Marshall Space Flight Center
Engineering, Science & Technical Services

JACOBS
ESTS Group

Task Order Plan (TOP)

Contract Number: *NNM05AB50C*
TO Title: *Launch Abort Systems Support*
TO Number: *33-050201* **Revision:** *14*

Period of Performance: 10/02/2010 to 03/31/2011

MSFC Initiator: *Philip Franklin*

(b)(4)

Emergency: *No*

Revision 13:
This revision aligns scope and resources with current expectations. The overall task had a net decrease of (b)(4). The period of performance of the task has been extended through March 31, 2011 to support additional scope. The Performance Plan and Risk Assessment have not been revised. Resource estimates are summarized as follows:

Subelement –EG had an overall decrease in cost estimate of (b)(4). Labor estimate was increased by (b) hours with an associated cost estimate of (b)(4). Labor was realigned due for additional scope on burn rate dispersion study. Travel was removed due to a project decision to hold meetings via teleconference instead of in person. Change resulted in a decrease of (b)(4). Funding for this task is provided per MSFC Work Breakdown Structure (WBS) 869021.05.08.07.08.

Revision 13:
This revision aligns scope and resources with current expectations. The overall task had a net decrease of (b)(4). The Performance Plan and Risk Assessment have not been revised. Resource estimates are summarized as follows:

Subelement –EA Closed in Revision 9.

Subelement –EB Closed in Revision 9.

Subelement –EC Closed in Revision 9.

Subelement –ED Closed in Revision 4.

Subelement –EE Closed in Revision 12

Subelement –EF Closed in Revision 12.

Subelement –EG Total cost is (b)(4) to support NESC Max Launch Abort System Study. Scope of work to include burn rate dispersion study, detailed igniter design and scaling, ballistics design for boost phase motor, and motor stability analysis. Labor has (b)(4) estimated man hours with an associated cost of (b)(4). Funding for this task is provided per MSFC Work Breakdown Structure (WBS) 869021.05.08.07.08.

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 January 1, 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 overall combined total for this task is (b)(4). Resource estimates are summarized as follows:

Subelement –EA Closed in Revision 9.

Subelement –EB Closed in Revision 9.

Subelement –EC Closed in Revision 9.

Subelement –ED Closed in Revision 4.

Subelement –EE Closed with this Revision.

Subelement –EF Closed with the Revision.

Subelement –EG had an overall decrease in cost estimate of (b)(4). Labor estimate was reduced by (b)(4) hours with an associated cost estimate of (b)(4). Labor was realigned to match the requested skill sets for burn rate dispersion study, detailed igniter design and scaling, and ballistics design for boost phase motor. Ballistics stability analysis and joint and seal analysis were removed. Funding for this task is provided per MSFC Work Breakdown Structure (WBS) 869021.05.08.07.08.

Revision 11:
This revision aligns scope and resources with current expectations. The overall task had a net decrease of (b)(4).

Subelement –EA Closed in Revision 9.

Subelement –EB Closed in Revision 9.

Subelement –EC Closed in Revision 9.

Subelement –ED Closed in Revision 4.

Subelement –EE had no cost change. Funding for the Max Launch Abort System study is provided by WBS number 869021.05.08.07.08 and 869021.05.08.07.12.

Subelement –EF had an overall decrease in cost estimate of (b)(4) Labor was realigned to adjust for a change in scope adding Pad Abort 1 Ballistics Reconstruction and Igniter Ballistics Performance Analysis support. Remaining Travel and Training

estimate was eliminated to align with current Project Funding. Funding for this task is provided by WBS number 644423.06.34.03.10.08.

The Performance Plan and Risk Assessment have not been revised.

Revision 10:
This revision aligns scope and resources with current expectations. The overall task had a net decrease of (b)(4).

Subelement –EA Closed in Revision 9.

Subelement –EB Closed in Revision 9.

Subelement –EC Closed in Revision 9.

Subelement –ED Closed in Revision 4.

Subelement –EE had an overall decrease in cost of (b)(4). Labor estimate was reduced by (b) hours with a corresponding decrease in labor cost of (b)(4) (b). Subcontract estimate was reduced by (b)(4) (b). The change is a result of a scope change from design and manufacturing of a Thruster Chamber Assembly to demonstration of chamber assembly manufacturing capability. Funding for the Max Launch Abort System study is provided by WBS number 869021.05.08.07.08 and 869021.05.08.07.12.

Subelement –EF had no change in cost. Funding for this task is provided by WBS number 644423.06.34.03.10.08.

The Performance Plan and Risk Assessment have not been revised. This revision is effective March 31, 2010.

Revision 09:
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 Orion Launch Abort System Abort Motor (Subelements-EA,-EB,-EC,-EF) funded by Work breakdown Structure (WBS) 644423.06.34.03.10.08 which has an overall cost of (b)(4). Work associated with all three motors for Contract Year 5 will be conducted under Subelement EF. The Revision also affect the Max Launch Abort System (Subelement –EE) funded by WBS 869021.05.08.07.08 and 869021.05.08.07.12 has a total cost of (b)(4). The overall task has a combined total of (b)(4).

Subelement –EA closes Subelement -EA for Contract Year 5. Work associated with this sub-element will is now conducted under Subelement-EF. Funding for this task was provided by WBS number 644423.06.34.03.10.08.

Subelement –EB has a total cost of (b)(4). Labor has (b) estimated man hours with an associated cost of (b)(4) for subcontractor overhead. Subcontract cost of (b)(4) has been included for work performed in September of Contract Year 4

that will be invoiced in CY5. This revision closes the task for new work. Work will not be conducted under Subelement –EF. Funding for this task is provided by Work breakdown Structure (WBS) number 644423.06.34.03.10.08.

Subelement –EC has a total cost of (b)(4). Labor has (b estimated man hours with an associated cost of (b)(4) for subcontractor overhead. Subcontract cost of (b)(4) (b have been included for work performed in September of Contract Year 4 that will be invoiced in CY5. This revision closes the task for new work. Work will not be conducted under Subelement –EF. Funding for this task is provided by WBS number 644423.06.34.03.10.08.

Subelement –ED Closed in Revision 4.

Subelement –EE total cost is (b)(4). Labor has (b) estimated man hours with an associated cost of (b)(4) for subcontractor overhead. Subcontract estimate is (b)(4) for Max Launch Abort System trade study engineering support. Funding for this task is provided by WBS number 869021.05.08.07.08 and 869021.05.08.07.12.

Subelement –EF total cost is (b)(4). Labor has (b)(4) estimated man hours with an associated cost of (b)(4) Labor estimate are an extrapolation of the previous year actuals based on the Work Year Equivalent allocations. Training costs of (b)(4) was included for employee professional development. (b)(4) of travel cost was included to attend and support technical meetings, design reviews, and program management reviews with motor manufacturers. Subcontract cost of (b)(4) was included based on the Contract Year 4 support. Funding for this task is provided by WBS number 644423.06.34.03.10.08.

This revision is effective October 3, 2009.

Revision 08: This revision aligns scope and resources with current expectations. The overall task has a net decrease of (b)(4). The Launch Abort System Abort Motor -EA, Attitude Control Motor -EB, and Jettison Motor -EC Subelements funded by WBS 644423.06.34.03.10.08 had a net decrease of (b)(4) as a result of a reduction in Work year Equivalent (WYE) resource allocations. Subcontractor distribution between Subelement –EA, Subelement-EB and Subelement –EC were also redistributed based on the reduction in Work Year Equivalent resources to support existing tasks. The overall subcontract cost was decreased by (b)(4) due to the delay in program schedule. The Max Launch Abort System Subelement –EE funded by Work Breakdown Structure (WBS) 869021.05.08.07.08 and 869021.05.08.07.12 had a net decrease of (b)(4). This revision removes subcontractor support due to a schedule slow down moving the required support to September and the next contract year. 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 total estimated cost for this is (b)(4).

