Marshall Space Flight Center
Engineering, Science & Technical Services

Task Order Plan (TOP)

Contract Number: *NNM05AB50C*
TO Title: *Fluid Dynamics Support for Crew Exploration Vehicle*
TO Number: *33-040220* **Revision:** *18*

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

MSFC Initiator: *Lisa Griffin*

(b)(4)

Emergency: *No*

Revision 18:

This Revision aligns scope, schedule and resources with current expectations for the remainder of the contract year. Changes by subelement are as follows:

Subelement EA (WBS 644423.06.34.03.10.08)

Adds (b)(4) Cost Category to complete additional scope included in Sections 1 and 2.
This revision adds the following support to subelement EA as item "g"; Perform LAS system level literature searches for data to be used in analysis models.

Subelement EC (WBS 510505.01.08.01.03, 869021.01.08.01.06, and 869021.05.08.07.23)

Adds (b)(4) Cost Category,adds (b)(4) Cost Category, to complete additional scope included in Sections 1 and 2.
This revision adds the following support:
g) Perform Taurus system level literature searches for data to be used in analysis models.
h) Support effort to obtain far field acoustical measurements of the AJ-26 engine being tested at Stennis.
i) Support NESC final Taurus II wrap-up face-to-face meeting and address findings from independent analyses and estimated risk assessment.

The total estimate for this Task Order is (b)(4)

Revision 17:

The purpose of this revision is to extend this task into Contract Year 6 of the NNM05AB50C ESTS contract. This revision defines and estimates work for the period October, 2, 2010 through September 30, 2011. Additionally, the Schedule, Performance Plan and Risk Assessment have been revised to reflect changes in task activities for the new period of performance. This revision affects the Crew Exploration Vehicle (Subelements EA, EC, EE, EF, and EG). Subelements EE and EF closes with Revision 17. Changes by subelement are as follows:

Subelement EA (WBS 644423.06.34.03.10.08)

Estimates (b)(4) Cost Category, (b)(4) Cost Category, one trip to support meetings, and (b)(4) of subcontractor support.

Subelement EC (WBS 510505.01.08.01.03, 869021.01.08.01.06, and 869021.05.08.07.23)

Estimates (b)(4) Cost Category, (b)(4) Cost Category, (b)(4) (b)(4) Cost Category and one trip to support meetings. Two additional WBS numbers have been added to this subelement.

Subelement EE (WBS 095240.04.03.02.01.08)

This subelement was closed with revision 17.

Subelement EF (WBS 253225.04.04.10.05.08)

This subelement was closed with revision 17.

Subelement EG (WBS 869021.05.08.07.08)

Estimates (b)(4) Cost Category.

The total estimate for this Task Order is (b)(4)

Revision 16:

This Revision aligns scope, schedule and resources with current expectations for the remainder of the contract year. Changes by subelement are as follows:

Subelement EA (WBS 644423.06.34.03.10.08)

1. Reduces the labor estimate by (b)(4) Cost Category due to the departure of a (b)(4)
2. Converts (b)(4) Cost Category to Subcontractor estimate for a backfill for the departing (b)(4)
3. Converts (b)(4) of travel estimate to Subcontractor estimate for a backfill for the departing (b)(4) Removes (b)(4) of travel estimate because travel will not be needed for the rest of the contract year.
4. Removes (b)(4) Cost Category because the scope of the task has been modified and as a result the vacancy will not need to be filled at this time and converts (b) (b)(4) Cost Category to ODC for recruiting advertisement.

Subelement EC (WBS 510505.01.08.01.03)

1. Reduces the labor estimate by (b)(4) Cost Category because the work has been completed.
2. Adds (b)(4) Cost Category,adds (b)(4) Cost Category, and adds Cost Category to complete additional scope included in Sections 1 and 2.
3. Changes the subelement title from Max Launch Abort System Acoustics and Combustion Stability to NASA Engineering Safety Center Acoustics and Combustion Stability Support. The purpose of this subelement is to support the NASA Engineering Safety Center for a variety of projects, one of which was MLAS.

