

## **Task Order Plan (TOP)**

**Contract Number:** NNM05AB50C  
**TO Title:** *Damage Tolerance Assessment Branch*  
**TO Number:** 34-020002 **Revision:** 18

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

**MSFC Initiator:** *Wayne Gamwell*

(b)(4)

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**Emergency:** *No*

Revision 18: This revision is written to correct the scope for each subelement to be consistent with the funding limitations defined by the customer. This is per the request of the customer. Additionally, subelement -99, Short Term Support has been reopened to allow for support of brief jobs that arise.

In addition, the risk assessment has been updated to identify the effects of decreased funding on the team's retained skill sets and its capability of accomplishing identified work (see risks (b)(4) and (b)(4)).

### **Subelement 99: Short Term Support (re-opened Rev. 18)**

**Labor:** added (b)(4) hours ( (b)(4) ) as place holders for anticipated, but unidentified work.

### **Subelement JA: ECLSS Star Spares Support**

Changed the subelement title (was ISS Support) and the scope of work to be more representative of the anticipated work.

### **Subelement SE: SSME Support**

**Labor:** reduced by (b)(4) hours (b)(4); this primarily comprised a reduction of the analytical efforts and support for the development of NASA standards. This also includes a shift of identified personnel who would be performing the effort.

**Subcontracts:** increased by (b)(4) this primarily represents a shift of identified personnel who would be performing the effort.

### **Subelement SM: RSRM Support**

**Subcontracts:** increased by (b)(4) this primarily represents the insertion of task management effort.

### **Subelement ST: External Tank Support**

**Labor:** increased by (b)(4) hours (b)(4); this primarily comprised a shift of identified personnel who would be performing the effort. This will provide for more analytical support.

Subcontracts: reduced by (b)(4) this primarily comprised a shift of identified personnel who would be performing the effort. Subcontracting effort is reduced to cover management oversight, only.

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.

Earlier subelements for Space Shuttle and the International Space Station (ISS) were functionally defined (subelements -03, -06, -22, -69, and -99), and these have been closed and replaced by subelements that are identified to funding sources (subelements –SE, space shuttle main engine, SSME; -SM, reusable solid rocket motor, RSRM; and –ST, external tank, ET). In addition, subelement -16, providing International Space Station (ISS) support has been re-identified as subelement –JA. Orion Launch Abort System (LAS) support subelement –EA has been closed, and any continuing effort has been moved to the Constellation task order and subelement 34-000002-ED.

**REVISIONS 1 - 16 SUMMARIES ARE PRIOR TO THE CURRENT FISCAL YEAR (2011) AND HAVE BEEN MOVED TO APPENDIX A AT THE BACK OF THIS NARRATIVE SECTION.**

## 1.0 Task Order Description & Objectives

This Task Order (TO) defines and estimates work for the period from October 2, 2010 through September 30, 2011. Funding for this task is provided per MSFC PR 4200173425. Additionally, the Schedule, Performance Plan, and Risk Assessment have been developed to reflect task activities for the period of performance. Damage Tolerance Assessments and Nondestructive Evaluations (NDE) activities were previously performed under TO 34-010003 and will now be accomplished under this task order.

The Jacobs-ESTS Group will provide support for the damage tolerance branch and NDE activities. The nondestructive evaluation support will occur predominantly in MSFC buildings 4702, and 4711, but some work will be done in MSFC buildings 4705 and 4755.

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

Sub element	Title	WBS
99	Short Term Support (opened in Rev. 18)	various
JA	ECLSS Star Spares (opened as ISS, in Rev. 17)	401769
SE	Space Shuttle Main Engine (SSME, opened in Rev. 17)	522094.08.01.01.03.01
SM	Reusable Solid Rocket Motor (RSRM, opened in Rev. 17)	520871.08.01.01.02
ST	External Tank (ET, opened in Rev 17)	524238.08.01.01.03

**SUBELEMENTS CLOSED AND REMOVED IN REVISION 17 AND PRIOR HAVE BEEN MOVED TO APPENDIX B AT THE BACK OF THIS NARRATIVE SECTION.**

Additional subelements will be added to this task order (TO) as new projects requiring Damage Tolerance and NDE support are identified.

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

The Jacobs-ESTS Group will provide support for the damage tolerance branch and NDE activities. Specific activities will include the following:

- Perform advanced fracture analyses using appropriate fracture modeling applications. Evaluate fracture control implementation approaches. Prepare reports and data packages on the analysis performed per customer requirements.
- Develop and implement fracture control requirements.
- Provide nondestructive evaluation support including, but not limited to, shearography, ultrasound, eddy current, radiography, and fluorescent penetrant inspections. Analyze data and report results.
- Provide all necessary training and certify that assigned personnel are proficient in the use of NDE methods and are knowledgeable in applicable safety regulations and procedures. No less than two persons shall be present in the NDE facilities when they are performing hazardous operations.
- Use existing Standard Operating Procedures (SOPs) for each type of analysis and NDE method.
- Procure all materials, hardware, services, and documentation (not otherwise provided by the Government) necessary to accomplish the required analyses and perform nondestructive evaluations.

Specific projects to be supported and the technical approach for each project are described below:

#### Subelement 99 – Short-Term Support

- Provide support for any task that requires less than (b) hours of effort and that has no specific deliverable documentation associated with it.

#### Subelement JA – ECLSS Star Spares Support

Effort expended for this subelement will be to perform NDE evaluations of ECLSS Star Spares tanks welds.

- Support EM20 personnel with NDE efforts.
- Operate NDE equipment to examine panels and hardware.
- Perform engineering review and quality check of data.
- Prepare reports and data packages from data per customer requirements.

#### Subelement SE – SSME

- Perform advanced fracture analyses using appropriate fracture modeling applications.
- Develop fracture control requirements.
- Perform engineering review and quality check of the analyses/assessments results.
- Prepare reports and data packages for assessments per customer requirements.
- Evaluate fracture control implementation approaches.
- Develop experimental programs to evaluate damage tolerance.
- Evaluate test data as needed for fracture assessments
- Support damage tolerance related activities as needed by EM20.
- Assist in planning of future DTA efforts

#### Subelement SM – RSRM

- Support EM20 personnel with NDE efforts.
- Operate NDE equipment to examine panels and hardware.
- Develop controls, tooling, and fixturing for NDE equipment.
- Travel to support NDE investigations.
- Perform an engineering review and quality check of inspection results.
- Prepare data packages from inspection results per customer requirements.
- Assist in planning of future NDE efforts

#### Subelement ST – External Tank

- Perform advanced fracture analyses using appropriate fracture modeling applications.
- Develop fracture control requirements.
- Perform engineering review and quality check of the analyses/assessments results.
- Prepare reports and data packages for assessments per customer requirements.
- Evaluate fracture control implementation approaches.
- Develop experimental programs to evaluate damage tolerance.

- Evaluate test data as needed for fracture assessments
- Support damage tolerance related activities as needed by EM20.
- Assist in planning of future DTA efforts
- Provide materials investigation support.
- Perform test planning.
- Perform engineering review and quality check of data.
- Prepare data packages from the data per customer requirements.

**SUBELEMENTS CLOSED AND REMOVED IN REVISION 17 AND PRIOR HAVE BEEN MOVED TO APPENDIX B AT THE BACK OF THIS NARRATIVE SECTION.**

### **3.0 Discussion of Skills Required**

To support the damage tolerance assessment aspect of this task order, personnel must have experience in fatigue and fracture assessments, fracture control requirements, and numerical and analytical modeling. Engineering expertise in metals and composites materials evaluation and testing is required.

