

Task Order Plan (TOP)

Contract Number: NNM05AB50C
TO Title: EM50 Environmental Effects Branch Support
TO Number: 34-050001 **Revision:** 16

Period of Performance: 10/02/2010 to 9/30/2011

MSFC Initiator: Jan Rogers

(b)(4)

Emergency: No

REVISION 16

The purpose of this revision is to modify the labor to match the available funding. The overall estimate has been decreased from (b)(4) a decrease of (b)(4). The scope of work on -00 has changed to include design and fabrication of a heating unit for the Impact Test Facility (b)(4) (b)(4) estimate to reflect a reduced effort performing space environmental effects test support for a net increase of (b)(4). Subelements -SB, SI, and -SM have been reduced (b)(4) for -SB; (b)(4) for -SI; and (b)(4) for -SM) to match the funding. The originally planned travel (b)(4) has also been eliminated. The result for these subelements is that less material testing will be accomplished as compared to the original planning. The schedule has also been revised.

The (b)(4)

REVISION 15

The purposes of this revision are to:

- 1) 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.
- 2) Revise the Schedule, Performance Plan and Risk Assessment to reflect changes in task activities for the new period of performance.
- 3) Add subelement - SB "Shuttle SRB Environmental Effects Branch Support".
- 4) Add subelement - SI "Shuttle PSE&I Environmental Effects Branch Support".
- 5) Add subelement - SM "Shuttle RSRM Environmental Effects Branch Support".

REVISION 14

The purpose of this revision is to modify the task descriptions and subelements to reflect the change in scope of this task order. Subelement CA will be administratively closed and the work corresponding to this subelement will be continued under the new TO # 34-000001 Subelement -CK. Subelement -CD will be administratively closed and work corresponding to this subelement will be continued under 34-000001 subelement -DK. The total task order estimate is decreased from (b)(4) a decrease of (b)(4). The Schedule, Risk Assessment and Performance Plan have been updated to reflect the changes in scope, subelements and task descriptions.

Subelement 00:

1. Increased the labor estimate (b)(4) to more accurately reflect labor expended and labor available for the remaining funding.
2. Increased the subcontract estimate (b)(4) to reflect the expense incurred at the completion of subcontracts initiated in contract year 4.

The net increase to 00 is (b)(4)

Subelement 02: Increased the material estimate (b)(4) to reflect additional expenses for consumable materials used in the test labs.

REVISION 13

The purposes of this revision are to:

- 1) Add subelement –CD “J-2X Combustion Devices – Nozzle” (WBS: 136905.08.04.01.08.11) to support new scope for electrostatic levitator and emissivity testing. Defined and estimated work for this task for the period of April 1, 2010 through September 24, 2010.
- 2) Reduced the work estimate for subelement -00 for the period of April 1, 2010 through September 25, 2010 so that resources can be made available to support subelement –CD. This reduction results in a zero net change to the task.
- 3) Modify sections 2.0, 3.0, and 6.0 for subelement –CA (WBS 136905.08.05.12.01.08) to reflect the current customer requirements. The customer requires an addition to the scope and required skills for an engineer to perform tasks as a Foreign Object Debris (FOD) Focal Point including the development of training and awareness materials. The customer also requires an engineer to develop documents for the Project in accordance with Project schedules and develop inputs for MSFC technical standards and directives that impact the Project. This additional scope will be accomplished with existing resources so no change to the estimate was required.

REVISION 12

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 the following APO element: Upper Stage (subelement CA – WBS 136905.08.05.12.01.08).

The (b)(4)

REVISION 11:

The purposes of this revision are to:

- 1) Officially change the name of this task order in (b)(4) to “EM50 Environmental Effects Branch Support” and the name of subelement -00 to “Space Environmental Effects Team Support.” The original task (subelement -00) was for Electrostatic Levitator (ESL) support only. The task has grown to support a variety of work across EM50, but the task name was never officially changed in (b)(4) to match the nomenclature in common use by ESTS and customer personnel. The scope of work for subelement -00 expanded to supporting the entire Space Environmental Effects Team. This revision implements those name changes.
- 2) Add the Ultra HiTEMS Emissometer to sections 2.0 and 3.0. The technical approach and skills needed for this piece of equipment were inadvertently left out of the previous revision to this TOP.
- 3) **Subelement -00:**
 - a. Increase labor estimate to help run the ESL. The customer anticipates a period of increased, concurrent operations for the ESL and the Emissometer. Additional labor will be required to support this short-term surge. A (b)(4) from another task who has previously operated the ESL will provide this temporary support.
 - b. Increase subcontracting estimate to perform numerical analysis of compound spherical optics supporting the customer’s thin-film solar cell research project. It was not known at the beginning of the year that the customer would be awarded this work. Details provided in section 5.0.

