

**Robotic Lunar Exploration Program
Lunar Reconnaissance Orbiter Project**

Battery Deliverable Items List and Schedule

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**Goddard Space Flight Center
Greenbelt, Maryland**

**National Aeronautics and
Space Administration**

CM FOREWORD

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LUNAR RECONNAISSANCE ORBITER PROJECT**DOCUMENT CHANGE RECORD**

Sheet: 1 of 1

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1.0 INTRODUCTION

This document is the Lunar Reconnaissance Orbiter (LRO) Battery Deliverable Items List and Schedule (DILS). This document provides specific information on the hardware and data deliverables for Battery.

1.1 PROPRIETARY DATA

Some of the content of documents may be of a proprietary nature to the document preparing/sending Party. In the event data is deemed to be proprietary, and for which protection is to be maintained, the sending Party shall mark the document with a notice to indicate that the data therein is proprietary and shall be used and disclosed by the receiving Party and its related entities (e.g., contractors and subcontractors) only for the purposes of fulfilling the receiving Party's responsibilities under the Lunar Reconnaissance Orbiter Project, and that the identified and marked technical data shall not be disclosed or retransferred to any other entity without prior written permission of the document preparer.

1.2 APPLICABLE DOCUMENTS

| | |
|-----------------|--|
| 431-SOW-000125 | Battery Statement of Work for the Lunar Reconnaissance Orbiter |
| 431-SPEC-000032 | Lunar Reconnaissance Orbiter Battery Performance Specification |

2.0 DELIVERABLE DOCUMENTATION

This section provides a tabular listing of documentation deliverables, including the following information:

Description: This provides the Title of the deliverable item.

Reference: This provides the reference back to the pertinent document calling out the deliverable.

Category:

A = Approval: Documents in this category require approval from the NASA GSFC CO. In general, documents shall be provided in contractor format as long as required content, as specified in the (431-SOW-000125), is addressed.

R= Review: Documents in this category do not require formal NASA GSFC CO approval. They must be received within a specified time period and are subject to evaluation. The NASA GSFC CO reserves the time-limited right of disapproval for each submission. The time-limited period is two weeks from receipt of documents.

I = Information: Documents in this category are informal and are for information only.

Quantity: This provides the required number of copies for the deliverable. All data is required to be submitted electronically. The number in the quantity column refers to the number of hard copies required.

Delivery Date: This provides the fixed or relative date or time that the deliverable is required.

2.1 HARDWARE DELIVERABLES AND SCHEDULE

| Item # | Description | Reference | Quantity | Delivery Date |
|---------------|------------------------------|------------------|---|---|
| 1 | Test Battery | SOW Section 4.1 | 1 | Twelve (12) months after contract award |
| 2 | Qualification Battery | SOW Section 4.1 | 1 | Sixteen (16) months after contract award |
| 3 | Flight Batteries | SOW Section 4.1 | 2 | Twenty-four (24) months after contract award |
| 4 | Spare Cells | SOW Section 4.1 | 12 | with Item #1, 2, 3 (Deliver 2 cells with Test, 2 cells with Qualification, and remaining 8 cells with Flight Batteries) |
| 5 | Cell and Battery Components | SOW Section 4.1 | 2 sets | Twenty-four (24) months after contract award |
| 6 | Connector Savers | SOW Section 4.2 | 1 for every external connector | with Item #1, 2, 3 |
| 7 | ESD Caps | SOW Section 4.3 | 1 for every external connector; 1 closeout cap for every test connector | with Item #1, 2, 3 |
| 8 | Shipping Containers | SOW Section 4.4 | 2 | with Item #1 |
| 9 | Lifting Harness | SOW Section 4.4 | 1 | with Item #1 |
| 10 | Mounting Hole Drill Template | SOW Section 4.4 | 1 | Two (2) months after Battery Design Review |

