Marshall Space Flight Center
Engineering, Science & Technical Services

Task Order Plan (TOP)

Contract Number: *NNM05AB50C*
TO Title: *ER33 Shuttle Element Support--Valves, Actuators, and Ducts Engineering*
TO Number: *33-030302* **Revision:** *12*

Period of Performance: *10/02/2010* to *09/30/2011*

MSFC Initiator: *Kevin Ward*

(b)(4)

Emergency: *No*

Revision 12: 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. The following Subelements have been closed: Subelement -01, Propulsion Systems Engineering & Integration Engineering Support; Subelement -02, External Tank Engineering Support; and Subelement -03, Space Shuttle Main Engine Engineering Support. The following Subelements have been added for Contract Year 6: Subelement -SA, Propulsion Systems Engineering & Integration Engineering Support; Subelement -SB, External Tank Engineering Support; and Subelement -SC, Space Shuttle Main Engine Engineering Support. This revision results in an estimate of (b)(4) as delineated below.

(b)(4)

The purpose of revision (-11) is to align scope, schedule, and resources with current priorities and expectations for the remainder of this Contract Year. (b)(4)
(b)(4)
(b)(4) The Schedule, Performance Plan and Risk Assessment have not been revised since there are no expected changes in task activities for this period of performance. This revision will increase the overall Task Order estimate by (b)(4) The table below details the revisions and provides additional rationale.

(b)(4)

[redacted]

The purpose of revision (-10) is to extend this task into Contract Year 5 of the NNM05AB50C ESTS contract. This revision defines and estimates work for the period 3 October 2009 through 14 October 2010. Additionally, the Schedule, Performance Plan and Risk Assessment have been revised to reflect any changes in task activities for the new period of performance. Subelement -04, Solid Rocket Booster Engineering Support, has been deleted from this task and will be covered in TO 33-030501, Shuttle Solid Rocket Booster Thrust Vector Control Systems Integration and Components, during Contract Year 5.

The purpose of revision (-09) is to align scope, schedule, and resources with current priorities and expectations for the remainder of this Contract Year. In particular, labor resources were adjusted on Subelements -01, -03 and -04, travel was added to Subelements -01 and -04, travel was removed from Subelements -02 and -03, and ODC was added to Subelements -01, -02 and -03 to reflect current expected project requirements. The Schedule, Performance Plan and Risk Assessment have not been revised since there are no expected changes in task activities for this period of performance. This revision will decrease the overall Task Order estimate by (b)(4) The table below details the revisions and provides additional rationale.

(b)(4)

[redacted]

(b)(4) [redacted]

The purpose of revision (-08) is to align scope, schedule, and resources with current priorities and expectations for the remainder of this Contract Year. In particular, labor resources were adjusted on Subelements -01, -02, and -04 to reflect current expected project requirements. The Schedule, Performance Plan and Risk Assessment have not been revised since there are no expected changes in task activities for this period of performance. This revision will reduce the overall Task Order estimate by (b)(4) [redacted] The table below details the revisions and provides additional rationale.

(b)(4) [redacted]

The purpose of revision (-07) is to align scope, schedule, and resources with current priorities and expectations for the remainder of this Contract Year. (b)(4) [redacted] (b)(4) [redacted] (b)(4) [redacted] The Schedule, Performance Plan and Risk Assessment have not been revised since there are no expected changes in task activities for this period of performance. The table below details the revisions and provides additional rationale.

(b)(4) [redacted]

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

The purpose of revision (-05) is to align scope, schedule, and resources with current priorities and expectations for the remainder of this Contract Year. In particular, ODC was added to Subelements -01 and -04 for advertising and relocation; travel was removed from Subelements -01 and -02; and labor resources were adjusted on all Subelements due to changes in staffing and project requirements. The Schedule, Performance Plan and Risk Assessment have not been revised since there are no expected changes in task activities for this period of performance. The effective date of this Revision (-05) is 1 July 2008.

The purpose of revision (-04) 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 26 September 2008. Additionally, the Schedule, Performance Plan and Risk Assessment have been revised to reflect any changes in task activities for the new period of performance.

The purpose of this revision (-03) is to align scope, schedule, and resources with current priorities and expectations for the remainder of this Contract Year. In particular, due to the time frame to replace a team member, (b)(4) [redacted] are removed from Subelement -01, (b)(4) [redacted] are removed from Subelement -02, and (b)(4) [redacted] are removed from Subelement -03. Travel that was estimated for the final two months of the Contract Year has also been removed since these trips are not required. The effective date of this Revision (-03) is 1 August 2007.