Subelement EE (WBS 095240.04.03.02.01.08)

Converts (b)(4) Cost Category to travel to support meetings.

Subelement EF (WBS 253225.04.04.10.05.08)

Adds (b)(4) Cost Category to complete scope given in Sections 1 and 2.

The total estimate for this Task Order is (b)(4)

Revision 15:

This Revision aligns scope, schedule and resources with current expectations for the remainder of the contract year. Changes by subelement are as follows:

Subelement EA (WBS 644423.06.34.03.10.08)

1. Reduces the labor estimate by (b)(4) Cost Category. Estimated start of additional acoustics support is now anticipated in April.
2. Converts (b)(4) Cost Category labor estimate to ODC for recruiting costs.

The total estimate for this Task Order is (b)(4) The net change since the previous estimate is - (b)(4)

Revision 14:
This Revision aligns scope, schedule and resources with current expectations for the remainder of the contract year. Changes by subelement are as follows:

Subelement EA (WBS 644423.06.34.03.10.08)

Moves (b)(4) Cost Category labor estimate from October, November, and December to January, February, and March. The (b)(4) represents a new (b)(4) position in which anticipated funding is being discussed.

The total estimate for this Task Order is (b)(4) The net change since the previous estimate is (b)(4

Revision 13:
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 Crew Exploration Vehicle (Subelements EA, EC, ED, and EE). The work being performed for subelements EA and ED will be consolidated into subelement EA with subelement ED being closed under revision 13. The title for subelement CA is being changed to "Launch Abort System Acoustics and Combustion Stability and CFD". Changes by subelement are as follows:

Subelement EA (WBS 644423.06.34.03.10.08)

1) Estimates (b)(4) Cost Category, (b)(4) Cost Category and ten trips to support meetings.

Subelement EC (WBS 510505.01.08.01.03)

1) Estimates (b)(4) Cost Category.

Subelement ED (WBS 644423.06.34.03.10.08)

This subelement was closed with revision 13.

Subelement EE (WBS 095240.04.03.02.01.08)

1. Estimates (b)(4) Cost Category.

The total estimate for this Task Order is (b)(4)

Revision 12:
This Revision aligns scope, schedule and resources with current expectations for the remainder of the contract year. Additionally, the performance and risk plans are updated. Changes by subelement are as follows:

Subelement EA (WBS 644423.06.34.03.10.08)

2) Adds (b)(4) of an (b)(4) Cost Category labor estimate to support existing acoustics work and
3) Adds two trips to support meetings.

Subelement EC (WBS 510505.01.08.01.03)

Converts (b)(4 of ODC estimate to Material estimate to accommodate materials needed to support testing.

Subelement EE (WBS 095240.04.03.02.01.08)

Adds an estimate for (b)(4) Cost Category to support existing CFD Analysis as given in sections 1.0 and 2.0.

The total estimate for this Task Order is (b)(4) The net change since the previous estimate is (b)(4)

Revision 11:
This Revision aligns scope, schedule and resources with current expectations for the remainder of the contract year. Additionally, the performance and risk plans are updated. Changes by subelement are as follows:

Subelement EC (WBS 510505.01.08.01.03)

Adds an estimate for two trips to support testing.

The total estimate for this Task Order is (b)(4) The net change since the previous estimate is (b)(4)

Revision 10:
This Revision aligns scope, schedule and resources with current expectations for the remainder of the contract year. In particular scope and resources are added for new Subelement EE, "Fluid Dynamics Support of Cryogenic Fluid Management". Additionally, the performance and risk plans are updated. Changes by subelement are as follows:

Subelement EE (WBS 095240.04.03.02.01.08)
Adds an estimate for (b)(4) Cost Category to support CFD Analysis as given in sections 1.0 and 2.0.