Subelement –EA had a total cost increase of (b)(4). The subcontract cost increased (b)(4). Other costs were decreased by (b)(4) for unused training and professional development. Travel was reduced by (b)(4) as a result of program schedule changes. Funding for this task is provided by WBS number 644423.06.34.03.10.08.

Subelement –EB had an overall decrease in cost of (b)(4). Labor estimate was decreased by (b)(4) hours with an associated cost decrease of (b)(4). The decrease in hours realigns resource estimates with the current scope reduction. Subcontract was increased by (b)(4) to realign resource estimates with current scope. Other costs were decreased by (b)(4) for unused training and professional development. Travel was reduced by (b)(4) as a result of program schedule changes. Funding for this task is provided by WBS number 644423.06.34.03.10.08.

Subelement –EC had an overall decrease in cost of (b)(4). Labor estimate was decreased by (b) hours with an associated cost decrease of (b)(4). The decrease in hours realigns resource estimates with the current scope reduction. Subcontract was decreased by (b)(4) to realign resource estimates with current scope. Other costs were decreased by (b)(4) for unused training and professional development. Travel was reduced by (b)(4) as a result of program schedule changes. Funding for this task is provided by WBS number 644423.06.34.03.10.08.

Subelement –ED Closed in Revision 4.

Subelement –EE had an overall net decrease of (b)(4). This revision removes subcontractor support due to a schedule slow down moving the required support to September and the next contract year. 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 total estimated cost for this is (b)(4).Travel was reduced by (b)(4) since no trip was required to support meetings at the subcontractor facility. Funding for this task is provided by WBS number 869021.05.08.07.08 and 869021.05.08.07.12.

The Schedule, Performance Plan and Risk Assessment have not been revised. This revision is effective August 7, 2009.

Revision 07: This revision aligns scope and resources with current expectations. The labor hours were also increase to account for the additional week in Contract Year 04 that was not initially estimated. Subcontractor distribution between Subelement -EB and Subelement –EC were also adjusted based on additional scope. The Launch Abort System Abort Motor, Attitude Control Motor, and Jettison Motor Subelements funded by WBS 644423.06.34.03.10.08 had a net increase of (b)(4). The Max Launch Abort System Subelement funded by Work Breakdown Structure (WBS) 869021.05.08.07.08 and 869021.05.08.07.12 had no change.

Subelement –EA had no change from the previous revision. Funding for this task is provided by WBS number 644423.06.34.03.10.08.

Subelement –EB had an overall increase in cost of (b)(4). Labor estimate was increased by (b)(4) hours with an associated cost of (b)(4). The increase in hours realigns resource estimates with current scope and accounts for the additional CY4 week that was not initially estimated. Subcontract was increased by (b)(4) to realign resource estimates with current scope. Subcontract estimate was transferred from Subelement –EC. Funding for this task is provided by WBS number 644423.06.34.03.10.08.

Subelement –EC had an overall increase in cost of (b)(4). Labor estimate was increased by (b) hours. The labor cost was increased by (b)(4) as a result of the increased hours and a transfer of (b)(4 hours to a resource rate. The increase in hours realigns resource estimates with current scope and accounts for the additional CY4 week that was not initially estimated. Subcontract estimate was decreased by (b)(4) to realign resource estimates with current scope. Subcontract estimate was transferred to Subelement –EB. Funding for this task is provided by WBS number 644423.06.34.03.10.08.

Subelement –ED Closed in Revision 4.

Subelement –EE had no change from the previous revision. Funding for this task is provided by WBS number 869021.05.08.07.08 and 869021.05.08.07.12.

The Schedule, Performance Plan and Risk Assessment have not been revised. This revision is effective April 27, 2009.

Revision 06: The purpose of this revision is to more accurately reflect the effort required during this period of performance, remove hours from Subelement-EB due to reduction in scope, and to add resources to support additional scope/effort in support of the Max Launch Abort System study. The Launch Abort System Abort Motor, Attitude Control Motor, and Jettison Motor Subelements funded by WBS 644423.06.34.03.10.08 had a net decrease of (b)(4) The Max Launch Abort System Subelement funded by Work Breakdown Structure (WBS) 869021.05.08.07.08 and 869021.05.08.07.12 had a net increase of (b)(4). This results in a next task order increase of (b)(4).

Subelement –EA had an overall increase in cost of (b)(4). Labor estimate was increased by (b) hours with a corresponding increase in labor cost of (b)(4). The increase is a result of adding management overhead hours for the subcontract work that was unintentionally left off the previous revision that realigned resources. Funding for this task is provided by WBS number 644423.06.34.03.10.08.

Subelement –EB had an overall decrease in cost of (b)(4). Labor estimate was reduced by (b)(4 hours with a corresponding reduction in labor cost of (b)(4). The decrease is a result of a reduction in scope. Funding for this task is provided by WBS number 644423.06.34.03.10.08.

Subelement –EC had an overall increase in cost of (b)(4) Labor estimate was increased by (b) hours with a corresponding increase in labor cost of (b)(4). The increase is a result of adding management overhead hours for the subcontract work that was unintentionally left off the previous revision that realigned resources. Funding for this task is provided by WBS number 644423.06.34.03.10.08.

Subelement –ED Closed in Revision 4.

Subelement –EE has an overall increase in cost of (b)(4). Subcontract cost was increased by (b)(4) at the request of the customer to support additional Max Launch Abort System studies. Labor estimate was increased by (b) hours with a corresponding increase in labor cost of (b)(4). The increase is a result of adding management overhead hours for the subcontract work. Funding for this task is provided by WBS number 869021.05.08.07.08 and 869021.05.08.07.12.

The Schedule was updated to show an extension in the Subelement EE task. The Performance Plan and Risk Assessment have not been revised. This revision is effective January 15, 2009.

Revision 05: The purpose of this revision is to more accurately reflect the effort required during this period of performance and to realign resources to match the customer support requests. The current estimate falls within the previous funding levels and no additional budget is required. The overall effect of this revision results in a net decrease of (b)(4).

Subelement –EA had an overall reduction in cost of (b)(4). Labor estimate-was reduced by (b)(4 hours with a corresponding reduction in labor cost of (b)((b)(4). This includes the transfer of funding for an employee to another task order and a change in the level of task support from the customer. Subcontract cost was reduced by (b)(4) and the support was transferred to Subelement –EC to match the requested support levels. The travel estimate was reduced by (b)(4) to match the personal changes. Funding for this task is provided by Work breakdown Structure (WBS) number 644423.06.34.03.10.08.

Subelement –EB had an overall reduction in cost of (b)(4). Labor estimate-was reduced by (b)(4 hours with a corresponding reduction in labor cost of (b)(4). This includes the transfer of funding for an employee to another task order and to realign with the current level of support requested. Funding for this task is provided by Work breakdown Structure (WBS) number 644423.06.34.03.10.08.