2.2 DATA DELIVERY DOCUMENTATION AND SCHEDULE

| Item # | Description | Reference | Category | Quantity | Delivery Date |
|--------|--|----------------------|----------|----------|--|
| 1 | Monthly Status Report (MSR) | SOW Section 2.1 | I | 1 | Ten (10) calendar days following the month being reported. |
| 2 | Monthly Financial Reports (533M) | SOW Section 2.1 | I | 1 | Ten (10) calendar days after close of previous month. |
| 3 | Quarterly Financial Reports (533Q) | SOW Section 2.1 | I | 1 | Fifteen (15) calendar days after start of each quarter. |
| 4 | Cell Design Review | SOW Section 2.3.1 | A | 1 | Four (4) weeks after contract award |
| 5 | Cell Design Review Report | SOW Section 2.3.1 | R | 5 | Ten (10) calendar days after completion of Cell Design Review |
| 6 | Test and Qualification Battery Cell Buyoff Review | SOW Section 2.3.2 | A | 1 | Seven (7) months after contract award |
| 7 | Test and Qualification Battery Cell Buyoff Review Report | SOW Section 2.3.2 | R | 5 | Ten (10) calendar days after completion of Test and Qualification Cell Buyoff Review |
| 8 | Flight Battery Cell Buyoff Review | SOW Section 2.3.2 | A | 1 | Fifteen (15) months after contract award |
| 9 | Flight Battery Cell Buyoff Review Report | SOW Section 2.3.2 | R | 5 | Ten (10) calendar days after completion of Flight Battery Cell Buyoff Review |
| 10 | Battery Design Review (BDR) | SOW Section 2.3.3 | A | 1 | Five (5) months after contract award |
| 11 | Battery Design Review Report | SOW Section 2.3.3 | R | 5 | Ten (10) calendar days after completion of BDR |
| 12 | Pre-Environmental Review (PER) – Test Battery | SOW Section 2.3.4 | A | 5 | Fifteen (15) calendar days before start of environmental testing on Battery |
| 13 | PER – Qualification Battery | SOW Section 2.3.4 | A | 5 | Fifteen (15) calendar days before start of environmental testing on Battery |

| Item # | Description | Reference | Category | Quantity | Delivery Date |
|--------|---|----------------------|----------|----------|---|
| 14 | PER – Flight Batteries | SOW Section 2.3.4 | A | 5 | Fifteen (15) calendar days before start of environmental testing on first Flight Unit |
| 15 | Battery Buyoff Review (BBR) – Test Battery | SOW Section 2.3.5 | A | 5 | Fifteen (15) calendar days prior to delivery of Battery |
| 16 | Pre-Shipment Review (PSR) – Test Battery | SOW Section 2.3.6 | A | 5 | Five (5) calendar days prior to delivery of Battery |
| 17 | PSR – Qualification Battery | SOW Section 2.3.6 | A | 5 | Five (5) calendar days prior to delivery of Battery |
| 18 | PSR – Flight Batteries | SOW Section 2.3.6 | A | 5 | Five (5) calendar days prior to delivery of each Flight Unit |
| 19 | Interface Control Documents (ICD) | SOW Section 3.2.1 | A | 3 | Fifteen (15) calendar days before BDR |
| 20 | Drawing Package | SOW Section 3.2.2 | A | 3 | Fifteen (15) calendar days before BDR |
| 21 | BDR Presentation Package | SOW Section 3.2.3 | I | 5 | Fifteen (15) calendar before BDR |
| 22 | Data Delivery Package (End Item Data Package) – Test Battery | SOW Section 3.2.6 | R | 5 | Delivered with Battery |
| 23 | Data Delivery Package (End Item Data Package) – Qualification Battery | SOW Section 3.2.6 | R | 5 | Delivered with Battery |
| 24 | Data Delivery Package (End Item Data Package) – Flight Batteries | SOW Section 3.2.6 | R | 5 | Delivered with Battery |
| 25 | Verification Test Plan – Qualification Test Plan | SOW Section 3.2.7 | A | 5 | Fifteen (15) calendar days before BDR |
| 26 | Verification Test Plan – Acceptance Test Plan | SOW Section 3.2.7 | A | 5 | Fifteen (15) calendar days before BDR |
| 27 | Thermal Analysis | SOW Section 3.3 | R | 2 | Fifteen (15) calendar days before BDR |