The total estimate for this Task Order is (b)(4) The net change since the previous estimate is (b)(4)

Revision 9:
This revision modifies scope, schedule and resources to align with expectations for the remainder of the contract year. Changes by subelement are as follows:

Subelement EC (WBS 510505.01.08.01.03)
Adds an estimate for three trips to support testing.

The total estimate for this Task Order is (b)(4) The net change since the previous estimate is (b)(4)

Revision 8:
This revision modifies scope, schedule and resources to align with expectations for the remainder of the contract year. Changes by subelement are as follows:

Subelement EA (WBS 644423.06.34.03.10.08)
Move (b)(4) Cost Category from June to March because of a reprioritization of the (b)(4) project needs.

Subelement EC (WBS 510505.01.08.01.03)
Move (b)(4) Cost Category from March through May to July through September because of a reprioritization of the (b)(4) project needs. Adds an estimate of (b)(4) for shipping of test materials.

Subelement ED (WBS 644423.06.34.03.10.08)
Adds an estimate for one additional trip to support meetings.

The total estimate for this Task Order is (b)(4) The net change since the previous estimate is (b)(4)

Revision 7:
This revision modifies scope, schedule and resources to align with expectations for the remainder of the contract year. Changes by subelement are as follows:

Subelement EA (WBS 644423.06.34.03.10.08)
Adds an estimate for an additional 3 trips to support meetings and increases the labor estimate by (b)(4 (b)(4) Cost Category to support an increase in (b)(4) time needed to support existing work for a total cost estimate of (b)(4)

Subelement EC (WBS 510505.01.08.01.03)
Move (b)(4) Cost Category from January and February to June and July because of a reprioritization of the (b)(4) project needs.

Subelement ED (WBS 644423.06.34.03.10.08)
Adds an estimate for three additional trips to support meetings for a total cost estimate of (b)(4)

The total estimate for this Task Order is (b)(4)

Revision 6:
This revision modifies scope, schedule and resources to align with expectations for the remainder of the contract year. Changes by subelement are as follows:

Subelement EA (WBS 644423.06.34.03.10.08)
Adds an estimate for an additional trip to support meetings for a total cost estimate of (b)(4)

Subelement EC (WBS 510505.01.08.01.03)
Move (b)(4) Cost Category from November and December to August and September because of a reprioritization of the (b)(4) project needs.

Subelement ED (WBS 644423.06.34.03.10.08)
Adds an estimate for two additional trips to support meetings for a total cost estimate of (b)(4)

The total estimate for this Task Order is (b)(4)

Revision 5:
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 Crew Exploration Vehicle (Subelements EA, EC, and ED). Subelement EB was closed under revision 5. Changes by subelement are as follows:

Subelement EA (WBS 644423.06.34.03.10.08)
Estimated (b)(4) Cost Category and 1 trip to support meetings for a total cost estimate of (b)(4)

Subelement EB (WBS 667560.08.03.32)
This subelement is closed.

Subelement EC (WBS 510505.01.08.01.03)
Estimated (b)(4) of an (b)(4) Cost Category and 1 trip to support meetings for a total cost estimate of (b)(4)

Subelement ED (WBS 644423.06.34.03.10.08)
Estimated (b)(4) Cost Category and 1 trip to support meetings for a total cost estimate of (b)(4)

The total estimate for this Task Order is (b)(4)

The purposes of this Revision (04) are to:

Subelement EA

1) reduces the (b)(4) cost category estimate by (b)(4) to reflect that the work will be performed with less resources than originally planned
2) adds 1 trip.

Subelement EC

1) decreases (b)(4) of (b)(4) cost category and (b)(4) of an (b)(4) cost category because the work will be accomplished with less than originally planned resources

Revision 03: This revision modifies scope, schedule and resources to align with expectations for the remainder of the contract year. In particular it 1) reallocates (b)(4) of an (b)(4) labor cost category from June and July to August and September for subelement EA, 2) reallocates (b)(4) of subcontractor labor estimate from June to July for subelement EB, and 3) reallocates (b)(4) of an (b)(4) labor cost category and (b)(4) of an (b)(4) labor cost category from June and July to August and September for subelement EC.