Subelement –EC had an overall increase in cost of (b)(4). Labor estimate-was reduced by (b)(4 hours with a corresponding reduction in labor cost of (b)(4). This includes the transfer of funding for an employee to another task order and a change in the level of task support from the customer. Subcontract cost was increased by (b)(4) to reflect the support that was transferred from Subelement –EA to match the requested support levels. The total change in contractor costs increased at the task level by (b)(4) due to an increase in the subcontractor rate. The travel estimate was increased by (b)(4) to match the amount transferred from Subelement –EA. Funding for this task is provided by Work breakdown Structure (WBS) number 644423.06.34.03.10.08.

Subelement –ED Closed in Revision 4.

Subelement –EE had no changes. Funding for this task is provided by Work breakdown Structure (WBS) number 510505.05.08.07.12.

The Schedule, Performance Plan and Risk Assessment have not been revised. This revision is effective November 26, 2008.

Revision 04: The purpose of this revision is to reflect the effort required to support Contract Year 4 period of performance. This task is a continuation of effort from Contract Year 3. **Subelement ED** has been closed for CY04. The overall task has a combined total of (b)(4)

Subelement –EA total cost is (b)(4). Labor has (b)(4 estimated man hours with an associated cost of (b)(4). Labor estimate are based on previous year actuals. Training costs of

(b)(4) was included for employee professional development. (b)(4) of Travel cost was included to support the CY04 test and review schedule. Subcontract cost of (b)(4) was included based on the Contract Year 3 support. Funding for this task is provided by Work breakdown Structure (WBS) number 644423.06.34.03.10.08.

Subelement –EB total cost is (b)(4). Labor has (b)(4) estimated man hours with an associated cost of (b)(4). Labor estimate are based on previous year actuals. Training costs of (b)(4) was included for employee professional development. (b)(4) of Travel cost was included to support the CY04 test and review schedule. Subcontract cost of (b)(4) was included for task support. Funding for this task is provided by Work breakdown Structure (WBS) number 644423.06.34.03.10.08.

Subelement –EC total cost is (b)(4). Labor has (b)(4) estimated man hours with an associated cost of (b)(4). Labor estimate are based on previous year actuals. Training costs of (b)(4) was included for employee professional development. (b)(4) of Travel cost was included to support the CY04 test and review schedule. Subcontract cost of (b)(4) was included based on the Contract Year 3 support. Funding for this task is provided by Work breakdown Structure (WBS) number 644423.06.34.03.10.08.

Subelement –EE total cost is (b)(4). This subelement provides resources for a subcontractor to provide consultants for MLAS. Subcontract cost of (b)(4) was included for task support. Labor estimates of (b)(4) hours was included with an associated cost of (b)(4). Travel costs of (b)(4) were added to cover task related travel. Funding has not yet been allocated for **–EE** under any existing WBS numbers but will be funded through the NESC.

The Schedule, Performance Plan and Risk Assessment have been revised to reflect the new contract year task activities for this period of performance. This revision is effective September 27, 2008.

Revision 03: The purpose of this revision is to more accurately reflect the effort required during this period of performance and to add a new Subelement, –EE, for Max Launch Abort System (MLAS) Support. The overall effect of this revision results in a net decrease of (b)(4)

Subelements -EA, -EB and -EC, all had a reduction in cost resulting in a reduction in funding.

Subelement -ED had no changes in scope or funding.

Subelement. –EE is a new task with funding provided by the NESC

Funding is provided for **–EA, -EB, -EC** through WBS number 644423.06.34.03.10.08.
Funding is provided for **–ED** through WBS number 510505.05.08.07.10.
Funding has not yet been allocated for **–EE** under any existing WBS numbers but will be funded through the NESC.

Subelement –EA had an overall reduction in cost of (b)(4) Labor estimate was reduced by (b)(4) hours with a corresponding reduction in labor cost of (b)(4). ODC was reduced by (b)(4) Subcontract cost was increased by (b)(4) The travel estimate was reduced by (b)(4)

Reduction in hours was due to a decision to not to fully staff the task to allowable levels and delay in hiring of personnel. Reduction in ODC, for Relocation and Recruiting was due to a decision to not to fully staff the task to allowable levels and hiring of personnel from the local area. Subcontract cost increase was due to realignment of subcontractor personnel during the period of performance. Travel estimate was reduced to better align with task requirements this year.

Subelement –EB had an overall reduction in cost of (b)(4) Labor estimate was reduced by (b)(4) hours with a corresponding reduction in cost of (b)(4). ODC was reduced by (b)(4) Subcontract cost was decreased by (b)(4) The travel estimate was reduced by (b)(4)

Reduction in hours was due to a decision to not to fully staff the task to allowable levels and delay in hiring of personnel. Reduction in ODC, for Relocation and Recruiting was due to a decision to not to fully staff the task to allowable levels and hiring of personnel from the local area. Subcontract cost decrease was due to realignment of subcontractor personnel during the period of performance and lower than expected need. Travel estimate was reduced to better align with actual task requirements for this year.

Subelement –EC had an overall reduction in cost of (b)(4) Labor estimate was reduced by (b)(4 hours with a corresponding reduction in cost of (b)(4) ODC was reduced by (b)(4) Subcontract cost was decreased by (b)(4). The travel estimate was reduced by (b)(4)

Reduction in hours was due to a decision to not to fully staff the task to allowable levels, delay in hiring of personnel and the later phasing of personnel from other tasks within the Solid Propulsion Systems Division. Reduction in ODC, for Relocation and Recruiting was due to a decision to not to fully staff the task to allowable levels and hiring of personnel from the local area. Subcontract cost decrease was due to realignment of subcontractor personnel during the period of performance. Travel estimate was reduced to better align with actual task requirements for this year.

Subelement – ED had no change for this revision.

Subelement –EE is a new task requested for support of MLAS. MLAS is a NASA Engineering and Safety Center (NESC) project that has the goal of demonstrating the feasibility of an alternate launch abort system design as risk mitigation for the Crew Exploration Vehicle (CEV) Launch Abort System (LAS). As such, the NESC MLAS project is composed of team members who are Government personnel from several NASA Centers, as well as independent technical consultants. This subelement provides resources for a subcontractor to provide consultants for MLAS. Resource estimates for the new Subelement –EE are: Added Labor of (b) hours, Subcontractor resources of (b)(4) for a total of (b)(4).

This revision is effective July 31, 2008.

Revision 02: This revision modifies scope, schedule and resources to add a new subelement –ED, Independent Assessment of Launch Abort System (LAS) Motor Qualification Test Matrices. The LAS system for Orion includes 3 Solid Rocket Motors (SRMs). All 3 motors are clean sheet designs. An independent NESC review of the motor's qualification test matrices has been requested by the LAS Project. Resource estimates for the new Subelement –ED

are: Added Labor of (b) hours, Subcontractor resources of (b)(4) and Travel of (b)(4). The total increase in resources is (b)(4). This revision is effective February 1, 2008.

Revision 01: This revision modifies scope, schedule and resources to align with expectations for remainder of contract year. In particular it adds additional resources for solid propulsion system engineers for subelement –EA, Abort Motor, and subelement –EB, Attitude Control Motor. Resource estimates are modified as follows:

Subelement -EA; Added Labor of (b)(4 hours and increased Travel of (b)(4)
Subelement -EB; Added Labor of (b)(4 hours and increased Travel of (b)(4)
Subelement -EC; Reduced Labor by (b)(4 hours.

This results in a total net increase in Labor of (b)(4 hours. Total net increase in Travel of (b)(4) is necessary to support the travel of additional personnel. The total increase in resources is (b)(4). This revision is effective December 31, 2007.