To support nondestructive evaluation activities of this task order, selected personnel must be experienced in the operation of NDE equipment. NASA NDE Level II skills certification is required to perform NDE on flight hardware.

Certain training identified by the NASA customer, Jacobs ESTS management, or resulting from annual SHE assessments are required.

### **4.0 Special Tools Required**

Personal protective equipment (PPE) appropriate to the performance of the various NDE operations is required. This PPE requirement is identified in the EM20 personnel job hazard analysis (JHA), which is performed annually.

### **5.0 Participating Subcontractors**

Subelements –SE, -SM, and -ST

- (b)(4)

### **6.0 Milestones & Deliverables**

Deliverables will include the following: technical reports, technical presentations, documents inputs, and review item discrepancies (RIDs), email and verbal communications, test plans, and support of product development meetings, NDE inspection test reports, fracture and damage tolerance analysis methodologies, analysis software, NDE process development, monthly activity reports, fracture assessments. Task order schedule slips due to uncontrollable circumstances (examples: reprioritization of testing by customer; etc.) will not be factored negatively in assessing schedule objectives.

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

Subelement -ST

- Travel is included to cover trips for task related NDE tests.

### **8.0 Work Shelf**

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

TO/Subelement	Description	Due Date	Skill
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## 9.0 Schedule

Task Order #	Subelemen	Task Work Element	2011														
			Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	
34 - 020002	00	<b>Damage Tolerance Assessments Branch</b>	▼														
34 - 020002	99	Short Term Support															
34 - 020002	JA	ECLSS Stars Spares Support															
34 - 020002	SE	SSME Support															
34 - 020002	SM	RSRM Support															
34 - 020002	ST	External Tank Support															

## **APPENDIX A: Revisions Prior to Fiscal Year 2011**

Revision 16: Ares subelements (Cx & Dx) have been administratively closed in an activity separate from this revision to reflect changes in scope for Ares work. The Ares work that would have been covered by this Task is now covered under Task 34-000001. The schedule has been revised to reflect the closed subelements and the costs for the Ares subelements have been updated administratively.

Subelements -CA, -CR, -CS, -CW, -CX, -CY, and -DD of this task order were closed, and the scope was moved to 34-000001-CD. Subelement -CD of this task order was closed, and the scope was moved to 34-000001-DD.

Non-Ares subelements (numerical subelements and subelement -EA) have been updated to conform to anticipated work, and a summary of those changes appears, below.

### **Subelement -03: Nondestructive Evaluation**

Labor: Increased by (b)(4) (b)(4) hours) to provide shuttle NDE, program management, and engineering support.

Materials: Increased (b)(4) to provide uniform maintenance service.

Subcontracts: Increased (b)(4) to provide team management support.

### **Subelement 06: Damage Tolerance**

Labor: Increased by (b)(4) (b)(4) hours) to cover writing of technical reports, develop damage tolerance standards documents, and archive support of the external tank damage tolerance and fracture control efforts.

Subcontracts: Increased (b)(4) to provide team management support and archive support of the external tank damage tolerance and fracture control efforts.

Travel: Reduced travel estimate by (b)(4) to reflect tightened travel policy.

### **Subelement 16: ECLSS Spares**

Labor: Increased by (b)(4) (b)(4) hours) to cover radiographic inspection of one tank.

### **Subelement 22: External Tank Nonmetals**

Labor: Increased by (b)(4) (b)(4) hours) to cover shearography inspections of shuttle external tanks, and to develop the shearography process.

Materials: Reduced materials estimate by (b)(4) to reflect a tightened spending policy.

Travel: Reduced travel estimate by (b)(4) to reflect tightened travel policy.

### **Subelement 69: 3D Crack Turning Tests & Analysis**

Subcontracts: Increased subcontractor estimate by (b)(4) to provide team management support.

### **Subelement 99: Short Term**

Labor: Reduced by (b)(4) (b)(4) hours) due to expectation of less short term work needed.

### **Subelement EA: Orion Launch Abort System**

This effort supports WBS# 644423.06.34.06.01.08.

Labor: Reduced by (b)(4) (b)(4) hours) to reflect a change of support to damage tolerance and fracture control oversight efforts.

Subcontracts: Reduced by (b)(4) to reflect a change of support to damage tolerance and fracture control oversight efforts and team management support needs.

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Revision 15: The primary purpose of this revision is to move scope from subelement -06 to upperstage subelement -CA. In addition, NDE work being done to support welding is better understood, and so those subelements reflect the anticipated work. Subelement -CA was also increased to reflect an increase of activity in the main propulsion system. Subelement -CD was increased to provide testing support and analysis. Subelements -CE and -EA were reduced to accommodate this change and with a perceived reduction of activity in the latter two elements. Subelement -22 scope has been reduced to better match anticipated needs for ET foam inspection for space shuttle flight support. This effort has been shifted to subelements -CS and -CW to develop the shearography process specification and to provide shearographic analysis development support for common bulkhead. NDE technician support has been moved from subelements -CA, -CS, and -CW to subelements -CR and -DD. This matches the effort anticipated in weld development and seal plate weld development. Subelement -CX was increased to provide NDE support for fabrication of a structural development article. Subelement -16 was increased slightly to reflect recent work on ECLSS Spare Tanks. Subelement -69 was augmented to include funding arising from a no-cost extension from fiscal year 2009.

### **Subelement 06: Damage Tolerance**

Labor: decreased by (b)(4) hours (b)(4) . This reflects the early and successful completion of the space shuttle fuel control valve (FCV) poppet material testing and analysis. This effort was pushed towards objectives in subelement -CA.

### **Subelement 16: ECLSS Spares**

Labor: increased by (b)(4) hours ((b)(4) to cover the evaluation of a spare tank weld.

### **Subelement 22: External Tank Nonmetals**

Labor: decreased by (b)(4) hours (b)(4) . This reflects the finish of the evaluation of ET-122 tank that was damaged by the Katrina hurricane and retains enough effort to support subsequent space shuttle launches.

### **Subelement 69: 3D Crack Turning Tests & Analysis (subelement reopened)**

Subcontracts: increased by (b)(4) This estimate was augmented to include funding arising from a no-cost extension from fiscal year 2009. The extension allowed the further development of the foam fracture modeling.

### **Subelement CA: Ares I Integrated Manufacturing and Assembly**

This effort supports WBS# 136905.08.05.12.01.08.

Labor: increased by (b)(4) hours (b)(4) Effort has been shifted primarily from subelement - 06. The purpose is to accelerate the development of knowledge of fracture of an alloy planned for use in cryogenic auxiliary fluid bottles. In addition, effort associated with the main propulsion system has been increased, arising from increases in meeting support activities.

Subcontracts: increased by (b)(4) This reflects a shift of (b)(4) management support based on increased efforts defined.

### **Subelement CD: Ares I J2X Engine**

This effort supports WBS# 136905.08.04.01.08.02.

Labor: increased by (b)(4) hours (b)(4) This estimates effort to guide testing and provide analysis support of cryogenic testing of J2X materials. Offsetting this is also a reduction in support of J2X weekly meetings, to match current activity levels in that area.

### **Subelement CE: Ares I First Stage (RSRMV, closed)**

This effort supports WBS# 136905.08.01.11.

Labor: reduced by (b)(4) hours (b)(4). This represents a reduction in support of 1<sup>st</sup> stage weekly meetings, to match current activity levels.

### **Subelement CR: Weld Development**

This effort supports WBS# 136905.08.05.12.02.08.02.

Labor: increased by (b)(4) hours (b)(4) to reflect accelerated requirements for NDE support of weld development.