The total increase in resources is (b)(4)

Revision 02: This Revision (02) aligns scope, schedule and resources with current expectations for the remainder of the contract year. In particular the labor estimate has been increased by (b)(4) of an (b)(4) Cost Category to support existing testing needs for Subelement EC, "Max Launch Abort System Acoustics and Combustion Stability". Also two trips to support testing have been added to subelement EC. The labor estimate for subelement EA, Launch Abort System Acoustics and Combustion Stability, has been decreased by (b)(4) and an estimate of (b)(4) has been added for recruiting costs. Additionally, the performance and risk plans are updated. Total cost impact for additional resources to support this effort is (b)(4)

Revision 01: This Revision (01) aligns scope, schedule and resources with current expectations for the remainder of the contract year. In particular scope and resources are added for new Subelement EC, "Max Launch Abort System Acoustics and Combustion Stability". Additionally, the performance and risk plans are updated. Total cost impact for additional resources to support this effort is (b)(4)

1.0 Task Order Description & Objectives

Subelement EA – Launch Abort System Acoustics and Combustion Stability and CFD

a) Perform acoustics analysis in support of Launch Abort System Motors and Components.
b) Attend and participate in team technical meetings, integrated product team meetings, data reviews, and project reviews.
c) Perform computational fluid dynamics analysis (CFD) investigations to support acoustics, combustion stability, environments, and loads.
d) Interrogate CFD solutions for unsteady environments and loads.
e) Support code and analysis verification activities by performing CFD analysis for flow tests and comparing results with data, empirical solutions, and other CFD solutions.
f) Document analytical and test results.
g) Perform LAS system level literature searches for data to be used in analysis models.

Subelement EB – Computational Fluid Dynamics Analysis of Service Module Tanks

This Subelement was closed under revision 5.

Subelement EC – NASA Engineering Safety Center Acoustics and Combustion Stability Support

a) Analyze test data for combustion stability, acoustics, and fluid dynamics.
b) Perform acoustics and combustion stability predictions and assessments.
c) Attend and participate in team technical meetings, integrated product team meetings, and project reviews.
d) Document analytical and test results.
e) Develop 3D model, (boundary conditions, grid requirements, solution techniques) of the Ares 1 LAS system firing at fixed (steady state freestream) trajectory points. LAS plume flow interactions with the freestream flow shall be determined and the impact/effect on the LAS/Orion aerodynamic coefficients must be determined. Multiple trajectory points will be analyzed (combinations of freestream Mach, LAS motors' thrust level and directions, vehicle angle of attack, etc). Any non-physical and/or atypical flow physics shall be identified. Grid independent solutions are required.
f) Develop a similar 3-D model as given in item f but now with the boundary conditions changing in time. Perform cases of time accurate solutions of the LAS/Orion flow field through the transonic (freestream) regime. The freestream approach flow velocity, LAS motors' thrust profiles and directions will now be prescribed as a function of time. LAS/Orion aerodynamic coefficients will be calculated continuously. Rigorous grid independence is not required. The objective

is to show that if the BCs are allowed to change w/time, as opposed to being artificially fixed, the non physical flow and subsequent large aero forces on the Orion do not develop (as they have in other organizations analyses with fixed BCs).

g) Perform Taurus system level literature searches for data to be used in analysis models.
h) Support effort to obtain far field acoustical measurements of the AJ-26 engine being tested at Stennis.
i) Support NESC final Taurus II wrap-up face-to-face meeting and address findings from independent analyses and estimated risk assessment.

Subelement ED – **CFD Support for Launch Abort System Motors**

This subelement was closed with revision 13.

Subelement EE – **Fluid Dynamics Support of Cryogenic Fluid Management**

This subelement was closed with revision 17.