| Item # | Description | Reference | Category | Quantity | Delivery Date |
|--------|---|----------------------|----------|----------|---|
| 28 | Thermal Model | SOW Section 3.3 | I | 1 | Fifteen (15) calendar days before BDR |
| 29 | Structural Analysis | SOW Section 3.4 | R | 2 | Fifteen (15) calendar days before BDR |
| 30 | Quality Assurance Plan | SOW Section 5.1.1 | A | 5 | Twenty-eight (28) calendar days after contract award |
| 31 | Class I CM Changes | SOW Section 5.1.3 | A | 2 | Five (5) calendar days after Contractor CM review |
| 32 | Class II CM Changes | SOW Section 5.1.3 | R | 2 | Five (5) calendar days after Contractor CM review |
| 33 | Failure Reports | SOW Section 5.1.4 | A | 2 | Five (5) calendar days after Contractor Failure Review Process determines disposition |
| 34 | Failure Mode and Effects Analysis (FMEA) | SOW Section 5.3.1 | R | 2 | Fifteen (15) calendar days before BDR |
| 35 | Parts Stress Analysis Criteria (if different from EEE-INST-002) | SOW Section 5.3.2 | A | 2 | Twenty-eight (28) calendar days after contract award |
| 36 | Parts Stress Analysis | SOW Section 5.3.2 | R | 2 | Ten (10) calendar days before BDR |
| 37 | Worst Case Circuit Analysis | SOW Section 5.3.3 | R | 2 | Fifteen (15) calendar days before BDR |
| 38 | Reliability Prediction | SOW Section 5.3 | I | 2 | Fifteen (15) calendar days before BDR |
| 39 | Trend Parameter List –Test Battery | SOW Section 5.5.2 | R | 3 | Fifteen (15) calendar days prior to PER |
| 40 | Trend Parameter List – Qualification Battery | SOW Section 5.5.2 | R | 3 | Fifteen (15) calendar days prior to PER |
| 41 | Trend Parameter List – Flight Batteries | SOW Section 5.5.2 | R | 3 | Fifteen (15) calendar days prior to PER |

| Item # | Description | Reference | Category | Quantity | Delivery Date |
|--------|---|------------------------|----------|-----------------------|--|
| 42 | Test and Trend Analysis Reports – Test Battery | SOW Section 5.5.2 | I | 5 | Delivered at BBR, quarterly status reports, & Delivered at PSR |
| 43 | Test and Trend Analysis Reports – Qualification Battery | SOW Section 5.5.2 | I | 5 | Delivered at PSR |
| 44 | Test and Trend Analysis Reports – Flight Batteries | SOW Section 5.5.2 | I | 5 | Delivered at PSR |
| 45 | Printed Wiring Board (PWB) Coupons (If Applicable) | SOW Section 5.6.5.1 | A | 1 Coupon per board | Deliver Twenty-one (21) calendar days before start of PWB Assembly |
| 46 | Advanced Packaging Technology Requirements Documentation (If Applicable) | SOW Section 5.6.5.3 | A | 2 | Twenty-eight (28) calendar days after contract award |
| 47 | Parts Identification List | SOW Section 5.7.1 | A | 5 | Fifteen (15) calendar days before BDR |
| 49 | Documentation on Custom Devices (If Applicable) | SOW Section 5.7.2 | A | 2 | Twenty-eight (28) calendar days after contract award |
| 50 | Plastic Encapsulated Microcircuit (PEM) Specification Documents (If Applicable) | SOW Section 5.7.3 | A | 2 | Twenty-eight (28) calendar days after contract award |
| 51 | Radiation Test Plans (If Applicable) | SOW Section 5.7.4 | A | 2 | Plans submitted thirty (30) calendar days prior to test. Returned with comments within fifteen (15) calendar days. |
| 52 | Radiation Test Reports (If Applicable) | SOW Section 5.7.4 | I | 2 | Ten (10) calendar days after test |
| 53 | Recertification Plans for Parts >5Yrs (If Applicable) | SOW Section 5.7.5 | A | 2 | Fifteen (15) calendar days before BDR |
| 54 | As-Built Parts List –Test Battery | SOW Section 3.2.6 | R | 1 | Due at BBR & Due at PSR |
| 55 | As-Built Parts List – Qualification Battery | SOW Section 3.2.6 | R | 1 | Due at PSR |
| 56 | As-Built Parts List – Flight Batteries | SOW Section 3.2.6 | R | 1 | Due at PSR |

