3. Change the (b)(4)

The purpose of Revision 01 is to extend this task into Contract Year 2 of the NNM05AB50C ESTS contract. This revision defines and estimates work for the period 30 September 2006 through 28 September 2007. Additionally, the Schedule, Performance Plan and Risk Assessment have been revised to reflect changes in task activities for the new period of performance.

This Task Order (TO) replaces TO 14-020001 due to the NASA/MSFC reorganization and the subsequent realignment of the NNM05AB50C ESTS contract. This TO defines and estimates work for the period 1 April 2006 through 29 September 2006. Additionally, the Schedule, Performance Plan and Risk Assessment have been revised to reflect changes in task activities for the new period of performance

1.0 Task Order Description & Objectives

Provide systems engineering analysis of system concepts associated with exploration missions. Develop analytical physics-based models for system concepts associated with lunar exploration missions. Perform test and analysis of prototype hardware associated with lunar missions. Manage and operate

a computer cluster to provide expanded capabilities of the available analytical models and architecture assessment tools in support of the proposed lunar mission's systems and architectures. Develop systems and methodologies to evaluate the trade space visualization of proposed systems, subsystems and mission scenarios for future space exploration. Support verification and validation of analytical tools and associated technology data.

2.0 Technical Approach (Including required input, guidelines & assumptions)

A. NASA's Exploration Systems Mission Directorate (ESMD) has a desire for a central tool to analyze exploration architectures that use data from detailed component models developed at the component system level. This strategic analysis tool would provide the framework to control analysis, generate runs, transfer data and collect and process results. A critical feature of this strategic analysis tool is the ability to communicate with the diverse component level models and tools (located at multiple NASA centers) and incorporate their data into the analysis. To support this activity the individual tools and models will be analyzed to determine the compatibility of the data available for exchange. In addition, the models will be evaluated to determine if the tools' / models' output supports the ability to roll up the data to the next higher level in the system under study. Based on the results recommendations will be made to resolve and problems.

B. Support for Lunar Surface Systems projects will be provided in the areas of systems analysis, integration, modeling and laboratory demonstration.
   1. Systems analysis: Provide support in the development of program ideas, experiments to extend, demonstrate, & verify technology, and concepts to support the various system elements. Using Design of Experiments (DOE) techniques perform sensitivity analysis of models to determine the key parameters that drive the modeled system or process.
   2. Integration: Develop analysis tools to provide the capability of estimating physical requirements of various integrated systems, and the flow down effects on subsystems due to the modification of system level requirements. Integrate inputs into families of experiments that are synergistic relative to resource utilization and technology requirement timeframes
   3. Modeling: Develop concepts using Computer Aided Design (CAD) software. Develop Physics-Based Simulation Models of the concepts for use in system studies. Provide electronic files of these concepts in various formats
   4. Demonstration: Acquire hardware to demonstrate the feasibility of the proposed system in support of Lunar ISRU and provide a method to verify and validate the related system models.

C. Support and maintain the computer lab that has been established using of a cluster of computer servers each containing multiple processors. Using lab resources, run, evaluate and integrate commercial software for use in the development and integration of analysis and modeling tools. Assess commercial software that can optimize the exploration systems and architectures for the ESMD proposed space exploration. Update the system's software to incorporate the latest revisions.

D. Verification and validation Support will consist of:
   1. Model level testing: Reviewing the analytical tools, running models with validated inputs, and checking the outputs for consistency. Sensitivity analysis shall apply customer supplied software tools to the system models to generate 3D plots of the trade space. Analysis of the trade space will identify discontinuities or credibility issues associated with the model outputs given a range of inputs. Sensitivity analysis will be primarily of the models used in the lunar exploration architectures
   2. Architecture Analysis: Evaluate analytical tools used for Lunar Exploration Architecture Analysis scenarios. Define the inputs and outputs required to interconnect the data from individual models and determine if proper data flow exists. Assess the sensitivity of each model to the parameters connected to other models and determine if the combination of the network of models is sufficient to achieve the desired results. Provide solutions for problems uncovered.

3. Verify and validate technical data used by the simulation models and in analysis tools to assure the physical parameters used can be referenced to a recognized source and identify the source.

E. Analytical data visualization techniques will be developed The focus will be the development of trade space visualization and data fusion techniques to display system data using tools such as the Virtual Reality Modeling Language (VRML) and X3D. Data displayed may be actual test data, flight data, or data generated by physics-based simulation models. .

3.0 Discussion of Skills Required

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(b)(4)

4.0 Special Tools Required

Two CAD capable computers.