Subelement EF – **Fluid Dynamics Support for CECE**

This Subelement was closed under revision 17.

Subelement EG – Fluid Dynamics Support for MLAS 2

a) Provide combustion stability assessments of the Design Analysis Cycle (DAC) 0 Abort Motor (AM) design.
b) Begin planning for needed unsteady CFD runs to assess AM internal flow hydrodynamics.
c) Begin planning for the AM combustion instability requirements and verification testing.

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

Subelement EA – Launch Abort System Acoustics and Combustion Stability and CFD

a) Perform acoustics analysis in support of Launch Abort System Motors and Components.
b) Attend and participate in team technical meetings, integrated product team meetings, data reviews, and project reviews.
c) Perform computational fluid dynamics analysis (CFD) investigations to support acoustics, combustion stability, environments, and loads.
d) Interrogate CFD solutions for unsteady environments and loads.
e) Support code and analysis verification activities by performing CFD analysis for flow tests and comparing results with data, empirical solutions, and other CFD solutions.
f) Document analytical and test results.
g) Perform LAS system level literature searches for data to be used in analysis models.

Subelement EB – **Computational Fluid Dynamics Analysis of Service Module Tanks**

This Subelement was closed under revision 5.

Subelement EC – **NASA Engineering Safety Center Acoustics and Combustion Stability Support**

a) Analyze test data for combustion stability, acoustics, and fluid dynamics.
b) Perform acoustics and combustion stability predictions and assessments.
c) Attend and participate in team technical meetings, integrated product team meetings, and project reviews.
d) Document analytical and test results.
e) Develop 3D model, (boundary conditions, grid requirements, solution techniques) of the Ares 1 LAS system firing at fixed (steady state freestream) trajectory

points. LAS plume flow interactions with the freestream flow shall be determined and the impact/effect on the LAS/Orion aerodynamic coefficients must be determined. Multiple trajectory points will be analyzed (combinations of freestream Mach, LAS motors' thrust level and directions, vehicle angle of attack, etc). Any non-physical and/or atypical flow physics shall be identified. Grid independent solutions are required.

f) Develop a similar 3-D model as given in item f but now with the boundary conditions changing in time. Perform cases of time accurate solutions of the LAS/Orion flow field through the transonic (freestream) regime. The freestream approach flow velocity, LAS motors' thrust profiles and directions will now be prescribed as a function of time. LAS/Orion aerodynamic coefficients will be calculated continuously. Rigorous grid independence is not required. The objective is to show that if the BCs are allowed to change w/time, as opposed to being artificially fixed, the non physical flow and subsequent large aero forces on the Orion do not develop (as they have in other organizations analyses with fixed BCs).
g) Perform Taurus system level literature searches for data to be used in analysis models.
h) Support effort to obtain far field acoustical measurements of the AJ-26 engine being tested at Stennis.
i) Support NESC final Taurus II wrap-up face-to-face meeting and address findings from independent analyses and estimated risk assessment.

Subelement ED – **CFD Support for Launch Abort System Motors**
This Subelement was closed under revision 13.
Subelement EE – **Fluid Dynamics Support of Cryogenic Fluid Management**
This subelement was closed with revision 17.
Subelement EF – **Fluid Dynamics Support for CECE**
This Subelement was closed under revision 17.
Subelement EG – Fluid Dynamics Support for MLAS 2

a) Provide combustion stability assessments of the Design Analysis Cycle (DAC) 0 Abort Motor (AM) design.
b) Begin planning for needed unsteady CFD runs to assess AM internal flow hydrodynamics.
c) Begin planning for the AM combustion instability requirements and verification testing.

3.0 Discussion of Skills Required

Subelement EA – Launch Abort System Acoustics and Combustion Stability and CFD
Engineers associated with this subelement must have a mechanical or aerospace background and be very familiar with acoustics and CFD analysis.