### **Subelement CS: MDA NDE Development**

This effort supports WBS# 136905.08.05.12.02.08.03.

Labor: decreased by (b)(4) hours (b)(4). This effort was improperly scoped in the earlier revision, and it is almost completed. This effort was pushed primarily towards subelement -CR to support in weld development.

### **Subelement CW: MDA, Common Bulkhead**

This effort supports WBS# 136905.08.05.12.02.08.11.

Labor: increased by (b)(4) hours (b)(4). This identifies the shearography work effort to be done to developing methodologies for inspecting the common bulkhead.

### **Subelement CX: MDA LH2 Tank Weld Demonstration**

This effort supports WBS# 136905.08.05.12.02.08.08.

Labor: increased by (b)(4) hours (b)(4) This reflects effort to evaluate y-ring-to-dome and vertical welds.

**Subelement CY: MDA Honeycomb Core & Adhesive Development**

This effort supports WBS# 136905.08.05.12.02.08.09.

Labor: reduced by (b)(4) hours (b)(4) This work was reduced to allow support of the weld development efforts.

**Subelement DD: Seal Plate Weld Development Support (subelement opening)**

This effort supports WBS# 136905.08.05.12.02.08.13.

Labor: added labor in the sum of (b)(4) hours (b)(4). Work effort has been moved to this subelement to work the seal plate weld development as a priority.

**Subelement EA: Orion Launch Abort System**

This effort supports WBS# 644423.06.34.06.01.08.

Labor: decreased by (b)(4) hours (b)(4) This represents a reduction in support of Orion launch abort system weekly meetings, to match current activity levels.

Subcontracts: decreased by (b)(4) This represents a reduction in support of Orion launch abort system weekly meetings, to match current activity levels and also reflects a shift of (b)(4) management support based on anticipated effort.

Travel: removed travel estimate of (b)(4) This represents a reduction in support of Orion launch abort system weekly meetings, to match current activity levels.

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Revision 14: The purpose of this revision is to close subelement –CG, Ares I-X support, and to open subelement –DD, Seal Plate Weld Development Support. Subcontract support has been added to subelement -69 to support further development of foam fracture modeling capabilities. In addition to this, estimates have been updated in many subelements to better reflect the current effort. A summary of the changes appears immediately below.

**Subelement 03: Nondestructive Evaluation**

Subcontracts: decreased by (b)(4) (b)(4) oversight of the task was reduced.

**Subelement 06: Damage Tolerance**

Labor: increased by (b)(4) hours (b)(4) to cover additional shuttle fuel control valve (FCV) poppet testing support and analysis.

Subcontracts: increased by (b)(4) (b)(4) oversight of the task increased to match current anticipation.

**Subelement 16: ECLSS Spares**

Labor: Reduced by (b)(4) hour (b)(4)

**Subelement 22: External Tank Nonmetals**

Labor: increased by (b)(4) hours (b)(4). This reflects the effort to finish the evaluation of ET-122 tank that was damaged by the Katrina hurricane, and to support subsequent launches.

**Subelement 69: 3D Crack Turning Tests & Analysis (subelement reopened)**

Subcontracts: increased by (b)(4) to provide additional anisotropic fracture analyses and finish the analytical code.

**Subelement CA: Ares I Integrated Manufacturing and Assembly**

This effort supports WBS# 136905.08.05.12.01.08.

Labor: decreased by (b)(4) hours (b)(4). Effort has been shifted to subelement –CR. This is a result of shifting design allowables.

Subcontracts: decreased by (b)(4). This reflects a shift of (b)(4) management support to subelement -06, based on anticipated effort.

**Subelement CD: Ares I J2X Engine**

This effort supports WBS# 136905.08.04.01.08.02.

Labor: reduced by (b)(4) hours (b)(4). Anticipated work has not been forthcoming.

**Subelement CE: Ares I First Stage (RSRMV)**

This effort supports WBS# 136905.08.01.11.

Labor: reduced by (b)(4) hours (b)(4). This has been done because the work has not been forthcoming.

**Subelement CG: First Stage (Ares I-X) (subelement closing)**

This effort supports WBS# 136905.08.01.09.

Labor: reduced by (b)(4) hours (b)(4). Ares I-X has launched and no further oversight is anticipated. Balance was shifted to subelement –EA, Orion Launch Abort Systems support.

**Subelement CR: Weld Development**

This effort supports WBS# 136905.08.05.12.02.08.02.

Labor: increased by (b)(4) hours (b)(4) to reflect increased requirements for NDE support of weld development. This was pushed to the front in the Ares I upperstage replan.

**Subelement CS: MDA NDE Development**

This effort supports WBS# 136905.08.05.12.02.08.03.

Labor: increased by (b)(4) hours (b)(4). This effort is pushed forward in the Ares I upperstage replan.

**Subelement CW: MDA, Common Bulkhead**

This effort supports WBS# 136905.08.05.12.02.08.11.

Labor: increased by (b)(4) hours (b)(4)

**Subelement CX: MDA LH2 Tank Weld Demonstration**

This effort supports WBS# 136905.08.05.12.02.08.08.

Labor: reduced by (b)(4) hours (b)(4) This effort was delayed, and so all remaining estimate was removed. The effort was pushed towards weld development subelements –CR and –CS.

**Subelement CY: MDA Honeycomb Core & Adhesive Development**

This effort supports WBS# 136905.08.05.12.02.08.09.

Labor: reduced by (b)(4) hours (b)(4) This work was reduced to allow support of the ET122 tank assessment and shuttle launches.

**Subelement DD: Seal Plate Weld Development Support (subelement opening)**

This effort supports WBS# 136905.08.05.12.02.08.13.

Labor: added labor in the sum of (b)(4) hours (b)(4) This work has been moved to this new subelement for closer tracking from the larger weld development effort subelement –CR.

**Subelement EA: Orion Launch Abort System**

This effort supports WBS# 644423.06.34.06.01.08.

Labor: increased by (b)(4) hours (b)(4) to allow additional coverage.

Subcontracts: decreased by (b)(4) (b)(4) support on this subelement has been picked up by other members of the team.

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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 following APO elements

- First Stage (subelement CE)
- Upper Stage (subelements CA, CR, CS, CX, and CY)
- Upper Stage Engine (subelement CD)
- Flight & Integrated Test Office/Ares I-X (subelement CG)

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Revision 12 is written to better forecast the effort of this task order. Several tasks identified in earlier estimates are better understood at this point, and so this revision inputs that understanding. Principally, this has been due a reprioritization of certain efforts.

**Subelement 03: Nondestructive Evaluation**

Subcontracts: decreased by (b)(4) The work was not needed in this subelement, but additional effort was needed for the Ares I upperstage.

Materials: increased by (b)(4) to cover cleaning of lab coats.

Other Direct Charges: increased by (b)(4) to cover NDE training for recertification.

### **Subelement 06: Damage Tolerance**

Labor: increased by (b)(4) hours (b)(4) to cover additional shuttle fuel control valve (FCV) poppet testing support and analysis.

Subcontracts: increased by (b)(4) This was to provide fracture mechanics consultation for the FCV effort.

Travel: increased by (b)(4) to cover travel to the annual fracture control panel meeting.

### **Subelement 22: External Tank Nonmetals**

Labor: increased by (b)(4) hours (b)(4) This reflects the effort to evaluate the ET-122 tank that was damaged by the Katrina hurricane.

Travel: increased by (b)(4) to cover travel to MAF to evaluate ET-122 and to KSC to evaluate ET131 and ET132.

### **Subelement CA: Ares I Integrated Manufacturing and Assembly**

This effort is conducted to support WBS# 136905.08.05.12.01.08.