1.0 Task Order Description & Objectives

The purpose of this Task Order (TO) is to establish this task in Contract Year (CY) 5 of the NNM05AB50C ESTS contract. It is a continuation of the effort previously performed under subelement –CA of TO 33-020203-02 from CY 03. This task defines and estimates work for the period 3 October 2009 through 1 October 2010. The Schedule, Performance Plan, and Risk Assessment reflect the estimates for task activities for the new period of performance.

1.1 Subelement – EA, Abort Motor

1.1.1 Develop and maintain detailed working knowledge of the Orion LAS abort SRM designs through attendance of and participation in Technical Interchange Meetings (TIMs) and planning meetings.

1.1.2 Provide engineering support required for development and integration of the components (propellant, liner, insulation, igniter, manifold, case and nozzles) of the LAS abort motor to meet the safety, technical, and program (cost & schedule) objectives of the overall system. Coordinate among the appropriate MSFC engineering disciplines to conduct independent assessments necessary to effectively evaluate the abort motor and its effect on the LAS. Support the evaluation of abort motor component and system program risks and provide recommendations for risk mitigation.

1.1.3 Provide support to requirements definition. Provide support to the identification of abort motor component and systems issues. Incorporate lessons learned from previous projects to ensure the requirements definition meets the intended objectives of the program and that thought is given towards the method for eventual verification of the requirements. Support the development of detailed abort motor component validation and verification plans.

1.1.4 Provide support to abort motor requirements definition and flow down. This includes providing support for developing the necessary requirements and incorporating these requirements into the proper documentation. Provide support to the integration of the abort motor to LAS to Orion vehicle, and to overall Crew Launch Vehicle (CLV) systems integration requirements, including the identification of issues where a pushback on abort motor requirements to the LAS, the Orion, and the CLV is needed. Incorporate lessons learned from previous projects to ensure the requirements definition meets the intended objectives of the program and that thought is given towards the method for eventual verification of the

requirements. Support the development of detailed validation and verification plans.

1.1.5 Develop and maintain detailed working knowledge of the abort motor and pyrotechnic device systems designs through attendance of and participation in TIMs and planning meetings.

1.1.6 Provide support for the evaluation of design features and any proposed component or functional design changes to the abort motor. Actively participate in abort motor reviews and support the resolution of all identified actions/issues generated during the review. Provide assessments of abort motor designs, including assessments of any impacts of changes to abort motor effects on system performance, identification of the technical risks associated with the design, and identification of any safety concerns regarding the abort motor design.

1.1.7 Provide support for abort motor trade studies and issue resolution. Actively participate in study activities to ensure the appropriate data is brought to bear on any abort motor issues. Develop and maintain working knowledge of systems issues and work with cognizant personnel to resolve.

1.1.8 Support the development of system, element and component level test plans, and their execution. Provide evaluation of abort motor test plans to ensure all the intended verification objectives can be accomplished. Provide independent test data analysis support. Support data reduction, analysis, and presentation of test data. This includes determining if test and performance objectives are met and identification and resolution of any anomalies. Follow-up with the resolution of, and recommendations for, any outstanding issues and present the findings to cognizant personnel to obtain closure.

1.1.9 Provide analytical support for abort motor trade studies, design analyses, tests, flights, and evaluations. This support consists of performing independent analyses for trade studies, designs, tests, flight test instrumentation, proposed and recommended design changes, and flights using existing, modified, and new modeling algorithms. Each performance element identified for requirement verification will be evaluated. Independent test and flight databases will be created and maintained as appropriate.

1.1.10 Provide support for field testing of the abort motor and/or its components. This support includes, but is not limited to overseeing and/or participating in inspections of hardware upon arrival at the test site, overseeing on-site abort motor integration activities, supporting daily integration and test planning meetings, daily status meetings and participating in readiness reviews, dress rehearsals and flight test countdowns and launch activities.

1.1.11 Perform other Solid Propulsion Systems Division related technical assessments and evaluations as specifically identified and coordinated between Task Lead and Task Initiator on a case-by-case basis.

1.2 Subelement – EB, Attitude Control Motor

1.2.1 Develop and maintain detailed working knowledge of the Orion LAS attitude control SRM designs through attendance of and participation in TIMs and planning meetings.

1.2.2 Provide engineering support required for development and integration of the components (propellant, liner, insulation, igniter, pintles, actuators, case and nozzles) of the LAS Attitude Control Motor (ACM) to meet the safety, technical, and program (cost &

schedule) objectives of the overall system. Coordinate among the appropriate MSFC engineering disciplines to conduct independent assessments necessary to effectively evaluate the ACM and its effect on the LAS. Support the evaluation of ACM components and system program risks and provide recommendations for risk mitigation.

1.2.3 Provide support to requirements definition. Provide support to the identification of ACM component and system issues. Incorporate lessons learned from previous projects to ensure the requirements definition meets the intended objectives of the program and that thought is given towards the method for eventual verification of the requirements. Support the development of detailed ACM component and system validation and verification plans.

1.2.4 Provide support to ACM requirements definition and flow down. This includes providing support for developing the necessary requirements and incorporating these requirements into the proper documentation. Provide support to the development of the ACM to LAS to Orion vehicle, and to overall CLV integration requirements, including the identification of issues where a pushback on ACM requirements to the LAS, the Orion, and the CLV is needed. Incorporate lessons learned from previous projects to ensure the requirements definition meets the intended objectives of the program and that thought is given towards the method for eventual verification of the requirements. Support the development of detailed validation and verification plans.

1.2.5 Develop and maintain detailed working knowledge of the ACM and pyrotechnic device system designs through attendance of and participation in TIMs and planning meetings.

1.2.6 Provide support for the evaluation of design features and any proposed component or functional design changes to the ACM. Actively participate in ACM reviews and support the resolution of all identified actions/issues generated during the review. Provide assessments of designs, including assessments of any impacts of changes to systems performance, identification of the technical risks associated with the design, and identification of any safety concerns regarding the design.

1.2.7 Provide support for ACM trade studies and issue resolution. Actively participate in study activities to ensure the appropriate data is brought to bear on any ACM issues. Develop and maintain working knowledge of systems issues and work with cognizant personnel to resolve.

1.2.8 Support the development of system, element, and component level test plans, and their execution. Provide evaluation of ACM test plans to ensure all the intended verification objectives can be accomplished. Provide independent test data analysis support. Support data reduction, analysis, and presentation of test data. This includes determining if test and performance objectives are met and identification and resolution of any anomalies. Follow-up with the resolution of, and recommendations for, any outstanding issues and present the findings to cognizant personnel to obtain closure.

1.2.9 Provide analytical support for ACM trade studies, design analyses, tests, flights, and evaluations. This support consists of performing independent analyses for trade studies, designs, tests, flight test instrumentation, proposed and recommended design changes, and flights using existing, modified, and new modeling algorithms. Each performance element identified for requirement verification will be evaluated. Independent test and flight databases will be created and maintained as appropriate.

1.2.10 Provide support for field testing of the ACM and/or its components. This support includes, but is not limited to overseeing and/or participating in inspections of hardware upon arrival at the test site, overseeing on-site abort motor integration activities, supporting daily integration and test planning meetings, daily status meetings and participating in readiness reviews, dress rehearsals and flight test countdowns and launch activities.

1.2.11 Perform other Solid Propulsion Systems Division related technical assessments and evaluations as specifically identified and coordinated between Task Lead and Task Initiator on a case-by-case basis.

1.3 Subelement – EC, Jettison Motor

1.3.1 Develop and maintain detailed working knowledge of the Orion LAS jettison SRM designs through attendance and participation in TIMs and planning meetings.

