

**Task Order Plan (TOP)**

**Contract Number:** NNM05AB50C  
**TO Title:** Life Support and Habitation Systems (LSHS)  
**TO Number:** 37-060203 **Revision:** 01

---

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

**MSFC Initiator:** Keith Parrish

(b)(4)  


---

**Emergency:** No

**Revision -01**

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. Subelement -04 no longer requires support and has been closed with this revision. Subelement -05 was administratively closed on July 3, 2010. Subelement -06 is being added with this revision to provide support for Sorbent Characterization. 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 programs listed in the table below:

Subelement	Previous Subelement	WBS	Program
01	01	780896.04.01.07.08	LSHS
02	02	780896.04.01.04.08	LSHS
03	03	780896.04.02.06.08	LSHS
06		4444543.02.06.03.01	LSHS

**Revision -00**

This Task Order (TO) is a continuation of work being performed on TO's 37-060101 and 37-020201 of the NNM05AB50C ESTS contract. This TO combines work performed previously in ES61 and ES22, and now supports ES62 within the ED organizational structure. 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. For Subcontracted efforts, this TO authorizes work for the same period. Additionally, the Schedule, Performance Plan and Risk Assessment reflect task activities for the new period of performance. This revision affects the following Science programs: (subelement -01) CO2 Removal Hardware and Systems, (subelement -02) CO2 Reduction Hardware and Systems, (subelement -03) Water Recovery Hardware and Systems, (subelement -04) ELS High Pressure Oxygen Support, and (subelement -05) Constellation ECLSS/Thermal Systems Integration Group (SIG) Support. The active subelements are now:

Sub-element Mapping and WBS funding:

New Subelement	Previous Subelement(s)	WBS
37-060203-01	37-060101-01 37-020201-00	439906.04.01.06.01.03

37-060203-02	37-060101-02	439906.04.01.06.04.05
37-060203-03	37-060101-03	439906.04.02.06.03.05 439906.04.02.06.04.01
37-060203-04	37-020201-04	439906.04.01.06.05.03
37-060203-05	37-020201-05	604746.02.06.05

## 1.0 Task Order Description & Objectives

The objectives of this TO are to provide systems and test engineering support for Life Support and Habitation Systems (LSHS) including, but not limited to:

Subelement 01: Atmosphere Revitalization Systems (ARS)

Subelement 02: ARS Resource Recovery and Recycling

Subelement 03: Water Recovery Systems

Subelement 04: ELS High Pressure Oxygen Support (*This subelement was closed under revision -01.*)

Subelement 05: Constellation ECLSS/Thermal SIG Support (*Administratively closed on July 3, 2010.*)

Subelement 06: Sorbent Characterization

Support includes system engineering, design, analysis, testing of development LSHS systems, material/procurement tracking, system verification, build-up of simulators, procedure writing, participation in LSHS meetings and design reviews, operation of the chemistry laboratory, operation of the machine shop and other manufacturing equipment within Building 4755 and Building 4754, and other engineering and technician functions as needed to accomplish the successful testing and operation of the LSHS test facility.

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

Systems and test engineering support for LSHS will be provided and tracked as described in the following four subelements:

Subelement -01: Systems and test engineering support for ARS development include: system engineering; design, development, testing, and analysis of ARS hardware and software systems; modeling of chemical processes and fluid mechanics; performing trade studies among competing technologies; identifying and resolving process technology design issues; defining test requirements; reducing, analyzing, correlating data and documenting findings; serve as the Principle Investigator (PI) for Engineered Structured Sorbent and subscale sorbent characterization testing; material/procurement tracking; system verification; build-up of simulators; procedure writing; participation in ARS meetings and design reviews; operation of the chemistry laboratory in support of quantifying test data/samples; operation of the machine shop and other manufacturing equipment within buildings 4754 and 4755; and provide other engineering and technical functions as needed to accomplish the successful testing and operations of the ARS test facilities. Required inputs for this subelement include system and test requirement information as well as timely delivery of test and support hardware and software.

Subelement-02: Systems and test engineering support for ARS Resource Recovery and Recycling development include: system engineering; development and testing of ARS Resource Recovery and Recycling hardware and software systems; material/procurement tracking; system verification; build-up of simulators; procedure writing; participation in ARS Resource Recovery and Recycling meetings and design reviews; operation of the chemistry laboratory in support of quantifying test data/samples; operation of the machine shop and other manufacturing equipment within buildings 4754 and 4755; and provide other engineering and technical functions as needed to accomplish the successful testing and operations of the ARS Resource Recovery and Recycling test facilities. Required inputs for this subelement include system and test requirement information as well as timely delivery of test and support hardware and software.