Labor: increased by (b)(4) hours (b)(4) primarily to cover added NDE efforts.

Materials: increased by (b)(4) to cover materials for NDE fixturing.

Travel: decreased by (b)(4) Estimate had been included to allow engineers to travel to meetings and possibly a symposium or seminar. The moratorium on travel earlier in the contract year caused us to drop any plans of the sort.

Subcontracts: increased by (b)(4) to provide additional support and oversight by the (b)(4)

### **Subelement CD: Ares I J2X Engine**

This effort was conducted to support WBS# 136905.08.04.01.08.02.

Labor: reduced by (b)(4) hours (b)(4) to reflect a momentary shifting of attention to the shuttle fuel cut off valve poppet efforts.

### **Subelement CE: Ares I First Stage (RSRMV)**

This effort is conducted to support WBS# 136905.08.01.11.

Labor: reduced by (b)(4) hours (b)(4) This effort has been delayed, and so the remaining estimate was removed, and the effort was pushed towards Orion support.

**Subelement CG: First Stage (Ares I-1)**

This effort was conducted to support WBS# 136905.08.01.09.

Labor: reduced by (b) hours (b)(4) This effort was delayed, and so the remaining estimate was removed, and the effort was pushed towards Orion support.

**Subelement CR: Weld Development (opening)**

This effort is conducted to support WBS# 136905.08.05.12.02.08.02.

Labor: increased by (b)(4) hours (b)(4) to reflect increased requirements for NDE support of weld development.

**Subelement CS: MDA NDE Development**

This effort is conducted to support WBS# 136905.08.05.12.02.08.03.

Labor: reduced by (b)(4) hours (b)(4) This effort was delayed, and so all remaining estimate was removed. The effort was pushed towards weld development.

**Subelement CW: MDA, Common Bulkhead**

This effort is conducted to support WBS# 136905.08.05.12.02.08.11.

Labor: reduced by (b)(4) hours (b)(4) This effort was delayed, and so all remaining estimate was removed. The effort was pushed towards weld development.

**Subelement CX: MDA LH2 Tank Weld Demonstration**

This effort is conducted to support WBS# 136905.08.05.12.02.08.08.

Labor: reduced by (b)(4) hours (b)(4) This effort was delayed, and so all remaining estimate was removed. The effort was pushed towards weld development.

**Subelement CY: MDA Honeycomb Core & Adhesive Development**

This effort is conducted to support WBS# 136905.08.05.12.02.08.09.

Labor: reduced by (b)(4) hours (b)(4) This work was reduced to allow support of the ET122 tank assessment and shuttle launches.

**Subelement EA: Orion Launch Abort System**

This effort is conducted to support WBS# 644423.06.34.06.01.08.

Labor: increased by (b)(4) hours (b)(4) to reflect an increase of scope to cover the subsystem design reviews (SSDR) and preliminary design review (PDR).

Subcontracts: decreased by (b)(4) This reflects a shift in requirement to provide more (b)(4) oversight support to Ares I upperstage.

Travel: decreased by (b)(4) No further travel is anticipated in this contract year.

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Revision 11 is written to insert fracture mechanics consultation into subelement -06, and to capture additional changes to scope which have occurred. Subelement -06 scope also increased substantially to cover the fuel control valve poppet valve analysis efforts, and some of the scope

associated with other subelements was delayed. Subelement -EA travel increased to support the Launch Abort Systems subsystem design reviews. This produced a reduction in subcontract effort in Subelements -03 and -CA.

### **Subelement 03: Nondestructive Evaluation**

Labor: Increased by (b)(4) hours (b)(4) to support nondestructive evaluation of the shuttle fuel control poppet valve.

Subcontracts: decreased by (b)(4)

Other Direct Charges: increased by (b)(4) to cover registration costs for NDE training.

### **Subelement 06: Damage Tolerance**

Labor: increased by (b)(4) hours (b)(4) to cover the added shuttle fuel control valve poppet testing support and analysis.

Other Direct Charges: increased by (b)(4) to cover registration requirements for a fracture symposium held at the ASTM committee week meetings.

Subcontracts: increased by (b)(4) This is to provide additional scope to finish the shuttle fuel control valve poppet analysis and to provide for fracture mechanics consultation.

Travel: increased by (b)(4) to cover travel to ASTM environmentally-assisted cracking committee meeting.

### **Subelement 22: External Tank Nonmetals**

Labor: increased by (b)(4) hours (b)(4). This reflects a slight increase in effort to evaluate the ET-122 tank that was damaged by the Katrina hurricane.

Travel: increased by (b)(4) to cover travel to MAF to evaluate ET-122.

### **Subelement CA: Ares I Integrated Manufacturing and Assembly**

This effort is conducted to support WBS# 136905.08.05.12.01.08.

Labor: increased by (b)(4) hours (b)(4) primarily to cover added NDE efforts.

### **Subelement CD: Ares I J2X Engine**

This effort was conducted to support WBS# 136905.08.04.01.08.02.

Labor: reduced by (b)(4) hours (b)(4) to reflect a momentary shifting of attention to the shuttle fuel cut off valve poppet efforts.

### **Subelement CE: Ares I First Stage (RSRMV)**

This effort is conducted to support WBS# 136905.08.01.11.

Labor: reduced by (b)(4) hours (b)(4) to reflect a focus on the Ares I-X instead.

**Subelement CG: First Stage (Ares I-1)**

This effort was conducted to support WBS# 136905.08.01.09.

Labor: increased by (b) hours (b)(4) to reflect a focus on the Ares I-X preparation efforts.

**Subelement CR: Weld Development (opening)**

This effort is conducted to support WBS# 136905.08.05.12.02.08.02.

Labor: reduced by (b) hours (b)(4) to reflect a late start of NDE support of weld development.

**Subelement CS: MDA NDE Development**

This effort is conducted to support WBS# 136905.08.05.12.02.08.03.

Labor: reduced by (b)(4) hours (b)(4). This was required because of a delay in the approval of revision 9, which provided a later start than anticipated.

**Subelement CW: MDA, Common Bulkhead**

This effort is conducted to support WBS# 136905.08.05.12.02.08.11.

Labor: reduced by (b) hours (b)(4). This was required because of a delay in the approval of revision 9, which provided a later start than anticipated.

**Subelement CX: MDA LH2 Tank Weld Demonstration**

This effort is conducted to support WBS# 136905.08.05.12.02.08.08.

Labor: reduced by (b)(4) hours (b)(4). This was required because of a delay in the approval of revision 9, which provided a later start than anticipated.

**Subelement CY: MDA Honeycomb Core & Adhesive Development**

This effort is conducted to support WBS# 136905.08.05.12.02.08.09.

Labor: reduced by (b) hours (b)(4). This was required because of a delay in the approval of revision 9, which provided a later start than anticipated.

**Subelement EA: Orion Launch Abort System (reopened)**

This effort is conducted to support WBS# 644423.06.34.06.01.08.

Labor: increased by (b) hours (b)(4) to reflect an increase of scope and established funding.

Travel: increased by (b)(4) to support upcoming launch abort system jettison motor and attitude control motor subsystem design reviews.

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Revision 10 has been written to capture numerous changes in scope that have occurred. Subelement –CR has been added to support weld development, beginning with the common bulkhead seal plate weld. Subelement –EA has been reopened due to establishment of financial support—this effort has been removed from subelements -06 and –CA. Equipment and fixturing purchases have been added to subelements -06, -22, and –CA. A software purchase has been added to subelement -03. Nondestructive evaluation (NDE) training in phased array ultrasound (PAUT) and training have been added to subelement -03, and this includes travel. Because of the moratorium on travel, all travel estimates have been reduced to include only cur-

rently identified travel related to scoped work. Analysis of the crack growth direction for the shuttle fuel cutoff valve poppet has been added to subelement -06. Additional scope has been added to subelement -22 to cover the extra engineering time being spent on shuttle ET122.