1.3.2 Provide engineering support required for development and integration of the components (propellant, liner, insulation, igniter, case and nozzles) of the LAS jettison motor to meet the safety, technical, and program (cost & schedule) objectives of the overall system. Coordinate among the appropriate MSFC engineering disciplines to conduct independent assessments necessary to effectively evaluate the jettison motor and its effect on the LAS. Support the evaluation of jettison motor component and system program risks and provide recommendations for risk mitigation.

1.3.3 Provide support to requirements definition. Provide support to the identification of jettison motor component and system issues. Incorporate lessons learned from previous projects to ensure the requirements definition meets the intended objectives of the program and that thought is given towards the method for eventual verification of the requirements. Support the development of detailed jettison motor component and system validation and verification plans.

1.3.4 Provide support to jettison motor requirements definition and flow down. This includes providing support for developing the necessary requirements and incorporating these requirements into the proper documentation. Provide support to the development of the jettison motor to LAS to Orion vehicle, and to overall CLV systems integration requirements, including the identification of issues where a pushback on jettison motor requirements to the LAS, the Orion, and the CLV is needed. Incorporate lessons learned from previous projects to ensure the requirements definition meets the intended objectives of the program and that thought is given towards the method for eventual verification of the requirements. Support the development of detailed validation and verification plans.

1.3.5 Develop and maintain detailed working knowledge of the jettison motor and pyrotechnic device system designs through attendance of and participation in TIMs and planning meetings.

1.3.6 Provide support for the evaluation of design features and any proposed component or functional design changes to the jettison motor. Actively participate in jettison motor reviews and support the resolution of all identified actions/issues generated during the review. Provide assessments of designs, including assessments of any impacts of changes to systems performance, identification of the technical risks associated with the design, and identification of any safety concerns regarding the design.

1.3.7 Provide support for jettison motor trade studies and issue resolution. Actively

participate in study activities to ensure the appropriate data is brought to bear on any jettison motor issues. Develop and maintain working knowledge of systems issues and work with cognizant personnel to resolve.

1.3.8 Support the development of system, element, and component level test plans, and their execution. Provide evaluation of jettison motor test plans to ensure all the intended verification objectives can be accomplished. Provide independent test data analysis support. Support data reduction, analysis, and presentation of test data. This includes determining if test and performance objectives are met and identification and resolution of any anomalies. Follow-up with the resolution of, and recommendations for, any outstanding issues and present the findings to cognizant personnel to obtain closure.

1.3.9 Provide analytical support for jettison motor trade studies, design analyses, tests, flights, and evaluations. This support consists of performing independent analyses for trade studies, designs, tests, flight test instrumentation, proposed and recommended design changes, and flights using existing, modified, and new modeling algorithms. Each performance element identified for requirement verification will be evaluated. Independent test and flight databases will be created and maintained as appropriate.

1.3.10 Provide support for field testing of the jettison motor and/or its components. This support includes, but is not limited to overseeing and/or participating in inspections of hardware upon arrival at the test site, overseeing on-site abort motor integration activities, supporting daily integration and test planning meetings, daily status meetings and participating in readiness reviews, dress rehearsals and flight test countdowns and launch activities.

1.3.11 Perform other Solid Propulsion Systems Division related technical assessments and evaluations as specifically identified and coordinated between Task Lead and Task Initiator on a case-by-case basis.

1.4 Subelement – ED, Independent Assessment of LAS Motor Qualification Test Matrices

1.4.1 Conduct an independent assessment of the two proposed qualification test matrices, one proposed by the Orion Prime Contractor and by the LAS Propulsion Integrated Product Team (IPT) and provide the LAS project with a recommendation as to what is required to qualify the 3 LAS SRMs.

1.4.2 The NASA Engineering and Safety Center (NESC) will form a team of experienced engineers to conduct this assessment. This team will participate in a 2-day TIM at the Langley Research Center (LaRC) where both the Orion Prime Contractor and the LAS Propulsion IPT will present their test matrices along with rationale as to why this meets NASA's needs.

1.4.3 The assessment team will provide an informal recommendation at the conclusion of the 2-day meeting at LaRC, and will follow with a more formal report containing findings, observations, and recommendations.

1.5 Subelement – EE, Max Launch Abort System Support

1.5.1 Provide engineering and technical consultation and support for the conduct of additional testing for reduction of risk and/or validation of the propulsion system concept for MLAS.

1.5.2 Provide engineering support to NESC MLAS project team teleconferences, video-conferences, face-to-face meetings, and other engineering meetings as requested by the Technical Monitor.

1.5.3 Provide engineering and technical consultation services to support the conceptual and preliminary design of the propulsion system of the MLAS vision vehicle. The MLAS demonstrator will utilize available MK70 motors as a schedule and cost cutting measure. Support NASA engineers in the conceptual and preliminary design of primary and, if required, secondary propulsion for a fully functional MLAS system.

1.5.4 A secondary propulsion system may be required to possibly perform jettison and/or fine attitude control under some of the abort conditions. Modification of existing propulsion systems and reliance on established technology capabilities will be emphasized in this activity and traded against clean sheet designs as appropriate. Propulsion system modeling, thermal analysis, CFD analysis, and finite element structural analysis are envisioned to be included in the design verification process of the resulting design(s).

1.5.5 Provide engineering and technical consultation services to support the conceptual and preliminary design of the Attitude Control System (ACS) for the MLAS vision vehicle. The primary focus of this effort will be for application to the baseline Orion tower configuration with traceability showing to how this system would have to be modified to fit the MLAS configuration. It is envisioned that the Orion configuration component requirements will envelope the MLAS configuration component requirements.

1.5.6 Conduct an initial review of driving requirements to ensure that the ACS MLAS design applies to the most current NASA concepts of operation with initial emphasis on the baseline Orion configuration. CAD modeling will be used to represent packaging and integration. System design activities will determine optimum integration schemes. System components will be sized and driving requirements for components will be developed. Transient modeling of the system will be conducted to assess water hammer effects and design features will be incorporated to mitigate negative consequences. Trades to be performed include, but not limited to, a passive vs. active control pressure relief valve as well as using the thrusters for pressure relief and the relief valve only serving a backup safety function. Updates the available draft system development plan will be made as required by the outcomes of this effort

1.6 Subelement – EF, Launch Abort System Support

1.6.1 Develop and maintain detailed working knowledge of the Orion LAS abort SRM designs through attendance of and participation in Technical Interchange Meetings (TIMs) and planning meetings.

1.6.2 Provide engineering support required for development and integration of the components (propellant, liner, insulation, igniter, manifold, case and nozzles) of the LAS to meet the safety, technical, and program (cost & schedule) objectives of the overall system. Coordinate among the appropriate MSFC engineering disciplines to conduct independent assessments necessary to effectively evaluate the abort motor and its effect on the LAS. Support the evaluation of abort motor component and system program risks and provide recommendations for risk mitigation.

1.6.3 Provide support to requirements definition. Provide support to the identification of abort motor component and systems issues. Incorporate lessons learned from previous

projects to ensure the requirements definition meets the intended objectives of the program and that thought is given towards the method for eventual verification of the requirements. Support the development of detailed abort motor component validation and verification plans.

1.6.4 Provide support to LAS motors requirements definition and flow down. This includes providing support for developing the necessary requirements and incorporating these requirements into the proper documentation. Provide support to the integration of the abort motor to LAS to Orion vehicle, and to overall Crew Launch Vehicle (CLV) systems integration requirements, including the identification of issues where a pushback on abort motor requirements to the LAS, the Orion, and the CLV is needed. Incorporate lessons learned from previous projects to ensure the requirements definition meets the intended objectives of the program and that thought is given towards the method for eventual verification of the requirements. Support the development of detailed validation and verification plans.