Subelement EB – **Computational Fluid Dynamics Analysis of Service Module Tanks**
This Subelement was closed under revision 5.

Subelement EC – **NASA Engineering Safety Center Acoustics and Combustion Stability Support**

Engineers associated with this subelement must have a mechanical or aerospace background and be very familiar with acoustics analysis.

Subelement ED – **CFD Support for Launch Abort System Motors**

This Subelement was closed under revision 13.

Subelement EE – **Fluid Dynamics Support of Cryogenic Fluid Management**
This Subelement was closed with revision 17.

Subelement EF – **Fluid Dynamics Support for CECE**
This Subelement was closed under revision 17.

Subelement EG – Fluid Dynamics Support for MLAS 2
Engineers associated with this subelement must have a mechanical or aerospace background and be very familiar with acoustics and CFD analysis.

4.0 Special Tools Required

There are no special tools required for this task. All computer hardware and software to be provided by NASA/MSFC.

5.0 Participating Subcontractors

Subelement EA – Launch Abort System Acoustics and Combustion Stability and CFD
(b)(4)

6.0 Milestones & Deliverables

Subelement EA – Launch Abort System Acoustics and Combustion Stability and CFD
Monthly Activity Reports
Acoustics Reports
CFD Reports

Subelement EB – **Computational Fluid Dynamics Analysis of Service Module Tanks**
This Subelement was closed under revision 5.

Subelement EC – **NASA Engineering Safety Center Acoustics and Combustion Stability Support**
Monthly Activity Reports
Acoustics Reports

Subelement ED – **CFD Support for Launch Abort System Motors**
This Subelement was closed under revision 13.

Subelement EE – **Fluid Dynamics Support of Cryogenic Fluid Management**
This Subelement was closed under revision 17.

Subelement EF – **Fluid Dynamics Support for CECE**
This Subelement was closed under revision 17.

Subelement EG – Fluid Dynamics Support for MLAS 2
Monthly Activity Reports
Acoustics Reports
CFD Reports

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

Subelement EA – Launch Abort System Acoustics and Combustion Stability and CFD
One trip will be needed to support meetings. The travel estimate is (b)(4)
Subcontractor costs of (b)(4) will be needed.

Subelement EB – **Computational Fluid Dynamics Analysis of Service Module Tanks**
This Subelement was closed under revision 5.

Subelement EC – **NASA Engineering Safety Center Acoustics and Combustion Stability Support**

One trip will be needed to support meetings. The travel estimate is (b)(4)

Subelement ED – **CFD Support for Launch Abort System Motors**
This Subelement was closed under revision 13.

Subelement EE – **Fluid Dynamics Support of Cryogenic Fluid Management**
This Subelement was closed under revision 17.

Subelement EF – **Fluid Dynamics Support for CECE**
This Subelement was closed under revision 17.

Subelement EG – Fluid Dynamics Support for MLAS 2
There are no special considerations associated with this subelement.