- c. Add subcontracting estimate for the Emissometer manufacturer to modify/upgrade the Emissometer which will be performed in August or September. Because the invoice(s) won't be paid this contract year no cost estimate is shown but instead will be estimated on the task order revision that continues this work into the next contract year, CY5. The estimated cost for this is (b)(4) Details provided in section 5.0.
- 4) **Subelement -02:**
- a. Increase labor estimate to account for increased scope of procurement. The customer obtained money to upgrade several pieces of equipment, which was not anticipated at the beginning of the year.
 - b. Increase material estimate to account for increased scope of procurement. The customer obtained money to upgrade several pieces of equipment, which was not anticipated at the beginning of the year. Details provided in section 7.0.
 - c. Increase ODC estimate to ship an ESL component to subcontractor for modification and to ship it back. The customer obtained money to upgrade several pieces of equipment, which was not anticipated at the beginning of the year. Details provided in section 7.0.
- 5) **Subelement –CA:**
- a. Increase material estimate. The contamination control engineer was requested to witness certain hardware handling procedures from within the controlled lift area. This will require personal protective equipment including hard toe safety shoes. This increased the material estimate by (b)(4) Details also provided in section 7.0.
 - b. Decrease travel estimate. Some anticipated contamination control engineer travel will be delayed until CY5 due to changes in cleaning process planning. This change decreased the travel estimate by (b)(4) Details also provided in section 7.0.
 - c. Increase ODC estimate to pay the National Aeronautics FOD Prevention Inc. (NAFPI) meeting and the Institute of Environmental Science and Technology (IEST) working group attendance fees for the contamination control engineer. This change increased the ODC estimate by (b)(4) Details also provided in section 7.0.
- The net change in cost for this subelement is a decrease of (b)(4)

REVISION 10:

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. This revision affects the following APO element: Upper Stage (subelement CA – WBS 136905.08.05.12.01.08).

CY1, CY2 and CY3 revision history is provided in section 10 at the end of this TOP.

1.0 Task Order Description & Objectives

The ESTS Group will provide technical and engineering support to the MSFC Materials and Processes Laboratory Environmental Effects Branch. The Branch is divided into two teams: the Space Environmental Effects team and the Contamination Control Team. The branch operates a number of facilities in support of its work and ESTS personnel are expected to work across both teams and within any of the branch facilities.

Specific projects to be supported and activities to be performed are listed in separate subelements below:

- Subelement 00 – Environmental Effects Branch Laboratory Support
- Subelement 02 – Laboratory Equipment and Instrumentation
- Subelement SB – Shuttle SRB Environmental Effects Branch Support
- Subelement SI – Shuttle PSE&I Environmental Effects Branch Support
- Subelement SM - Shuttle RSRM Environmental Effects Branch Support

Additional subelements will be added to this TOP as new projects requiring support are identified.

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

Environmental Effects Branch Support (all subelements: -00, -02 –SB, -SI, and –SM):

- Provide technical and operations support to EM50. Test equipment support including but not limited to the Electrostatic Levitator (ESL) and the Ultra HiTEMS Emissometer :
 - A. Help operate, maintain and modify the equipment.
 - B. Help develop new technology and equipment designs including fabrication, integration, and field testing.
 - C. Maintain the laboratory.
- Provide Contamination and FOD Control Program definition, development, coordination, training materials development, and implementation support
- Support requirements development, documentation review, document revision/conversion, identification and assessment of development needs, cost/schedule estimates for technical approach activities, and input for safety/risk assessments
- Support problem resolution activities
- Support design trades and manufacturing process definition/changes including but not limited to materials obsolescence studies, cleaning process evaluations/development, coupon/panel level testing, inspection instrumentation applications, and cleaning facilities
- Support materials obsolescence studies
- Support manufacturing/refurbishment activities
- Support Vehicle Integration and Ground Operations Contamination and FOD control program operations, process modifications, and audits
- Support MAF process development and MSFOC planning and controls for shared facilities