1.6.5 Develop and maintain detailed working knowledge of the LAS motors and pyrotechnic device systems designs through attendance of and participation in TIMs and planning meetings.

1.6.6 Provide support for the evaluation of design features and any proposed component or functional design changes to the LAS motors. Actively participate in abort motor reviews and support the resolution of all identified actions/issues generated during the review. Provide assessments of abort motor designs, including assessments of any impacts of changes to abort motor effects on system performance, identification of the technical risks associated with the design, and identification of any safety concerns regarding the abort motor design.

1.6.7 Provide support for LAS motor trade studies and issue resolution. Actively participate in study activities to ensure the appropriate data is brought to bear on any abort motor issues. Develop and maintain working knowledge of systems issues and work with cognizant personnel to resolve.

1.6.8 Support the development of system, element and component level test plans, and their execution. Provide evaluation of LAS motor test plans to ensure all the intended verification objectives can be accomplished. Provide independent test data analysis support. Support data reduction, analysis, and presentation of test data. This includes determining if test and performance objectives are met and identification and resolution of any anomalies. Follow-up with the resolution of, and recommendations for, any outstanding issues and present the findings to cognizant personnel to obtain closure.

1.6.9 Provide analytical support for LAS motor trade studies, design analyses, tests, flights, and evaluations. This support consists of performing independent analyses for trade studies, designs, tests, flight test instrumentation, proposed and recommended design changes, and flights using existing, modified, and new modeling algorithms. Each performance element identified for requirement verification will be evaluated. Independent test and flight databases will be created and maintained as appropriate.

1.6.10 Provide support for field testing of the LAS motor and/or its components. This support includes, but is not limited to overseeing and/or participating in inspections of hardware upon arrival at the test site, overseeing on-site abort motor integration activities, supporting daily integration and test planning meetings, daily status meetings and participating in readiness reviews, dress rehearsals and flight test countdowns and launch activities.

1.6.11 Perform other Solid Propulsion Systems Division related technical assessments and evaluations as specifically identified and coordinated between Task Lead and Task Initiator on a case-by-case basis.

1.6.12 Perform ballistic assessments for PA-1 motor, including but not limited to grain reconstruction, burn rate prediction, and thrust output. Also evaluate igniter construction and performance.

1.7 Subelement – EG, Max Launch Abort System Engineering Support

1.7.1 Provide analytical and technical support for Max Launch Abort System Project supported trade studies, design analysis, and evaluation of Critical Math Models (CMMs). This support consists of performing independent ballistic, sensitivity, propellant and ignition transient analyses for tests, and proposed and recommended design changes.

1.7.2 Support development of upgrades to Solid Motor Branch tools suite. This includes development of Graphical User Interfaces (GUIs) for ballistics analysis codes. This will also include the evaluation, development, and validation of tools for the Ignition Transient Program and the Solid Propellant Performance Program, and GUIs for related analysis databases.

1.7.3 Provide support to MLAS motors requirements definition and flow down. This includes providing support for developing the necessary requirements and incorporating these requirements into the proper documentation.. Support the development of detailed validation and verification plans.

1.7.4 Provide engineering support to NESC MLAS project team teleconferences, videoconferences, face-to-face meetings, and other engineering meetings as requested by the Technical Monitor

1.7.5 Provide engineering and technical consultation services to support the boost phase motor design. This includes an in depth analysis of existing motor systems that meet the requirements of transonic scenarios.

1.7.6 Perform other Solid Motor Branch related technical assessments and evaluations as specifically identified and coordinated between Task Lead and Task Initiator on a case-by-case basis.

2.0 Technical Approach

Specific technical approaches for each support activity will be identified and coordinated on a case-by-case basis between the MSFC Task Initiator and the ESTS Task Lead.

2.1 Subelement – EA, Abort Motor

2.1.1 Systems Engineering and Component Development

2.1.1.1 Attend TIMs and planning meetings. Complete assigned action items. Document and deliver results with recommendations.

2.1.1.2 Support relevant LAS requirements and design reviews. Identify and pursue resolution of issues. Document and deliver results with recommendations.

2.1.1.3 Support trade studies and other assessments. Identify and pursue resolution of issues. Document and deliver results with recommendations.

2.1.1.4 Support relevant testing, including assessments of test plans, test procedures, and test reports. Identify and pursue resolution of issues. Document and deliver results with recommendations.

2.1.1.5 Support relevant anomaly investigations and failure investigation teams. Identify and pursue resolution of issues. Document and deliver results with recommendations.

2.1.2 Performance Analysis

2.1.2.1 Collect inputs: Motor configuration, propellant characteristics, launch / test conditions, launch / test telemetry, etc.

2.1.2.2 Create and/or modify performance modeling algorithms as appropriate.

2.1.2.3 Generate model input data files.

2.1.2.4 Perform analysis.

2.1.2.5 Compare results to requirements, historical experience, statistical analyses, and results of other analyses.

2.1.2.6 Update database.

2.1.2.7 Document and deliver results with recommendations.

2.1.2.8 Other technical assessments and evaluations technical approaches will be coordinated between NASA and technical personnel to perform the efforts, and negotiated with Task Lead and Task Initiator on a case-by-case basis.

2.2 Subelement – EB, Attitude Control Motor

2.2.1 Systems Engineering and Component Development

2.2.1.1 Attend TIMs and planning meetings. Complete assigned action items. Document and deliver results with recommendations.

2.2.1.2 Support relevant LAS requirements and design reviews. Identify and pursue resolution of issues. Document and deliver results with recommendations.

2.2.1.3 Support trade studies and other assessments. Identify and pursue resolution of issues. Document and deliver results with recommendations.

2.2.1.4 Support relevant testing, including assessments of test plans, test procedures, and test reports. Identify and pursue resolution of issues. Document and deliver results with recommendations.

2.2.1.5 Support relevant anomaly investigations and failure investigation teams. Identify and

pursue resolution of issues. Document and deliver results with recommendations.

2.2.2 Performance Analysis

2.2.2.1 Collect inputs: Motor configuration, propellant characteristics, launch / test conditions, launch / test telemetry, etc.

2.2.2.2 Create and/or modify performance modeling algorithms as appropriate.

2.2.2.3 Generate model input data files.

2.2.2.4 Perform analysis.

2.2.2.5 Compare results to requirements, historical experience, statistical analyses, and results of other analyses.

2.2.2.6 Update database.

2.2.2.7 Document and deliver results with recommendations.

2.2.2.8 Other technical assessments and evaluations technical approaches will be coordinated between NASA and technical personnel to perform the efforts, and negotiated with Task Lead and Task Initiator on a case-by-case basis.

2.3 Subelement – EC, Jettison Motor

2.3.1 Systems Engineering and Component Development

2.3.1.1 Attend TIMs and planning meetings. Complete assigned action items. Document and deliver results with recommendations.

2.3.1.2 Support relevant LAS requirements and design reviews. Identify and pursue resolution of issues. Document and deliver results with recommendations.

2.3.1.3 Support trade studies and other assessments. Identify and pursue resolution of issues. Document and deliver results with recommendations.

2.3.1.4 Support relevant testing, including assessments of test plans, test procedures, and test reports. Identify and pursue resolution of issues. Document and deliver results with recommendations.