### **Subelement 03: Nondestructive Evaluation**

Labor: Reduced by (b)(4) hours (b)(4)

Travel: reduced by (b)(4).

### **Subelement 06: Damage Tolerance**

Labor: increased by (b)(4) hours (b)(4) to cover the added shuttle fuel control valve poppet analysis.

Other Direct Charges: increased by (b)(4) to cover internet job advertising costs associated with an earlier hire.

Subcontracts: increased by (b)(4) This adds effort to analyze crack growth characteristics in the shuttle fuel cutoff valve poppet, while transferring some of the onsite subcontract effort to cover subelement –EA.

### **Subelement 22: External Tank Nonmetals**

Labor: increased by (b)(4) hours (b)(4) This reflects an increase in effort to evaluate the ET-122 tank that was damaged by the Katrina hurricane.

Materials: increased by (b)(4) to cover replacement of worn speaker diaphragms.

Travel: increased by (b)(4) to cover the evaluation of ET-122 for repairs and also ET-131 for preflight.

### **Subelement CA: Ares I Integrated Manufacturing and Assembly**

This effort is conducted to support WBS# 136905.08.05.12.01.08.

Labor: increased by (b)(4) hours (b)(4) to cover NDE efforts.

Materials: increased by (b)(4) to cover the purchase of precision alignment fixturing to run mechanical tests.

Subcontracts: reduced by (b)(4) to better reflect actual effort. Some of effort has been moved to subelement –EA.

Travel: reduced by (b)(4) to remove conference travel and any travel anticipated but not currently planned.

### **Subelement CD: Ares I J2X Engine**

This effort was conducted to support WBS# 136905.08.04.01.08.02.

Labor: reduced by (b) hours (b)(4) to reflect a momentary shifting of effort to cover the shuttle fuel cutoff valve poppet efforts.

Travel: reduced by (b)(4) to remove conference travel and any travel anticipated but not currently planned.

**Subelement CE: Ares I First Stage (RSRMV)**

This effort is conducted to support WBS# 136905.08.01.11.

Labor: reduced by (b) hours (b)(4) to reflect a focus on the Ares I-X instead. The minor reduction in estimate relative to the hours arises from the correction of an error in job codes in the earlier revision.

Travel: reduced by (b)(4) to remove conference travel and any travel anticipated but not currently planned.

**Subelement CG: First Stage (Ares I-1)**

This effort was conducted to support WBS# 136905.08.01.09.

Labor: increased by (b)(4) hours (b)(4) to reflect a focus on the Ares I-X preparation efforts.

**Subelement CR: Weld Development (opening)**

This effort is conducted to support WBS# 136905.08.05.12.02.08.02.

Labor: added (b)(4) hours (b)(4) to provide NDE support of weld development.

**Subelement CS: MDA NDE Development**

This effort is conducted to support WBS# 136905.08.05.12.02.08.03.

Labor: reduced by (b)(4) hours (b)(4) This was required because of a delay in the approval of revision 9, which provided a later start than anticipated.

**Subelement CW: MDA, Common Bulkhead**

This effort is conducted to support WBS# 136905.08.05.12.02.08.11.

Labor: reduced by (b)(4) hours (b)(4) This was required because of a delay in the approval of revision 9, which provided a later start than anticipated.

**Subelement CX: MDA LH2 Tank Weld Demonstration**

This effort is conducted to support WBS# 136905.08.05.12.02.08.08.

Labor: reduced by (b)(4) hours (b)(4) This was required because of a delay in the approval of revision 9, which provided a later start than anticipated.

**Subelement CY: MDA Honeycomb Core & Adhesive Development**

This effort is conducted to support WBS# 136905.08.05.12.02.08.09.

Labor: reduced by (b)(4) hours (b)(4) This was required because of a delay in the approval of revision 9, which provided a later start than anticipated.

### **Subelement EA: Orion Launch Abort System (reopened)**

This effort is conducted to support WBS# 644423.06.34.06.01.08.

Subcontracts: added (b)(4) to cover anticipated efforts.

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Revision 09 has been written principally to close subelement –CB, moving a portion of the effort to subelement –CA and shifting effort according to the Ares I Upper Stage replan. In addition to this, all labor estimate has been removed from subelement –EA, beginning in February 2009. This estimate has been moved to subelements -03, -06, and -CA. (b)(4) effort for (b)(4) has been removed from subelements -16, -99, and –CB. Several other modifications have been made to better reflect the effort.

### **Subelement 03: Nondestructive Evaluation**

Labor: increased by (b)(4) hours (b)(4)

Materials: charges of (b)(4) for lab coats have been added. Also, added (b)(4) to purchase four copies of (b)(4) for NDE.

Other Direct Charges: added in the amount of (b)(4) to cover training for NDE (b)(4)

Subcontracts: increased by (b)(4)

### **Subelement 06: Damage Tolerance**

Labor: increased by (b)(4) hours (b)(4)

Subcontracts: increased by about (b)(4) to support standards development activities this was accomplished by moving subelement –EA subcontract support.

Other Direct Charges: added in the amount of (b)(4) to cover postage.

### **Subelement 16: ECLSS Spares**

Labor: estimate of (b)(4) hours (b)(4) has been removed. This subelement will be charged as work is identified.

### **Subelement 22: External Tank Nonmetals**

Labor: nondestructive evaluation (NDE) engineering effort of about (b)(4) hours (b)(4) has been shifted from subelement -22 to subelement –CY.

### **Subelement 69: 3D Crack Turning Tests and Analysis**

Other Direct Charges: an estimate of (b)(4) has been added to cover mailing charges.

Subcontracts: increased by about (b)(4) This reflects carry-over funds from last year and not a change of scope.

### **Subelement 99: Short Term Support**

Labor: reduced by (b)(4) hours (b)(4) This subelement was established to allow for short term work, and the quantity is indefinite. The effort has been distributed across subelements – CS, -CW, -CX, and –CY. Estimate will be added as work is identified.

**Subelement CA: Ares I Integrated Manufacturing and Assembly**

This effort is conducted to support WBS# 136905.08.05.12.01.08.

Labor: increased effort by about (b)(4) hours (b)(4) to better reflect where the work is being done. Much of this was moved from subelement –CB to subelement –CA to cover damage tolerance analysis of composite-overwrapped pressure vessels (COPV), and provide technician support to integrated manufacturing and assembly work. One technician's support was extended from December 2008 to the end of fiscal year 2009.

Materials: charges of about (b)(4) for lab coats cleaning have been removed from –CA to -03.

Subcontracts: reduced by about (b)(4) to shift support to subelement -06 for standards development activities.

Travel: increased by (b)(4) to support off-site work. This was moved from subelement –CB.

**Subelement CB: Ares I LOX and LH2 Tank and Structural Test Articles (closing)**

This effort was conducted to support WBS# 136905.08.05.12.02.08 and 136905.08.05.12.03.08.

Labor: estimate of (b)(4) hours (b)(4) has been removed effective 30 November 2008, and this subelement is being closed. The efforts have been distributed into several new subelements (-CS, -CW, -CX, -CY) that allow the effort to be tracked more closely. Some of the effort is being shifted to subelement –CA to cover damage tolerance analysis of composite-overwrapped pressure vessels (COPV) and other integrated manufacturing and assembly work.