Subelement -03: Systems and test engineering support for Water Recovery Systems development include: system engineering; development and testing of Water Recovery hardware and software sys-

tems; analyzing the performance of custom and commercial catalysts; reducing, analyzing, correlating data, and documenting findings; material/procurement tracking; system verification; build-up of simulators; procedure writing; participation in Water Recovery Systems meetings and design reviews; operation of the chemistry laboratory in support of quantifying test data/samples; operation of the machine shop and other manufacturing equipment within buildings 4754 and 4755; and provide other engineering and technical functions as needed to accomplish the successful testing and operations of the Water Recovery Systems test facilities. Required inputs for this subelement include system and test requirement information as well as timely delivery of test and support hardware and software.

Subelement -06: Systems and test engineering support for Sorbent Characterization development include: evaluating various commercial and specialty sorbent materials, and applying data toward the development of next generation atmosphere revitalization gas separation technologies for future manned space missions; develop and execute bench level breakthrough and cyclic tests to characterize/compare various sorbents and obtain fundamental data to support numerical modeling; design, fabricate and assemble test articles; determine the benefits and drawbacks of using structured sorbents, and sorbent coated substrates in lieu of standard packed sorbents; define potential applications for specific sorbents based on observed data; develop system level mass/power/volume estimates for proposed applications; support sorbent process model development using COMSOL, MATLAB and other software; validate model predictions with test data.

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

To accomplish the objectives of this TO a diverse and comprehensive skill mix is required. The team will consist of chemists, electrical, mechanical, and chemical engineers, and electrical and mechanical technicians.

### **4.0 Special Tools Required**

None.

### **5.0 Participating Subcontractors**

The following companies will contribute toward accomplishing the objectives of this TO:

(b)(4)

### **6.0 Milestones & Deliverables**

Subelement-01 – Milestones and deliverables in support of ARS to include development hardware, test support hardware and software, test plans, test procedures, test reports, input to the Monthly Activity Report (MAR), and trip reports.

Subelement-02 – Milestones and deliverables in support of ARS Resource Recovery and Recycling to include development hardware, test support hardware and software, test plans, test procedures, test reports, input to the MAR and trip reports.

Subelement-03 – Milestones and deliverables in support of Water Recovery Systems to include development hardware, test support hardware and software, test plans, test procedures, test reports, input to the MAR and trip reports.

Subelement -06: Milestones and deliverables in support of Sorbent Characterization to include development hardware, test support hardware and software, test plans, test procedures, test reports, input to the MAR and trip reports.

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

A (b)(4) is included in Subelement -01 to cover the estimated cost for participation at the International Conference on Environmental Systems (ICES). A (b)(4) is included in Subelement -02 to cover the anticipated cost of Personal Protective Equipment (PPE) needed by supporting team members.

### **8.0 Work Shelf**



# ESTS Contract Task Order Request Performance Plan

Task Order Title: [Life Support and Habitation Systems \(LSHS\)](#)

Task Order Number: [37-060203](#) Revision: 01

Category	Weighting Technical %	End of Period Technical Score
<b>Technical Objectives</b>	65%	X <u>65%</u> = <b>Justification</b>
Engineering, Chemical Laboratory, and Technician Support of Life Support and Habitation Systems in the following areas:  Atmosphere Revitalization Systems (ARS) ARS Resource Recovery and Recycling Water Recovery Systems Sorbent Characterization		
<b>Schedule Objectives (Milestones)</b>	Weighting Schedule % <u>10%</u> (min 10%)	Schedule Score  X <u>10%</u> = <b>Justification</b>
Deliverables in support of Life Support and Habitation Systems in the following areas:  Atmosphere Revitalization Systems (ARS) ARS Resource Recovery and Recycling Water Recovery Systems Sorbent Characterization		
<b>Cost (actual vs. negotiated)</b>	Weighting Cost% <u>25%</u> (min.25%)	Cost Score  X <u>25%</u> = <b>Justification</b>
	Weighting Total % <u>100.00%</u>	<b>Total Score</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: [Life Support and Habitation Systems \(LSHS\)](#)

Task Order Number: [37-060203](#)      Revision: 01

---

**Comments:**

---

**Risk Assessment**

**Contract Number:** NNM05AB50C  
**TO Title:** Life Support and Habitation Systems (LSHS)  
**TO Number:** 37-060203 **Revision:** 01

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

**MSFC Initiator:** Keith Parrish

(b)(4)

**Task Order Risk Assessment to Cost, Technical, and Schedule**

List identified risk associated with Task Order performance as related to task cost, technical, and schedule. Classify the risk(s) according to probability of occurrence and impact as defined below and enter the risk into risk matrix.

Risk	Risk Type	Probability (1-4)	Impact (1-4)	Risk Description
Risk C1	Cost			No cost risks have been identified for this Task Order.
Risk C2	Cost			
Risk T1	Technical			No technical risks have been identified for this Task Order.
Risk T2	Technical			
Risk S1	Schedule			No schedule risks have been identified for this Task Order.
Risk S2	Schedule			

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