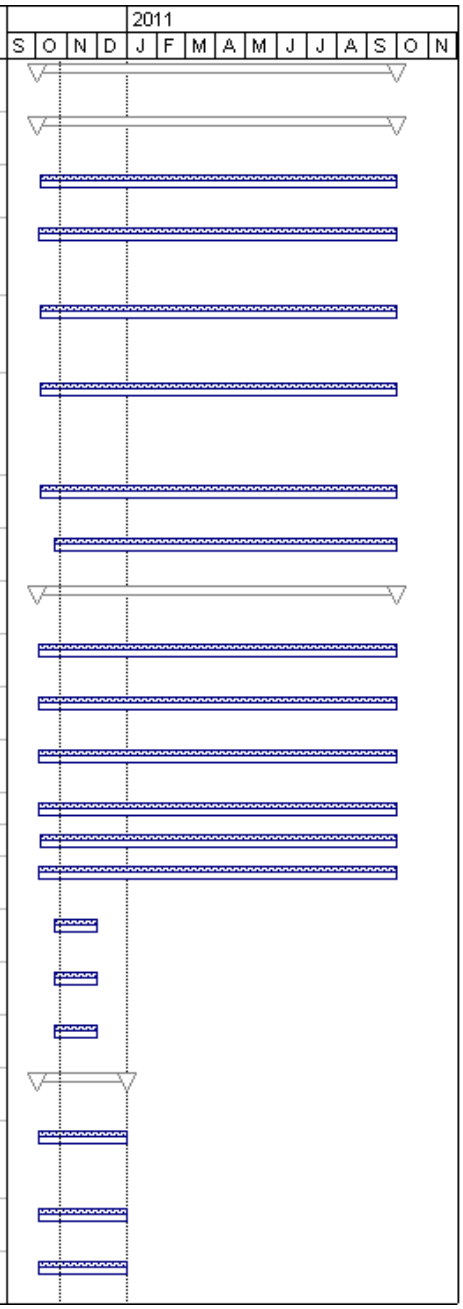
8.0 Work Shelf

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
None			

9.0 Schedule

Task Order	SubE	Task Work Element
33-040220	**EA**	**Fluid Dynamics Support for Crew Exploration Vehicle**
33-040220	**EA**	**Launch Abort System Acoustics and Combustion Stability**
33-040220	EA	Perform acoustics analysis in support of Launch Abort System Motors and Components.
33-040220	EA	Attend and participate in team technical meetings, integrated product team meetings, data reviews, and project reviews.
33-040220	EA	Perform computational fluid dynamics analysis (CFD) investigations to support acoustics, combustion stability, environments, and loads.
33-040220	EA	Support code and analysis verification activities by performing CFD analysis for flow tests and comparing results with data, empirical solutions, and other CFD solutions.
33-040220	EA	Document analytical and test results.
33-040220	EA	Perform LAS system level literature searches for data to be used in analysis models.
33-040220	**EC**	**NASA Engineering Safety Center Acoustics and Combustion Stability Support**
33-040220	EC	Analyze test data for combustion stability, acoustics, and fluid dynamics.
33-040220	EC	Perform acoustics and combustion stability predictions and assessments.
33-040220	EC	Attend and participate in team technical meetings, integrated product team meetings, and project reviews.
33-040220	EC	Document analytical and test results.
33-040220	EC	Develop 3-D model of Ares 1 LAS system firing.
33-040220	EC	Develop 3-D model of the Ares 1 LAS firing system with boundary conditions changing in time.
33-040220	EC	Perform Taurus system level literature searches for data to be used in analysis models.
33-040220	EC	Perform Taurus system level literature searches for data to be used in analysis models.
33-040220	EC	Perform Taurus system level literature searches for data to be used in analysis models.
33-040220	**EG**	**Fluid Dynamics Support for MLAS 2**
33-040220	EG	Provide combustion stability assessments of the Design Analysis Cycle (DAC) 0 Abort Motor (AM) design.
33-040220	EG	Begin planning for needed unsteady CFD runs to assess AM internal flow hydrodynamics.
33-040220	EG	Begin planning for the AM combustion instability requirements and verifi-cation testing.



ESTS Contract Task Order Request Performance Plan

Task Order Title: Fluid Dynamics Support for Crew Exploration Vehicle

Task Order Number: 33-040220 Revision: 18

Category	Weighting Technical %	End of Period Technical Score
Technical Objectives	65%	X 65% = **Justification**
Subelement EA – Launch Abort System Acoustics and Combustion Stability and CFD a) Perform acoustics analysis in support of Launch Abort System Motors and Components. b) Attend and participate in team technical meetings, integrated product team meetings, data reviews, and project reviews. c) Perform computational fluid dynamics analysis (CFD) investigations to support acoustics, combustion stability, environments, and loads. d) Interrogate CFD solutions for unsteady environments and loads. e) Support code and analysis verification activities by performing CFD analysis for flow tests and comparing results with data, empirical solutions, and other CFD solutions. f) Document analytical and test results. g) Perform LAS system level literature searches for data to be used in analy-sis models. Subelement EC – NASA Engineering Safety Center Acoustics and Combustion Stability Support a) Analyze test data for combustion stability, acoustics, and fluid dynamics. b) Perform acoustics and combustion stability predictions and assessments. c) Attend and participate in team technical meetings, integrated product team meetings, and project reviews. d) Document analytical and test results. e) Develop 3D model, (boundary conditions, grid requirements, solution techniques) of the Ares 1 LAS		