5.0 Participating Subcontractors

None

6.0 Milestones & Deliverables

Systems Analysis of Modeled Systems Version 4 by late Sept 2011

7.0 Special Considerations (Recruiting, Special Equipment / Material, Safety, etc.)

None

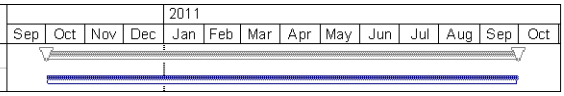
8.0 Work Shelf

The following activities could be accomplished as part of the Task Order performance by personnel that are temporarily available due to program or funding delays on other Tasks. Specific assignments will be coordinated with the Task Initiator to ensure appropriate skills and experience.

TO/Subelement	Description	Due Date	Skill

9.0 Schedule

Task Order #	Subelement	Task Order #	Task Work Element
43-030303	**00**	**43-030303**	**Systems Integration & Analysis Support**
43-030303	00	43-030303	Systems Analysis of Modeled Systems-Version 4



ESTS Contract Task Order Request Performance Plan

Task Order Title: Systems Integration and Analysis Support

Task Order Number: 43-030303 Revision: 11

Category	Weighting Technical %	End of Period Technical Score
Technical Objectives	65%	X 65% =
		Justification
Provide systems engineering analysis of system concepts associated with exploration missions. Develop analytical physics-based models for system concepts associated with lunar exploration missions. Perform test and analysis of prototype hardware associated with lunar missions. Manage and operate a computer cluster to provide expanded capabilities of the available analytical models and architecture assessment tools in support of the proposed lunar mission's systems and architectures. Develop systems and methodologies to evaluate the trade space visualization of proposed systems, subsystems and mission scenarios for future space exploration. Support verification and validation of analytical tools and associated technology data.		
	Weighting Schedule %	**Schedule Score**
Schedule Objectives (Milestones)	10% *(min 10%)*	X 10% =
		Justification
Systems Analysis of Modeled Systems Version 4 Sept 2011 (Rev 11)		
	Weighting Cost%	**Cost Score**
Cost (actual vs. negotiated)	25% *(min.25%)*	X 25% =
		Justification

ESTS Contract Task Order Request Performance Plan

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	Weighting Total %	Total Score
	100.00%	

Technical, Schedule, and Cost Grading Scale

Score	Description
9.0-10.0	Exceeded TO Performance Plan objectives resulting in major benefit(s)
8.0-8.9	Exceeded TO Performance Plan objectives resulting in modest benefit(s)
7.0-7.9	Met TO Performance Plan objectives
3.0-6.9	Did not meet all TO Performance Plan objectives resulting in minimal impact or requiring additional agency funds
0.0-2.9	Did not meet TO Performance Plan objectives resulting in substantial impact and/or requiring additional agency funds

ESTS Contract Task Order Request Performance Plan

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Comments:

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Risk Assessment

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(b)(4)

Task Order Risk Assessment to Cost, Technical, and Schedule

List identified risk associated with Task Order performance as related to task cost, technical, and schedule. Classify the risk(s) according to probability of occurrence and impact as defined below and enter the risk into risk matrix.

Risk	Risk Type	Probability (1-4)	Impact (1-4)	Risk Description
Risk C1	Cost			No cost risks have been identified for this Task Order.
Risk C2	Cost			
Risk T1	Technical			No technical risks have been identified for this Task Order.
Risk T2	Technical			
Risk S1	Schedule			No schedule risks have been identified for this Task Order.
Risk S2	Schedule			

*Note: See page 2 for risk mitigation plan for those risks which are Primary Risk Drivers.

Task Order Risk Matrix

		1 Minimal Impact	2 Minor Impact	3 Medium Impact	4 Major Impact
Inevitable Occurrence (>95% Probability)	4	Y	Y	R	R
High Probability of Occurrence (>60% but <95% Probability)	3	G	Y	Y	R
Medium Probability of Occurrence (>25% but <60% Probability)	2	G	Y	Y	Y
Low Probability of Occurrence (<25% Probability)	1	G	G	Y	Y

Legend

- R — **Primary Risk Driver:** Requires Risk Mitigation Plan
- Y — **Caution:** Requires status updates and general plan for risk reduction as determined necessary by Team Lead and Initiator
- G — **Watch:** No Action required

Impact Level	Cost Impact Definition	Technical Impact Definition	Schedule Impact Definition
(1) Minimal Impact	No significant cost impact	No significant technical impact	No significant schedule impact
(2) Minor Impact	Potential to recover cost	Potential to gain required technology without impact	Minor delay in deliverables but no impact to customer
(3) Medium Impact	>0 but <10% subtask cost overrun	Some technical impact but potential to recover	Delay in subtask deliverables but work arounds available and acceptable to customer
(4) Major Impact	>10% subtask cost overrun	Unable to meet technical requirements to perform subtask	Delay in subtask deliverables with impact to customer

Risk Mitigation Plan

Complete the following chart for those risks identified on page 1 as “Primary Risk Drivers”. The following chart will serve as the Risk Mitigation Plan.

Risk No.: Risk Description:		
Mitigation Step No.	Planned Completion Date	Mitigation Step Description