3.0 Discussion of Skills Required

Space Environmental Effects Team and Contamination Control Team support requires:

- A. (b)(4) with experience in the levitation of a variety of materials including metals and alloys, along with an understanding of optical diagnostic equipment, pyrometers, high-resolution videography, a working knowledge of vacuum systems, and high-voltage laboratory systems. Additionally the (b)(4) must possess a general knowledge of laboratory equipment as well as fabrication methods and techniques required for developing enhancements to the Electrostatic Levitator equipment/facility, the Ultra HiTEMS Emissometer, the Exploding Wire Gun apparatus, the Space Environmental Effects Facility and the Lunar Environment Test System.
- B. (b)(4) familiar with space environmental effects, aerospace contamination control, and foreign object damage (FOD) control including requirements definition/implementation, process and facilities controls. Skills include development, review and coordination of program/project/customer test plans and procedures, Program/Project level documentation, and material and process specifications. The generation of design requirements, operations control plans, test plans, test reports, training and awareness materials, Standard Operating Procedures, and technical articles are considered integral to this position.

4.0 Special Tools Required

None.

5.0 Participating Subcontractors

Subelement -00 :

(b)(4)

6.0 Milestones & Deliverables

- Monthly Activity Reports.
- Support scheduled Principal Investigator visits and research objectives.
- Deliver analysis reports, training and awareness materials, document review inputs, and draft document revisions in accordance with Shuttle program schedules.

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

Subelement -02:

Material: An estimate has been included to purchase materials required for use on the task order.

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
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9.0 Schedule

Task Order #	Subelemen	Task Work Element	Qtr 4, 2010				Qtr 1, 2011			Qtr 2, 2011			Qtr 3, 2011			Qtr 4, 2011		
			Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct		
34-050001	00	Space Environmental Effects Team Support	[Gantt chart bars]															
34-050001	02	Laboratory Equipment and Instrumentation	[Gantt chart bars]															
34-050001	SB	Shuttle SRB Environmental Effects Branch Support	[Gantt chart bars]															
34-050001	SI	Shuttle PSE&I Environmental Effects Branch Suppo	[Gantt chart bars]															
34-050001	SM	Shuttle RSRM Environmental Effects Branch Suppo	[Gantt chart bars]															

10.0 Revision History

REVISION 09:

This TO Revision 09 revises subelements -00, -02 and -CA. Specific subelement detail is provided below. The total task order estimate is decreased from (b)(4)

Subelement -00 (Revised):

Labor:

Increased labor estimate to accommodate an increased scope of work. The support requirement changed from (b)(4) during the July period, which increased the labor hours estimated under this subelement from (b)(4) which increased the labor cost estimate by (b)(4)

Material:

Decreased the material estimate by (b)(4) fewer resources were required to accomplish the work than were originally estimated.

No-Fee Subcontracts:

Deleted the Electrostatic Levitator data analysis and creep test modifications to reflect the revised procurement strategy. This reduced the subcontracting estimate by (b)(4)

Other Direct Charges (ODC):

1. Added Electrostatic Levitator (ESL) data analysis and creep test modifications to reflect the revised procurement strategy. The vendor provided fixed-price quotations for the requested work, so a subcontract was not necessary. Since these two pieces of work will not be paid for this contract year, the estimate was removed from the TO. However, approval of this TO revision will continue approval to procure a vendor to analyze ESL creep data and modify the ESL to produce more creep during instrument operation for approximately (b)(4). This cost will be estimated in the CY4 TO revision.
2. Removed ESL emissometer service from the estimate since this work will not be paid for this contract year. However, approval of this TO revision will continue approval to procure at the customer's direction a vendor to service the ESL emissometer for approximately (b)(4). This cost will be estimated in the CY4 TO revision. This reduced the ODC estimate by (b)(4).

Paragraph 7.0 further defines the non-labor effort supporting the cost estimate.