Travel: estimate of (b)(4) has been moved to subelement –CA.

Other Direct Charges: in the amount of (b)(4) have been added to Subelement -CB to cover training registration fees paid.

**Subelement CD: Ares I J2X Engine**

This effort was conducted to support WBS# 136905.08.04.01.08.02.

Labor: Slight reduction in effort of (b)(4) hrs (b)(4) was made to account for a delay in funding. Work was delayed until this was resolved.

**Subelement CE: Ares I First Stage (RSRMV)**

This effort is conducted to support WBS# 136905.08.01.11.

Labor: The labor estimated for this subelement was reduced by (b)(4) hours to reflect a slight difference in the actual effort, and this effort is being performed by an (b)(4) engineer, providing a reduction in estimate of (b)(4)

**Subelement CG: First Stage (Ares I-1)**

This effort was conducted to support WBS# 136905.08.01.09.

Labor: The labor estimated for this subelement was reduced by (b) hours to reflect a slight difference in the actual effort, and this effort is being performed by an (b)(4) providing a reduction in estimate of (b)(4)

**Subelement CS: MDA NDE Development (opening)**

This effort is conducted to support WBS# 136905.08.05.12.02.08.03.

Labor: this subelement is being opened to cover support for nondestructive evaluation (NDE) efforts estimated at (b)(4) hours (b)(4). This has been moved from subelements -99 and -CB.

**Subelement CW: MDA, Common Bulkhead (opening)**

This effort is conducted to support WBS# 136905.08.05.12.02.08.11.

Labor: this subelement is being opened to cover support for the development of the common bulkhead manufacturing demonstration article (MDA), and it is estimated at (b)(4) hours (b)(4). This has been moved from subelements -99 and -CB.

**Subelement CX: MDA LH2 Tank Weld Demonstration (opening)**

This effort is conducted to support WBS# 136905.08.05.12.02.08.08.

Labor: this subelement is being opened to cover support for the development of the liquid hydrogen (LH2) tank weld demonstration, and it is estimated at (b)(4) hours (b)(4). This has been moved from subelements -99 and -CB.

**Subelement CY: MDA Honeycomb Core & Adhesive Development (opening)**

This effort is conducted to support WBS# 136905.08.05.12.02.08.09.

Labor: this subelement is being opened to cover support for the development of the honeycomb core and adhesive for the manufacturing demonstration article (MDA), and it is estimated at (b)(4) hours (b)(4). This has been moved from subelements -99 and -CB.

**Subelement EA: Orion Launch Abort System (closed)**

This effort is conducted to support WBS# 644423.06.34.06.01.08.

Subcontracts: All future effort was removed, and subelement is being closed.

Travel: estimate of (b)(4) has been removed.

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Revision 08: The purpose of this revision is to extend this task into Contract Year 4 of the NNM05AB50C ESTS contract. This revision defines and estimates work for the period September, 27, 2008 through October 2, 2009. Additionally, the Schedule, Performance Plan and Risk Assessment have been revised to reflect changes in task activities for the new period of performance. This revision affects the following APO elements

- First Stage (subelement CE)
- Upper Stage (subelements CA and CB, WBS# 136905.08.05.12.03.08 added in this revision)
- Upper Stage Engine (subelement CD)

- Flight & Integrated Test Office/Ares I-X (subelement CG)
- Orion Launch Abort Systems (added in this revision, subelement EA, WBS# 644423.06.34.06.01.08)

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Revision 07 is written for several reasons:

1. Changed the (b)(4)
2. Subelement -06 is being increased by (b)(4) in subcontracting to support the development and addition of computer modeling capabilities of friction plug welds to FEACrack crack modeling software.
3. Subelement -06 has been increased by (b)(4) to cover the cost of purchasing a camera and measurement microscope.
4. Subelements -06 and -CA are also being increased by (b)(4) and (b)(4) (total (b)(4)) respectively in subcontracting to cover team management and provide analytical support.
5. Subelement -69 was reduced by (b)(4) for a subcontract. The portion of this work represented by this amount is to be done in FY09, and this will be reflected on FY09 estimates.
6. Minor changes have been made in most of the subelements to better reflect the current work efforts. The loss of one engineer produced an overall reduction of about (b)(4) in labor with Upperstage reduced by about (b)(4). Details of these changes follow:

(b)(4)



7. Subelements -99 and -CE have been increased by (b)(4) and (b)(4) respectively, to cover travel requirements.
8. Subelement -CA is being increased by (b)(4) to cover the cost of a nondestructive evaluation alignment fixture.

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The purpose of revision 06 is to:

1. Change the (b)(4)
2. Add (b)(4) in subcontract estimate to subelement -69 (3D Crack Turning Tests and Analysis) to support a subcontract with the (b)(4) to model crack turning behavior.
3. Add (b)(4) to subelement -CA (CLV Integrated Manufacturing and Assembly – WBS# 136905.08.05.12.01.08) to support and an increased damage tolerance engineering scope for this effort and relocation expenses to provide additional engineering support.
4. Add (b)(4) to subelement -CB (CLV LOX and LH2 Tank and Structural Test Articles – WBS# 136905.08.05.12.02.08) to support increased nondestructive evaluation and damage tolerance technical and engineering scope for this effort.
5. Redistribute resources among the other subelements to more accurately reflect expected requirements.

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The purpose of this revision 05 is to extend this task into Contract Year 3 of the NNM05AB50C ESTS contract. This revision defines and estimates work for the period 29 September 2007 through 26 September 2008. Additionally, the Schedule, Performance Plan and Risk Assessment have been revised to reflect changes in task activities for the new period of performance.

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The purpose of revision 04 is the following:

6. To remove (b)(4) labor supporting subelements -06, CA, and CD to reflect this (b)(4) transition from this task.
7. To allocate traveling funds for subelements -06 and -99.
8. To redistribute resources to more accurately reflect expected requirements.

No additional funding was required to support Constellation efforts (subelements –CA, CB, CC, CD, CE, and CG).

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The purpose of revision 03 is to expand the scope of this task. The estimate is updated to reflect the addition of a new engineer and three subelements as follows:

1. Add (b)(4) labor to cover the addition of an (b)(4) supporting subelement -06.
  2. Add subelement -CE and -CG to cover additional first stage activities (RSRMV and Ares I-1).
  3. Add subelement-70 to cover additional activities in the elastic plastic fracture mechanics area outside the scope of subelement -06.
- 

The purpose of revision 02 is to expand the scope of this task. The estimate is updated to reflect the redistribution of labor allocation and material resources as follows:

1. Add (b)(4) labor to cover the addition of an (b)(4) supporting subelements -06, -CA, and –CD.
  2. Remove (b)(4) labor supporting subelements -22, and –CD to reflect this (b)(4) transitioning off this task.
  3. Redistribute existing material estimate to account for the payment incurred during the month of January for the procurement of a nondestructive evaluation machine.
  4. Extend subelement -22 through September 30, 2007 to cover continued work supporting Nondestructive Evaluation of the External Tank (ET) foam.
- 

The purpose of revision 01 is to expand the scope of this task. The estimate is updated to reflect the addition of a new technician to perform nondestructive evaluation in support of subelements -03 and -CB. This revision also includes the redistribution of existing material estimate to account for a down payment cost incurred during the month of October for the procurement of a nondestructive evaluation machine.