The purpose of this revision (-02) is to align scope, schedule, and resources with current priorities and expectations for the remainder of this Contract Year. In particular, due to an increase in scope, (b)(4) (b)(4) [redacted] are removed from Subelement -01, (b)(4) [redacted] are added to Subelement -02, and (b)(4) [redacted] are added to Subelement -03. Additional resources will be provided through recruitment of new personnel. Additional travel is estimated under Subelements -02 and -03 to support these recruiting efforts and also to support trips to other NASA sites and/or vendor sites. The participating subcontractor has been changed to STS. The Performance Plan and Risk Assessment have been revised to reflect changes in task activities and task order lead. The effective date of this Revision (-02) is 1 February 2007.

The purpose of this 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. Subelements have been added to provide engineering support to the External Tank, Space Shuttle Main Engine, and Solid Rocket Booster.

This Task Order (TO) replaces TO 23-030301 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. Funding for this task is provided per MSFC PR 4200151945. 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 engineering support for planning, design, development, analysis, review, testing, inspection, anomaly resolution, and insight relating to Space Shuttle Main Propulsion System (MPS), External Tank (ET), and Space Shuttle Main Engine (SSME) valves, actuators, ducts, miscellaneous components, and fluid systems. Aggressive engagement with the Project Office and "Shuttle community" must be emphasized. Personnel performing this function must become integral team members. Hardware expertise is considered essential. The task involves flight hardware, developmental hardware, and test hardware. Mission safety is critical, and must be considered and assessed in all engineering activities relating to the Shuttle MPS and ET. Travel to Johnson Space Center (JSC), Kennedy Space Center (KSC), prime contractor facilities, and vendor facilities are likely.

Subelement -SA, Propulsion Systems Engineering & Integration Engineering Support

Provide engineering and technical support to Propulsion Systems Engineering & Integration (PSE&I) programs. Responsibilities include, but are not limited to supporting anomaly resolution and problem investigation efforts, supporting corrective action activities including developing test plans, test procedures, technical reports, design modifications, fabrication of hardware; development of program documentation; and hardware management.

Additionally, develop specifications, test plans, test procedures, and technical reports for evaluation of fluid system components, perform detailed design changes and documentation preparation. Support component level evaluations, analyze design specifications and drawings, and recommend changes to enable proper functioning of the hardware. Support component test activities to evaluate performance of valves, actuators, lines, ducts, miscellaneous fluid components, and fluid systems.

Subelement -SB, External Tank Engineering Support

Provide engineering and technical support to the Space Shuttle ET program. Responsibilities include, but are not limited to supporting anomaly resolution and problem investigation efforts, supporting corrective action activities including developing test plans, test procedures, technical reports, design modifications, fabrication of hardware; development of program documentation; and hardware management.

Additionally, develop specifications, test plans, test procedures, and technical reports for evaluation of fluid system components, perform detailed design changes and documentation preparation. Support component level evaluations, analyze design specifications and drawings, and recommend changes to enable proper functioning of the hardware. Support component test activities to evaluate performance of valves, actuators, lines, ducts, miscellaneous fluid components, and fluid systems.

Subelement -SC, Space Shuttle Main Engine Engineering Support

Provide engineering and technical support to the Space Shuttle Main Engine (SSME) program. Responsibilities include, but are not limited to supporting anomaly resolution and problem investigation efforts, supporting corrective action activities including developing test plans, test procedures, technical reports, design modifications, fabrication of hardware; development of program documentation; and hardware management.

Additionally, develop specifications, test plans, test procedures, and technical reports for evaluation of fluid system components, perform detailed design changes and documentation preparation. Support

component level evaluations, analyze design specifications and drawings, and recommend changes to enable proper functioning of the hardware. Support component test activities to evaluate performance of valves, actuators, lines, ducts, miscellaneous fluid components, and fluid systems.

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

Technical support for Subelements -SA, -SB, and -SC will involve the following activities.

1. Review MPS, ET, and SSME design requirements and objectives.
2. Prepare system schematics, component preliminary sizing and descriptive documentation.
3. Develop preliminary system layouts using Intergraph EMS, Pro-E, or Unigraphics as the CAD system.
4. Perform fluid flow analysis, preliminary thermal/stress analysis and kinematics analysis of engine gimbal operations, if applicable.
5. Revise design sizing of components, system layout and schematics to reflect required changes.
6. Evaluate component requirements, develop specifications and select appropriate components that satisfy the specifications.
7. Provide trade studies on alternate system requirements and configurations, materials selections and other design aspects.
8. Prepare development plans and test procedures for components and systems.