| Item # | Description | Reference | Category | Quantity | Delivery Date |
|--------|---|----------------------|----------|----------|--|
| 57 | Alert/Advisory Disposition and Preparation | SOW Section 5.7.6 | R | 2 | Due 3 working days after Contractor disposition |
| 58 | Materials Identification List | SOW Section 5.8.1 | A | 5 | Fifteen (15) calendar days before BDR |
| 59 | As-Built Materials List –Test Battery | SOW Section 5.8.1 | R | 1 | Due at Five (5) calendar days prior to BBR & Due at Five (5) calendar days prior to PSR |
| 60 | As-Built Materials List – Qualification Battery | SOW Section 5.8.1 | R | 1 | Due at Five (5) calendar days prior to PSR |
| 61 | As-Built Materials List – Flight Batteries | SOW Section 5.8.1 | R | 1 | Due at Five (5) calendar days prior to PSR |
| 62 | Materials Usage Agreement | SOW Section 5.8.2 | A | 2 | Fifteen (15) calendar days before BDR |
| 63 | Limited-Life Items List | SOW Section 5.3.4 | A | 2 | Fifteen (15) calendar days before BDR |
| 64 | Shipping Container Design | SOW Section 7.0 | A | 1 | Fifteen (15) days prior to delivery of first Battery |

Appendix A. Abbreviations and Acronyms

| Abbreviation/ Acronym | DEFINITION |
|----------------------------------|--|
| A | Analysis |
| ABML | As-Built Materials List |
| ANSI | American National Standards Institute |
| ASIC | Applied Specific Integrated Circuit |
| ASQ | American Society for Quality |
| ASTM | American Society for Testing and Materials |
| BBR | Battery Buy-Off Review |
| BDR | Battery Design Review |
| BGA | Ball Grid Arrays |
| CBR | Cell Buy-Off Review |
| CCB | Configuration Control Board |
| CCR | Configuration Change Request |
| CGA | Column-grid Arrays |
| CM | Configuration Management |
| CMO | Configuration Management Office |
| COTR | Contracting Officer's Technical Representative |
| CVCM | Collected Volatile Condensable Mass |
| °C | Degrees Centigrade |
| DPA | Destructive Physical Analysis |
| EEE | Electrical, Electronic, and Electromechanical |
| EIDP | End Item Data Package |
| EMI | Electromagnetic Interference |
| ESD | Electrostatic Discharge |
| F.O.B | Freight-On-Board |
| FMEA | Failure Modes Effects Analysis |
| FRB | Failure Review Board |
| GIDEP | Government Industry Data Exchange Program |
| GSE | Ground Support Equipment |
| GSFC | Goddard Space Flight Center |
| I | Inspection |
| I&T | Integration and Test |
| INST | Instrument |
| IPC | Interconnecting and Packaging of Electronic Circuits |
| ISO | International Standards Organization |
| LRO | Lunar Reconnaissance Orbiter |
| MCD | Manufacturing Control Document |
| MCM | Multi-Chip Modules |
| MIL | Military |
| MIPS | Mandatory Inspection Points |
| MRB | Material Review Board |

| Abbreviation/ Acronym | DEFINITION |
|----------------------------------|--|
| MSFC | Marshall Space Flight Center |
| MUA | Material Usage Agreement |
| NASA | National Aeronautics and Space Administration |
| PEM | Plastic Encapsulated Microcircuits |
| PER | Pre-Environmental Review |
| PG | Procedure and Guidelines |
| PIND | Particle Impact Noise Detection |
| PWB | Printed Wiring Board |
| QA | Quality Assurance |
| R&I | Receive and Inspection |
| RLEP | Robotic Lunar Exploration Program |
| SCC | Stress Corrosion Cracking |
| SEE | Single-Event Effect |
| SINDA | Systems Improved Numerical Differencing Analyzer |
| SMT | Surface Mount Technology |
| SOW | Statement of Work |
| SPEC | Specification |
| STD | Standard |
| T | Test |
| TID | Total Ionizing Dose |
| TIM | Technical Interchange Meeting |
| TML | Total Mass Loss |