**APPENDIX B: Subelements Closed and Removed by Revision 16  
and Moved to Task Order 34-000001**

<b>Sub element</b>	<b>Title – WBS #</b>	<b>Status</b>
03	Nondestructive Evaluation	(closed)
06	Damage Tolerance	(closed)
16	ECLSS Spares	(re-identified as subelement -JA)
22	External Tank Nonmetals	(effort moved to subelement - ST)
69	3D Crack Turning Tests and Analysis	(closed)
70	Elastic Plastic Fracture Mechanics	(closed)
CA	Ares I Integrated Manufacturing and Assembly – WBS# 136905.08.05.12.01.08	(subelement closed)
CB	Ares I LOX and LH2 Tank and Structural Test Articles – WBS# 136905.08.05.12.02.08 and 136905.08.05.12.03.08	(subelement closed)
CC	Ares I Cryogenic Insulation – WBS# 136905.08.05.12.07.08	(closed)
CD	Ares I J2X Engine – WBS# 136905.08.04.01.08.02.	(subelement closed)
CE	Ares I First Stage (RSRMV) – WBS# 136905.08.01.11	(subelement closed)
CG	First Stage (Ares I-1) – WBS# 136905.08.01.09	(subelement closed)
CO	SDTA—WBS# 136905.08.05.12.03.08	(subelement closed)
CR	MDA Weld Development -- WBS# 136905.08.05.12.02.08.02	(subelement closed)
CS	MDA NDE Dev – WBS# 136905.08.05.12.02.08.03	(subelement closed)
CW	MDA, Common Bulkhead – WBS# 136905.08.05.12.02.08.11	(subelement closed)
CX	MDA LH2 Tank Weld Demo – WBS# 136905.08.05.12.02.08.08	(subelement closed)
CY	MDA Honeycomb Core & Adhesive Dev – WBS# 136905.08.05.12.02.08.09	(subelement closed)
DD	Seal Plate Weld Development Support -- WBS# 136905.08.05.12.02.08.13	(subelement closed)
EA	Orion LAS	(closed)

Subelement 03 – Nondestructive Evaluation (NDE, closed in Rev. 17: efforts moved to new subelements)

- Support EM20 personnel with NDE efforts.
- Operate NDE equipment to examine panels and hardware.
- Develop controls, tooling, and fixturing for NDE equipment.
- Travel to support NDE investigations.

- Perform an engineering review and quality check of inspection results.
- Prepare data packages from inspection results per customer requirements.
- Assist in planning of future NDE efforts

Subelement 06 – Damage Tolerance (closed in Rev. 17: efforts moved to new subelements)

- Perform advanced fracture analyses using appropriate fracture modeling applications.
- Develop fracture control requirements.
- Perform engineering review and quality check of the analyses/assessments results.
- Prepare reports and data packages for assessments per customer requirements.
- Evaluate fracture control implementation approaches.
- Develop experimental programs to evaluate damage tolerance.
- Evaluate test data as needed for fracture assessments
- Support damage tolerance related activities as needed by EM20.
- Assist in planning of future DTA efforts

Subelement 16 – ECLSS Spares (re-identified in Rev. 17 as subelement –JA)

- Support EM20 personnel with NDE efforts.
- Operate NDE equipment to examine panels and hardware.
- Perform engineering review and quality check of data.
- Prepare reports and data packages from data per customer requirements.

Subelement 22 – External Tank Nonmetals (closed in Rev. 17: efforts moved to subelement – ST)

- Provide materials investigation support.
- Perform test planning.
- Perform engineering review and quality check of data.
- Prepare data packages from the data per customer requirements.

Subelement 69 – 3D Crack Turning Tests and Analysis (closed in Rev. 17)

- Prepare test samples and test fixtures.
- Coordinate machining activities.
- Provide purchasing services.
- Perform fatigue and fracture assessments.
- Perform an engineering review and quality check of the data.
- Develop 3D and 2D analytical tools to evaluate anisotropic fracture.
- Prepare a final report and data packages.

Subelement 70 – Elastic Plastic Fracture Mechanics (closed in Rev. 17)

- Perform mechanical testing in air, LN2, and LH2 environments to evaluate tensile and fracture properties.
- Perform an engineering review and quality check of the data.
- Prepare data packages from the test data per customer requirements.
- Perform fatigue and fracture assessments.

Subelement CA – Ares I Integrated Manufacturing and Assembly (closed)

- Provide NDE planning and inspection.
- Perform nondestructive evaluations.
- Perform engineering review and data reduction.
- Support development of test plans for design allowables.
- Develop and implement fracture control requirements.
- Provide analytical details support.
- Prepare reports and data packages from data per customer requirements.
- Assist in planning of future DTA activities.

Subelement CB – Ares I LOX and LH<sub>2</sub> Tank and Structural Test Articles (closed)

- Implement fracture control requirements.

- Provide detailed analytical support.
- Provide NDE planning and inspection.
- Perform nondestructive evaluations.
- Develop and execute design of experiment studies.
- Perform engineering review and quality check of the data.
- Develop design allowables.
- Prepare reports and data packages from data per customer requirements.

Subelement CC – Ares I Cryogenic Insulation (closed)

- Coordinate machining activities.
- Develop and execute design of experiment studies.
- Perform nondestructive evaluations.
- Perform engineering review and quality check of the data.
- Develop design allowables.
- Prepare reports and data packages from data per customer requirements.

Subelement CD – Ares I J2X Engine (closed)

- Implement fracture control requirements.
- Provide analytical details support.
- Coordinate machining activities.
- Perform engineering review and quality check of the data.
- Prepare reports and data packages from data per customer requirements.

Subelement CE – Ares I First Stage (RSRMV) (closed)

- Implement fracture control requirements.
- Provide analytical details support.
- Coordinate specimen fabrication activities.
- Perform engineering review and data reduction.
- Prepare reports and data packages from data per customer requirements.

Subelement CG – First Stage (Ares I-1) (closed)

- Implement fracture control requirements.
- Provide analytical details support.
- Provide NDE planning and inspection.
- Perform nondestructive evaluations.
- Coordinate specimen fabrication activities.
- Perform engineering review and data reduction.
- Prepare reports and data packages from data per customer requirements.

Subelement CO – Structural Development Test Article (SDTA, closed)

- Provide NDE planning and inspection.
- Perform nondestructive evaluations.
- Perform engineering review and quality check of the data.
- Prepare reports and data packages from data per customer requirements.

Subelement CR – Manufacturing Demo Article (MDA) Weld Development (closed)

- Provide NDE planning and inspection.
- Perform nondestructive evaluations.
- Perform engineering review and quality check of the data.
- Prepare reports and data packages from data per customer requirements.

Subelement CS – Manufacturing Demo Article NDE Development (closed)

- Provide NDE planning and inspection.
- Perform nondestructive evaluations.
- Perform engineering review and quality check of the data.

- Prepare reports and data packages from data per customer requirements.

Subelement CW –MDA Common Bulkhead (closed)

- Provide NDE planning and inspection.
- Perform nondestructive evaluations.
- Perform engineering review and quality check of the data.
- Prepare reports and data packages from data per customer requirements.

Subelement CX – MDA LH2 Tank Welding Demo (closed)

- Provide NDE planning and inspection.
- Perform nondestructive evaluations.
- Perform engineering review and quality check of the data.
- Prepare reports and data packages from data per customer requirements.

Subelement CY – MDA Honeycomb Core & Adhesive Dev (closed)

- Provide NDE planning and inspection.
- Perform nondestructive evaluations.
- Perform engineering review and quality check of the data.
- Prepare reports and data packages from data per customer requirements.

Subelement DD – Seal Plate Weld Development Support (closed)

- Provide NDE planning and inspection.
- Perform nondestructive evaluations.
- Perform engineering review and quality check of the data.
- Prepare reports and data packages from data per customer requirements.