The total subelement estimate decrease is (b)(4).

Subelement -02 (Revised):

Material:

Decreased the material estimate by (b)(4). Fewer resources were required to accomplish the work than were originally estimated.

Other Direct Charges (ODC):

Increased the ODC estimate (b)(4) to account for material shipping charges.

Paragraph 7.0 further defines the non-labor effort supporting the cost estimate.

The total subelement estimate decrease is (b)(4).

Subelement -CA (Revised):

This revision affects the following Ares Project Office (APO) Element: Upper Stage WBS# 136905.08.05.12.01.08. (b)(4)

Labor:

Corrected the (b)(4) labor category. It was estimated that a labor category as high as an (b)(4) might be required to secure an (b)(4) with the required training, skills and experience. However, a suitable candidate was hired at the (b)(4) labor category. The estimate was also corrected for the actual (b)(4) start date. These changes decreased the labor hours estimate by (b)(4) and decreased the labor cost estimate by (b)(4).

Travel:

Added (b)(4) estimate for the (b)(4) to attend an ASTM International conference on foreign object debris control.

Other Direct Charges (ODC):

Added (b)(4) estimate for the (b)(4) ASTM International membership.

Paragraph 7.0 further defines the non-labor effort supporting the cost estimate.

The total subelement estimate decrease is (b)(4).

Revision 08:

The purposes of revision 08 are:

1. Create subelement 02 with scope and resources for obtaining several pieces of laboratory equipment which will be installed under subelement 01. The purpose of this new subelement is

to separate this particular equipment funding from the rest of the task funding. These procurement resources were allocated as follows:

- a. Lunar dust particle velocimeter for the Lunar Environment Test System (materials).
 - b. A liquid nitrogen shroud for the Lunar Environment Test System (materials).
 - c. A 2nd high-speed camera for the Exploding Wire Gun (materials).
 - d. Additional Electrostatic Levitator support equipment (materials).
 - e. An X-Y stage with electronics for use with various pieces of equipment (materials).
 - f. An ion gun for use in the Space Environmental Effects Facility (materials).
2. Create subelement CA with scope and resources for a (b)(4) supporting Ares I CLV Integrated Manufacturing and Assembly.

Ares I Crew Launch Vehicle (CLV) Summary

Subelement –CA: Ares I CLV Integrated Manufacturing & Assembly

(b)(4)

February-September 2007).

These modifications increased the cost of this task by (b)(4) **NOTE: This change involves modifications to Crew Launch Vehicle tasks.**

Revision 07:

The purposes of revision 07 are:

1. Add scope and resource estimates to subelement 00 for additional Electrostatic Levitator (ESL) experiments. The resources were allocated as follows:
 - a. Labor to operate, maintain and modify the ESL equipment.
 - b. Procurement support (materials) to obtain optics, electronics, vacuum equipment, mechanisms and laboratory supplies for the ESL.
 - c. A blanket purchase order (ODC) to service and support the Ultra-HiTEMS Emissometer.
 - d. A consulting agreement to determine creep deformation using specialized image analysis and finite element modeling and to help increase the sample rotation rate (and resultant sample creep) during testing.
2. Account for the promotion of (b)(4) from the (b)(4) labor category to the (b)(4) labor category.
3. Account for changes in the balance between ESL support and Plasmoid Thruster Support (under a separate task) which affect the labor estimate for this task.
4. Reopen subelement 01 (Plasmoid Thruster Support) to account for (b)(4) CY2 labor hours not billed until the first period of CY3. The work was moved to another task at the CY2-CY3 transition and this subelement will be closed in the next revision.