3.0 Discussion of Skills Required

The task requires engineering experience with fluid components for the Space Shuttle launch vehicle design. Development, testing and/or fluid systems design experience are required. Experience with Pro E modeling and fundamental working knowledge of cryogenic propellant fluid systems is desired. Experience with inert gas, hydraulic and/or pneumatic systems is desired. Ability to read and understand technical specifications, interpret test results, and communicate technical conclusions to the team is also necessary. Prepare reports as required to inform and backup technical decisions regarding Shuttle components.

4.0 Special Tools Required

None.

5.0 Participating Subcontractors

None.

6.0 Milestones & Deliverables

Work is primarily driven by the requirements of the respective project customers and are not within the control of the task. Deliverables will include presentations, reports, and letters documenting findings, issues, meetings, trips, etc., as scheduled on a case-by-case basis. Reports documenting significant tasks will be provided as they are completed. Progress of efforts and significant issues will be formally documented in Monthly Activity Reports provided in the (b)(4)

Deliverables will include:

- ❑ Monthly Activity Reports.
- ❑ Trip reports.
- ❑ Results of analyses, trade studies, test data assessments, and investigations.

- ❑ System schematics and component layout drawings.
- ❑ Component specifications and test plans/procedures.

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

7.1 Subelement -SA, Propulsion Systems Engineering & Integration Engineering Support

7.1.1 Travel = (b)(4) or two (2) trips to NASA sites or vendor sites.

7.2 Subelement -SB, External Tank Engineering Support

7.2.1 Travel = (b)(4) for one (1) trip to NASA site or vendor site.

7.3 Subelement -SC, Space Shuttle Main Engine Engineering Support

7.3.1 Travel = (b)(4) for one trip (1) to NASA site or vendor site.

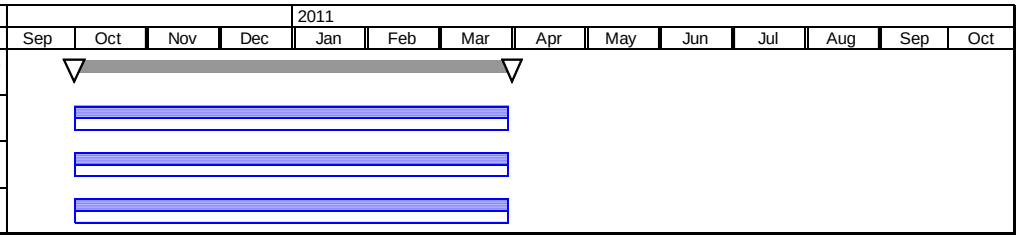
8.0 Work Shelf

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
All	Monthly Activity Report	Monthly	All

9.0 Schedule

Task Order	s/e	Task Work Element
33-030302	S	**ER33 Shuttle Element Support -- Valves, Actuators, and Ducts Engineering**
33-030302	SA	Propulsion Systems Engineering and Integration Engineering Support
33-030302	SB	External Tank Engineering Support
33-030302	SC	Space Shuttle Main Engine Engineering Support



ESTS Contract Task Order Request Performance Plan

Task Order Title: ER33 Shuttle Element Support--Valves, Actuators, and Ducts Engineering

Task Order Number: 33-030302 Revision: 12

Category	Weighting Technical %	End of Period Technical Score
Technical Objectives	65%	X 65% =
		Justification
Provide Valves, actuators, and ducts engineering expertise for the Space Shuttle Main Propulsion System (MPS), External Tank (ET), and Space Shuttle Main Engine (SSME). Must aggressively work component anomalies, monitor onging issues, participate in reviews, boards, and telecons. Must establish solid technical working relationship in the noted areas with the JSC and KSC "Shuttle community". Will be required to provide professional technical documentation such as reports, presentations, and review item discrepancies. Will require some travel to component vendor facilities, prime contractor facilities, JSC, and KSC.		
	Weighting Schedule %	**Schedule Score**
Schedule Objectives (Milestones)	10% *(min 10%)*	X 10% =
		Justification
Must support schedules established by "Shuttle community". Must attend/participate in applicable reviews, telecons, and boards. Must remain current on issues associated with Shuttle MPS, ET, and SSME valves, actuators, and ducts.		
	Weighting Cost%	**Cost Score**
Cost (actual vs. negotiated)	25% *(min.25%)*	X 25% =
		Justification
	Weighting Total %	**Total Score**

ESTS Contract Task Order Request Performance Plan

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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:

Marshall Space Flight Center
Engineering, Science & Technical Services

JACOBS ESTS Group

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.
Risk C2	Cost			
Risk T1	Technical	3	1	Program requirements or design are changed.
Risk T2	Technical			
Risk S1	Schedule	3	1	Task/program schedule changes.
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