Subelement EA – Orion Launch Abort Systems (closed in Rev 17: moved to 34-000002-ED)

- Support the development of fracture control requirements.
- Provide analytical details support.
- Perform engineering review and data reduction.
- Prepare reports and data packages from data per customer requirements.
- Assist in planning of future DTA activities.

# ESTS Contract Task Order Request Performance Plan

Task Order Title: [Damage Tolerance Assessment Branch](#)

Task Order Number: [34-020002](#) Revision: 18

Category	Weighting Technical %	End of Period Technical Score
<b>Technical Objectives</b>	60%	X <u>60%</u> = <u>0.00</u> <b>Justification</b>
Provide engineering and technical support to the Damage Tolerance Assessment Branch. Perform advanced fracture analyses using appropriate fracture modeling applications. Provide nondestructive evaluation support including, but not limited to, shearography, ultrasound, eddy current, radiography, and fluorescent penetrant inspections. Operate the nondestructive evaluation equipment.		
<b>Schedule Objectives (Milestones)</b>	<u>15%</u> (min 10%)	X <u>15%</u> = <u>0.00</u> <b>Justification</b>
A majority of the work performed is real time support and is negotiated at the time of receipt. Provide deliverables on or before the negotiated date, which may need to be renegotiated due to changing priorities or scope of work.		
<b>Cost (actual vs. negotiated)</b>	<u>25%</u> (min.25%)	X <u>25%</u> = <u>0.00</u> <b>Justification</b>
	<b>Weighting Total %</b>	<b>Total Score</b>
	100.00%	<b>0.00</b>

## 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: [Damage Tolerance Assessment Branch](#)

Task Order Number: [34-020002](#)      Revision: [18](#)

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**Comments:**

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**Risk Assessment**

**Contract Number:** NNM05AB50C  
**TO Title:** Damage Tolerance Assessment Branch  
**TO Number:** 34-020002 **Revision:** 18

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

**MSFC Initiator:** Wayne Gamwell

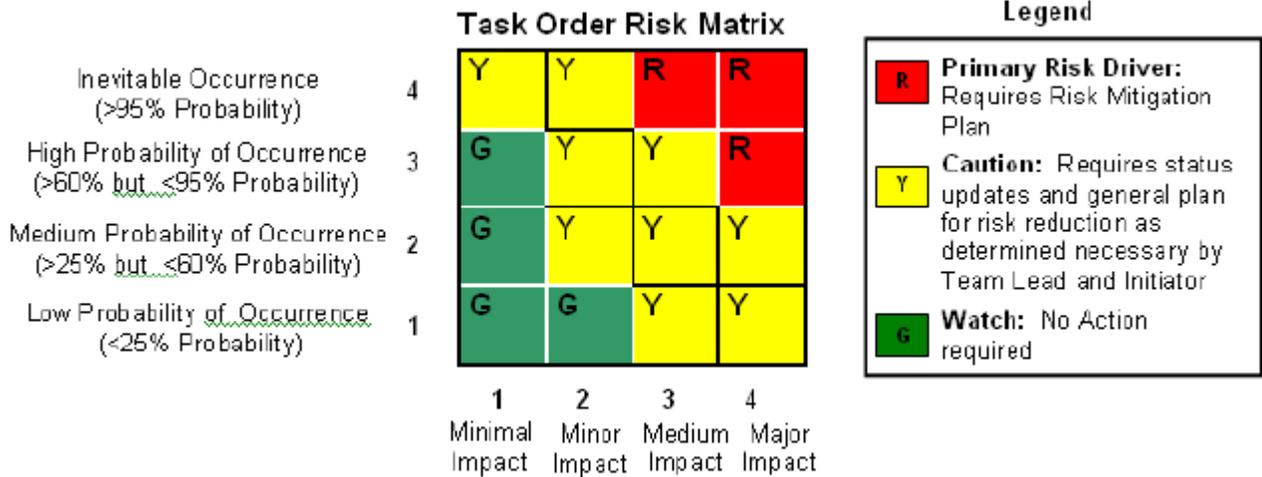
(b)(4)

**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.

<b>Risk</b>	<b>Risk Type</b>	<b>Probability (1-4)</b>	<b>Impact (1-4)</b>	<b>Risk Description</b>
Risk C1	Cost	2	1	There is a risk that the subtask cost estimate will increase due to unanticipated overtime
Risk C2	Cost	1	1	There is a risk that the subtask cost estimate will increase due to unanticipated material and ODC charges
Risk T1	Technical	1	2	Inadequate finite element modeling or review of documents
Risk T2	Technical	1	2	Potential for receiving incorrect data or information
Risk T3	Technical	2	3	There is a risk that with the current funding apparatus that needed skills will be lost. In the case of an effort to solve a critical problem, this may render resolution impossible.
Risk S1	Schedule	1	2	Unable to complete tests or analysis by due date
Risk S2	Schedule	1	2	Limited resource allocations may cause slippage of subtasks completion and schedule delay
Risk S3	Schedule	2	3	There is a risk that with the current funding apparatus that needed skills will be lost. In the case of an emergency effort to solve a critical problem, this will delay resolution.

\*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

The following tables provide a Risk Mitigation Plan for those risks identified on page 1 as "Primary Risk Drivers".

<b>Risk No.: C1</b>		
<b>Risk Description: There is a risk that the subtask cost estimate will increase due to unanticipated overtime</b>		
Mitigation Step No.	Planned Completion Date	Mitigation Step Description
1	Upon becoming aware of the increase	verify the need
2	Upon verification	Communicate the issues and needs to the customer as quickly as possible

<b>Risk No.: T1</b>		
<b>Risk Description: Inadequate finite element modeling or review of documents</b>		
Mitigation Step No.	Planned Completion Date	Mitigation Step Description
	Prior to delivery to customer	Follow evaluation process in PQP.

<b>Risk No.: T2</b>		
<b>Risk Description: Potential for receiving incorrect data or information</b>		
Mitigation Step No.	Planned Completion Date	Mitigation Step Description
	After receipt of Information	Review information for reasonableness or request verification.
<b>Risk No.: T3</b>		
<b>Risk Description: There is a risk that with the current funding apparatus that needed skills will be lost. In the case of an effort to solve a critical problem, this may render resolution impossible.</b>		
Mitigation Step No.	Planned Completion Date	Mitigation Step Description
1	Prior to layoff	Conduct a critical review of skill set needs

<b>Risk No.: T2</b>		
<b>Risk Description: Potential for receiving incorrect data or information</b>		
2	Prior to layoff	Identify funding sources to maintain talents in-place, or alternately, identify another mechanism to resolve the technical problems often encountered.

<b>Risk No.: S1</b>		
<b>Risk Description: Unable to complete tests or analysis by due date</b>		
<b>Mitigation Step No.</b>	<b>Planned Completion Date</b>	<b>Mitigation Step Description</b>
1	Upon becoming aware of the schedule concern	verify the concern
2	upon verification	inform the customer
3	upon completion of customer information	establish corrective course, mitigation, or new understanding of schedule

<b>Risk No.: S3</b>		
<b>Risk Description: There is a risk that with the current funding apparatus that needed skills will be lost. In the case of an emergency effort to solve a critical problem, this will delay resolution.</b>		
<b>Mitigation Step No.</b>	<b>Planned Completion Date</b>	<b>Mitigation Step Description</b>
1	Prior to layoff	Conduct a critical review of skill set needs
2	Prior to layoff	Identify funding sources to maintain talents in-place, or alternately, identify another mechanism to resolve the technical problems often encountered.