2.3.1.5 Support relevant anomaly investigations and failure investigation teams. Identify and pursue resolution of issues. Document and deliver results with recommendations.

2.3.2 Performance Analysis

2.3.2.1 Collect inputs: Motor configuration, propellant characteristics, launch / test conditions, launch / test telemetry, etc.

2.3.2.2 Create and/or modify performance modeling algorithms as appropriate.

2.3.2.3 Generate model input data files.

2.3.2.4 Perform analysis.

2.3.2.5 Compare results to requirements, historical experience, statistical analyses, and results of other analyses.

2.3.2.6 Update database.

2.3.2.7 Document and deliver results with recommendations.

2.3.2.8 Other technical assessments and evaluations technical approaches will be coordinated between NASA and technical personnel to perform the efforts, and negotiated with Task Lead and Task Initiator on a case-by-case basis.

2.4 Subelement – ED, Independent Assessment of LAS Motor Qualification Test Matrices

2.4.1 Attend and participate at the 2-day TIM at LaRC.

2.4.2 Provide and informal recommendation at the conclusion of the 2-day meeting at LaRC.

2.4.3 Submit a more formal report containing findings, observations, and recommendations.

2.5 Subelement – EE, Max Launch Abort System Support

2.5.1 Support weekly propulsion team telecoms (approximately 1 hour in length) and half-day team wide reviews will need to be supported remotely approximately every other month. Two two-day reviews will need to be supported by key team member(s) at the meeting site, currently planned to be in the Langley Research Center vicinity.

2.5.2 An informal conceptual design review will be conducted prior to conclusion of the preliminary design activity.

2.5.3 Create a preliminary propulsion system development plan for the systems designed. This plan is to include preliminary schedule and cost estimates for full qualification of the motors for crewed flight.

2.5.4 Prepare a final report of the activities performed.

2.5.5 Provide a comprehensive PowerPoint presentation with complete disclosure of trade studies, analyses, CAD models, transient simulations, conclusions and recommendations for follow-on system component risk reduction activities for ACS. Also required is an ACS simplified model that can be used to predict system performance and mass as a function of time for an arbitrary thruster utilization schedule.

2.6 Subelement – EF, Launch Abort System Support

2.6.1 Systems Engineering and Component Development

2.6.1.1 Attend TIMs and planning meetings. Complete assigned action items. Document and

deliver results with recommendations.

2.6.1.2 Support relevant LAS requirements and design reviews. Identify and pursue resolution of issues. Document and deliver results with recommendations.

2.6.1.3 Support trade studies and other assessments. Identify and pursue resolution of issues. Document and deliver results with recommendations.

2.6.1.4 Support relevant testing, including assessments of test plans, test procedures, and test reports. Identify and pursue resolution of issues. Document and deliver results with recommendations.

2.6.1.5 Support relevant anomaly investigations and failure investigation teams. Identify and pursue resolution of issues. Document and deliver results with recommendations.

2.6.2 Performance Analysis

2.6.2.1 Collect inputs: Motor configuration, propellant characteristics, launch / test conditions, launch / test telemetry, etc.

2.6.2.2 Create and/or modify performance modeling algorithms as appropriate.

2.6.2.3 Generate model input data files.

2.6.2.4 Perform analysis.

2.6.2.5 Compare results to requirements, historical experience, statistical analyses, and results of other analyses.

2.6.2.6 Update database.

2.6.2.7 Document and deliver results with recommendations.

2.6.2.8 Other technical assessments and evaluations technical approaches will be coordinated between NASA and technical personnel to perform the efforts, and negotiated with Task Lead and Task Initiator on a case-by-case basis.

2.7 Subelement – EG, Max Launch Abort System Engineering Support

2.7.1 Systems Engineering and Component Development

2.7.1.1 Attend TIMs and planning meetings. Complete assigned action items. Document and deliver results with recommendations.

2.7.1.2 Support relevant MLAS requirements and design reviews. Identify and pursue resolution of issues. Document and deliver results with recommendations.

2.7.1.3 Support trade studies and other assessments. Identify and pursue resolution of issues. Document and deliver results with recommendations.

2.7.2 Perform analysis.

2.7.2.1 Create and/or modify performance modeling algorithms as appropriate.

2.7.2.2 Generate model input data files.

2.7.2.3 Performance burn rate dispersion studies. To include analysis of propellant burn rate sensitivities and control measures for proposed Flight Test Vehicle 2 propellant and OS propellants.

2.7.2.4 Sensitivity analysis to minimize start up transients.

2.7.2.5 Perform detailed uncertainty analysis of proposed AMRDEC mix and cast procedure

2.7.3 Document and deliver results with recommendations.

2.7.4 Other technical assessments and evaluations technical approaches will be coordinated between NASA and technical personnel to perform the efforts, and negotiated with Task Lead and Task Initiator on a case-by-case basis.

3.0 Discussion of Skills Required

3.1 Subelement – EA, Abort Motor

Journeyman and Senior Engineers with knowledge of solid propellant chemistry and solid propellant rocket motor ballistic analysis, SRM systems engineering, and subcontractors with knowledge of SRM systems engineering.

3.2 Subelement – EB, Attitude Control Motor

Senior Engineers with knowledge of solid propellant chemistry and solid propellant rocket motor ballistic analysis, SRM systems engineering, and subcontractors with knowledge of SRM systems engineering.

3.3 Subelement – EC, Jettison Motor

Journeyman and Senior Engineers with knowledge of solid propellant chemistry solid propellant rocket motor ballistic analysis, SRM systems engineering, and subcontractors with knowledge of SRM systems engineering.

3.4 Subelement – ED, Independent Assessment of LAS Motor Qualification Test Matrices

Senior Engineers and subcontractors with experience in the development, qualification, and operation of small solid rocket motors (tactical motors, motors with less than 200,000 lbf-sec total impulse).

3.5 Subelement – EE, Max Launch Abort System Support

Senior engineers and subcontractors with an in-depth knowledge of solid and liquid rocket motor propulsion and design. Subcontractors with specific knowledge of the MK70 rocket motors as applied to the Thrust Vectoring capability of the vehicle.

3.6 Subelement – EF, Launch Abort System Support

Journeyman and Senior Engineers with knowledge of solid propellant chemistry solid propellant rocket motor ballistic analysis, igniter ballistics analysis, SRM systems engineering,

and subcontractors with knowledge of SRM systems engineering.

3.7 Subelement – EG, Max Launch Abort System Engineering Support

Journeyman and Senior Engineers with knowledge of solid propellant chemistry solid propellant rocket motor ballistic analysis, igniter ballistics analysis, and SRM systems engineering.

4.0 Special Tools Required

All computer hardware and software will be provided by NASA MSFC.

5.0 Participating Subcontractors

(b)(4)

6.0 Milestones & Deliverables

Work is primarily driven by milestones that are set by the project customers, and are not within the control of the Task. Deliverables will be formatted as 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 th (b)(4)

Milestones for technical assessments and evaluations as specified above, will be coordinated between NASA and technical personnel to perform the efforts, and negotiated with Task Lead and Task Initiator on a case-by-case basis.

The currently agreed Milestones and Deliverables are reflected in the schedule in Section 9.