These modifications increased the cost of this task by (b)(4) **NOTE: This change does not involve any modifications to Crew Launch Vehicle or Crew Exploration Vehicle tasks.**

Revision 06:

The purpose of revision 06 is to add procurement of a high-speed camera to support the exploding wire gun work. This increased the cost of this task by (b)(4). **NOTE: This change does not involve any modifications to Crew Launch Vehicle or Crew Exploration Vehicle tasks.**

Revision 05:

The purpose of revision 05 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. **NOTE: This change does not involve any modifications to Crew Launch Vehicle or Crew Exploration Vehicle tasks.**

Revision 04:

This revision updates the estimate to account for completing the work with fewer resources than previously estimated, resulting in a net reduction of (b)(4) labor hours. This revision also adds a trip to Argonne National Laboratory to operate the Electrostatic Levitator. This trip was also accomplished for less than previously estimated, resulting in a (b)(4) reduction in travel estimate. The net change due

to this revision is an overall reduction of (b)(4). **NOTE: This change does not involve any modifications to Crew Launch Vehicle or Crew Exploration Vehicle tasks.**

Revision 03:

The purpose of this revision is to update the resources to reflect work done on the Exploding Wire Gun and charged to 34-010003-CA. The Electrostatic Levitator resources were reduced by this amount. This resulted in a net decrease of (b)(4) for the overall task. This revision also shifts Plasmoid Thruster Support resources to later in the year to reflect the fact that this support has not yet started.

NOTE: This change does not involve any modifications to Crew Launch Vehicle or Crew Exploration Vehicle tasks.

Revision 02:

The purpose of this revision is to increase the scope of this task by adding subelement 01 supporting ER24 plasmoid thruster activities. (b)(4) labor hours were moved from subelement 00 to subelement 01 to support this new work. (b)(4) labor hours were added for additional skills requested to complete the work. This resulted in a (b)(4) decrease in estimate for subelement 00. The estimate for subelement 01 is (b)(4) resulting in a net increase of (b)(4) for the overall task. Funding for this task continues to be provided by PR 4200173425. **NOTE: This change does not involve any modifications to Crew Launch Vehicle or Crew Exploration Vehicle tasks.**

Revision 01:

The purpose of this revision is to extend this task into Contract Year 2 of the NNM05AB50C 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. Funding for this task is provided by PR 4200173425.

Revision 00:

Provide technical and operations support for the Electrostatic Levitator (ESL) Facility and Environment Effects Branch. Activities may include: the maintenance and operation of equipment required to support materials development and characterization in support of NASA's exploration mission. Additional activities include operations and studies in support of Environment Effects and Materials Science and Characterization. Efforts may include the fabrication and development of equipment to improve performance, and provide new capabilities.

ESTS Contract Task Order Request Performance Plan

Task Order Title: [EM50 Environmental Effects Branch Support](#)

Task Order Number: [34-050001](#) Revision: 16

Category	Weighting Technical %	End of Period Technical Score
Technical Objectives	65%	X <u>65%</u> = Justification
1. Provide technical and operations support for Environmental Effects Branch 2. Support development of Environmental Effects technology and equipment design, fabrication and integration, and field testing 3. Maintain laboratory cleanliness 4. Provide technical support to the Contamination Control Team in support of requirements definition, training materials development, document review, material obsolescence studies, process development, and problem resolution.		
Schedule Objectives (Milestones)	Weighting Schedule % <u>10%</u> (min 10%)	Schedule Score X <u>10%</u> = Justification
1. Provide Monthly Activity Reports 2. Support scheduled experiments 3. Deliver analysis reports, training and awareness materials, document review inputs, and draft document revisions in accordance with Shuttle program schedules.		
<u>Cost (actual vs. negotiated)</u>	Weighting Cost % <u>25%</u> (min.25%)	Cost Score X <u>25%</u> = Justification
	Weighting Total %	Total Score

ESTS Contract Task Order Request Performance Plan

Task Order Title: [EM50 Environmental Effects Branch Support](#)

Task Order Number: [34-050001](#) Revision: 16

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

Task Order Number: [EM50 Environmental Effects Branch Support](#)

Task Order Number: [34-050001](#) Revision: [16](#)

Comments:

Risk Assessment

Contract Number: NNM05AB50C

TO Title: EM50 Environmental Effects Branch Support

TO Number: 34-050001 Revision: 16

Period of Performance: 10/02/2010 to 9/30/2011

MSFC Initiator: Jan Rogers

(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	2	1	There is a risk that the Subtask cost estimate will increase due to unanticipated overtime, travel, material and ODC charges
Risk C2	Cost			
Risk T1	Technical			No technical risks have been identified
Risk T2	Technical			
Risk S1	Schedule			No schedule risks have been identified
Risk S2	Schedule			

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