system firing at fixed (steady state frees-tream) trajectory points. LAS plume flow interactions with the freestream flow shall be determined and the impact/effect on the LAS/Orion aerody-namic coefficients must be determined. Multiple trajectory points will be analyzed (combinations of freestream Mach, LAS motors' thrust level and directions, vehicle angle of attack, etc). Any non-physical and/or atypical flow physics shall be identified. Grid independent solutions are required. f) Develop a similar 3-D model as given in item f but now with the boundary conditions changing in time. Perform cases of time accurate solutions of the LAS/Orion flow field through the transonic (freestream) regime. The freestream approach flow velocity, LAS motors' thrust profiles and direc-tions will now be prescribed as a function of time. LAS/Orion aerodynam-ic coefficients will be calculated continuously. Rigorous grid independence is not required. The objective is to show that if the BCs are allowed to change w/time, as opposed to being artificially fixed, the non physical flow and subsequent large aero forces on the Orion do not develop (as they have in other organizations analyses with fixed BCs). g) Perform Taurus system level literature searches for data to be used in analysis models. h) Support effort to obtain far field acoustical measurements of the AJ-26 engine being tested at Stennis. i) Support NESC final Taurus II wrap-up face-to-face meeting and address findings from independent analyses and estimated risk assessment. Subelement EG – Fluid Dynamics Support for MLAS 2		

ESTS Contract Task Order Request Performance Plan

Task Order Title: Fluid Dynamics Support for Crew Exploration Vehicle

Task Order Number: 33-040220 Revision: 18

a) Provide combustion stability assessments of the Design Analysis Cycle (DAC) 0 Abort Motor (AM) design. b) Begin planning for needed unsteady CFD runs to assess AM internal flow hydrodynamics. c) Begin planning for the AM combustion instability requirements and verifi-cation testing.		
Schedule Objectives (Milestones)	**Weighting Schedule %** 10% *(min 10%)*	**Schedule Score** X 10% = **Justification**
Subelement EA – Launch Abort System Acoustics and Combustion Stability Monthly Activity Reports Acoustics Reports CFD Reports Subelement EC – NASA Engineering Safety Center Acoustics and Combustion Stability Support Monthly Activity Reports Acoustics Reports Subelement EG – Fluid Dynamics Support for MLAS 2 Monthly Activity Reports Acoustics Reports CFD Reports		
Cost (actual vs. negotiated)	**Weighting Cost%** 25% *(min.25%)*	**Cost Score** X 25% = **Justification**
	Weighting Total % 100.00%	**Total Score**

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: Fluid Dynamics Support for Crew Exploration Vehicle

Task Order Number: 33-040220 Revision: 18

Comments:

Marshall Space Flight Center
Engineering, Science & Technical Services

JACOBS
ESTS Group

Risk Assessment

Contract Number: *NNM05AB50C*
TO Title: *Fluid Dynamics Support for Crew Exploration Vehicle*
TO Number: *33-040220* **Revision:** *18*

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

MSFC Initiator: *Lisa Griffin*

(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	No cost risks have been identified for this Task Order.
Risk T1	Technical	1	1	No technical risks have been identified for this Task Order.
Risk S1	Schedule	1	1	No schedule risks have been identified for this Task Order.

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

Task Order Risk Matrix

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

Legend

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

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

Risk Mitigation Plan

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

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