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

7.1 Subelement – EA, Abort Motor

None

7.2 Subelement – EB, Attitude Control Motor

None

7.3 Subelement – EC, Jettison Motor

None

7.4 Subelement – ED, Independent Assessment of LAS Motor Qualification Test Matrices

None

7.5 Subelement – EE, Max Launch Abort System

None

7.6 Subelement – EF, Launch Abort System Support

None

7.7 Subelement – EG, Max Launch Abort System Engineering Support

None

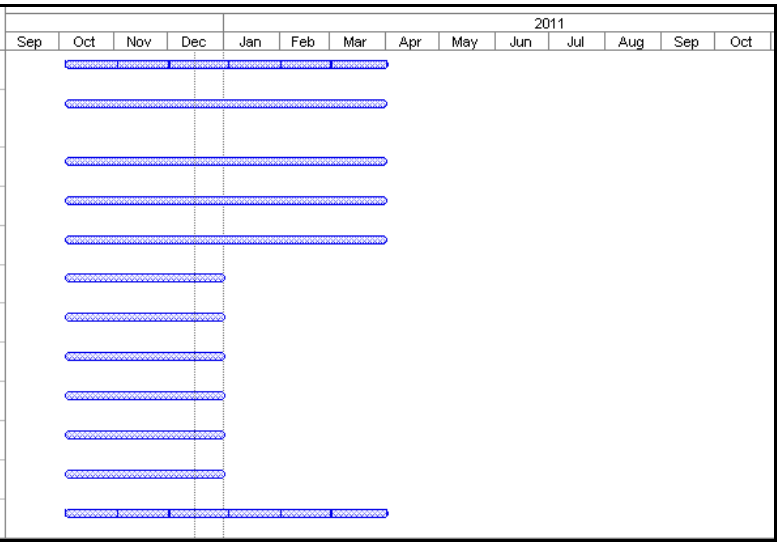
8.0 Work Shelf

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

ID	Task Number	S/E	Work Element
287	**33-050201**	**00**	**Launch Abort System Support**
288	**33-050201**	**EG**	**Max Launch Abort System Engineering Support**
289	**33-050203**	**EG**	**MLAS Burn Rate Dispersion Study**
290	33-050203	EG	Burn Rate Sensitivity Analysis
291	33-050203	EG	Uncertainty analysis of AMERDEC Procedures
292	**33-050203**	**EG**	**Detailed Igniter Design and Scaling**
293	33-050203	EG	Ignition Sensitivity Study
294	33-050203	EG	Ullage Motor Desgin Scaling
295	**33-050203**	**EG**	**Ballistic Design For Boost Phase Motor**
296	33-050203	EG	Development of Custom Design
297	33-050203	EG	Review of existing motor systems
298	**33-050203**	**00**	**Monthly Activity Reports**



ESTS Contract Task Order Request Performance Plan

Task Order Title: Launch Abort Systems Support

Task Order Number: 33-050201 Revision: 14

Category	Weighting Technical %	End of Period Technical Score
Technical Objectives	65%	X 65% =
		Justification
1. Conduct burn rate dispersion study on proposed propellants. 2. Perform analysis and sensitivity studies for Max Launch Abort System. 3. Document development and use of analysis tools and methodologies as appropriate for future reference. 4. Communicate results, issues, action items, etc., to both NASA and Jacobs management.		
	Weighting Schedule %	**Schedule Score**
Schedule Objectives (Milestones)	10% *(min 10%)*	X 10% =
		Justification
1. Unless otherwise noted, milestones and deliverables are defined on a case-by-case basis as coordinated between the Task Initiator and Task Lead and are met. 2. Work progression is appropriate for action assigned. 3. Resource loading commensurate with task schedule. 4. Analysis preparation and performance completed on time to support other areas. 5. Exemplify ability/willingness to adjust changing priorities. 6. Response to action items are timely		
	Weighting Cost%	**Cost Score**
Cost (actual vs. negotiated)	25% *(min.25%)*	X 25% =
		Justification
	Weighting Total %	**Total Score**
	100.00%	

ESTS Contract Task Order Request Performance Plan

Task Order Title: Launch Abort Systems Support

Task Order Number: 33-050201 Revision: 14

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: Launch Abort Systems Support

Task Order Number: 33-050201 Revision: 14

Comments: This is a continuation of Task Order 33-050201.
Technical
5. Demonstrate initiative in taking independent actions when required.
6. Communicate ideas for improvement of current efforts.
7. Assess MLAS motor concepts from the system engineering performance and ballistics standpoint as requested by Task Initiator.
8. Work is accurate for intended use.
9. Level of detail is appropriate for intended use.
10. Tools and methodologies applied are appropriate for intended use.
11. Work is of appropriate quality.
12. Resources assigned exemplify appropriate technical knowledge.
13. Progress and results are appropriately documented.
14. Results, issues, actions items, etc., are appropriately communicated and exemplify appropriate knowledge.
15. Demonstrate continuous improvement.
16. Level of technical oversight required is appropriate for resources and work assigned.

Marshall Space Flight Center
Engineering, Science & Technical Services

JACOBS
ESTS Group

Risk Assessment

Contract Number: *NNM05AB50C*
TO Title: *Launch Abort System Support*
TO Number: *33-050201* **Revision:** 14

Period of Performance: 10/02/2010 to 3/31/2011
MSFC Initiator: *Philip Franklin*

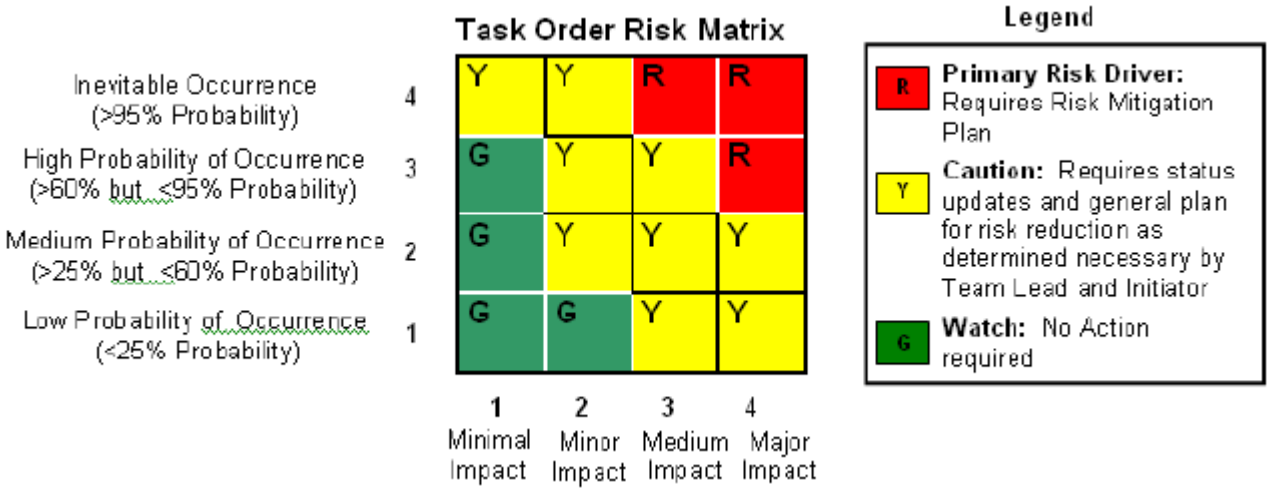
(b)(4)

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	1	1	Staffing commensurate with funding. Negative programmatic cost risk impacts are avoided through reviews. Only positive programmatic cost impacts are expected.
Risk T1	Technical	1	1	Technical knowledge of personnel assigned appropriate for work assigned.
Risk S1	Schedule	1	1	Task schedule is driven almost exclusively by programmatic schedules. Negative programmatic schedule risk impacts are avoided through status reviews. Only positive programmatic schedule impacts are expected.

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



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