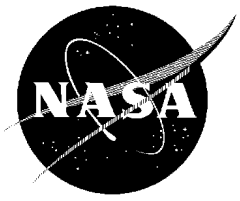
Non-Recoverable Cargo (Trash/Waste) Management Plan

International Space Station Program

Baseline

DECEMBER 2000

National Aeronautics and Space Administration
International Space Station Program
Johnson Space Center
Houston, Texas



REVISION AND HISTORY PAGE

REV.	DESCRIPTION	PUB. DATE
-	Initial Release (Reference per SSCD XXXXXX, EFF. XX-XX-XX)	XX-XX-XX

INTERNATIONAL SPACE STATION PROGRAM

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DECEMBER 2000

MIOCB APPROVAL NOTICE

INTERNATIONAL SPACE STATION PROGRAM

NON-RECOVERABLE CARGO (TRASH/WASTE) MANAGEMENT PLAN

DECEMBER 2000

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MIOCB APPROVAL NOTICE

INTERNATIONAL SPACE STATION PROGRAM

NON-RECOVERABLE CARGO (TRASH/WASTE) MANAGEMENT PLAN

DECEMBER 2000

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INTERNATIONAL SPACE STATION PROGRAM

NON-RECOVERABLE CARGO (TRASH/WASTE) MANAGEMENT PLAN

LIST OF CHANGES

DECEMBER 2000

All changes to paragraphs, tables, and figures in this document are shown below:

MIOCB	Entry Date	Change	Paragraph(s)

TABLE OF CONTENTS

INTRODUCTION

1.1 PURPOSE

This document provides a single source for all requirements, constraints, and groundrules, International Partner (IP) agreements, and top-level planning applicable to trash/waste management for the entire International Space Station (ISS).

The ISS Program shall provide accommodations and capabilities for the pre-flight, flight, on-orbit and return to earth of trash, waste, and non-recoverable materials in order to ensure the safety and health of both flight crew and ground operations personnel.

1.2 SCOPE

All ISS planning products for trash/waste management will be derived from the contents herein.

1.3 PRECEDENCE

If there are any discrepancies between the information contained in this document and ISS requirements as defined in the parent documents from which this information has been drawn, the parent documents take precedence.

1.4 DELEGATION OF AUTHORITY

The Non-Recoverable Cargo (Trash/Waste) Management Plan is the responsibility of the Mission Integration and Operations Control Board (MIOCB) and is subject to the ISS Program change control process. This process is defined in SSP 41170, Configuration Management Requirements.

1.5 WAIVER/DEVIATION

The instructions for waiver/deviation is contained in SSP 41170, Configuration Management, Section 3.4.1.7 and Section 3.4.3.

1.6 ISSUES AND OPEN WORK

Open work is identified by a **"<TBD x.x>**" in the text. Unresolved issues are identified by a **"<TBR x.x>**" in the text. Appendix D, Table D-1, captures all of the To Be Determined (TBD) and To Be Resolved (TBR) items associated with this document. Once the TBD or TBR information is defined and approved, the correct text is to be inserted in place of the TBD or TBR in the document.

2.0 DOCUMENTS

2.1 APPLICABLE DOCUMENTS

The following documents include requirements, specifications, models, standards, guidelines, handbooks, and other special publications applicable to this document. The current issue of the following documents is identified in the Program Automated Library System (PALS) (http://issa-www.jsc.nasa.gov/cgi-bin/dsql+/ORAP?-h+palshome).

The documents listed in this paragraph are applicable to the extent specified herein. Inclusion of applicable documents herein does not in any way supersede the order of precedence identified in Paragraph 1.3 of this document.

SSP 30233	Space Station Requirements for Materials and Processes
SSP 30575	Space Station Interior and Exterior Operational Location Coding System
SSP 30599	Safety Review Process
SSP 41000	System Specification for the International Space Station
SSP 41161	Segment Specification for the United States Ground Segment
SSP 41162	Segment Specification for the United States On-Orbit
SSP 41163	Russian Segment Specification
SSP 41170	Configuration Management
SSP 50004	Ground Support Equipment Design Requirement
SSP 50005	International Space Station Flight Crew Integration Standard (NASA-STD-3000/T)
SSP 50006	International Space Station Internal & External Decals & Placards Specification
SSP 50007	Space Station Inventory Management System Label Specification
SSP 50011	Concept of Operation and Utilization
SSP 50014	International Space Station Utility Coding Specification
SSP 50021	Safety Requirements Document
SSP 50094	NASA/RSA Joint Specifications/Standards Document for the ISS Russian Segment
SSP 50200-02	Station Program Implementation Plan, Volume 2: Program Planning and Manifesting
SSP 50200-03	Station Program Implementation Plan, Volume 3: Cargo Analytical Integration
SSP 50200-05	Station Program Implementation Plan, Volume 5, Logistics and Maintenance

SSP 50200-06	Station Program Implementation Plan, Volume 6: Cargo Physical Processing
SSP 50260	International Space Station Medical Operations Requirements Document (ISS MORD)
SSP 50261-01	Generic Groundrules, Requirements, and Constraints Part 1: Strategic and Tactical Planning
SSP 50480	ISS Joint Medical Operations Implementation Plan (JMOIP)
SSP 54500	International Ground System Specification Document
No Number	Memorandum of Agreement Between International Space Station Program and Space Shuttle Program

2.2 REFERENCE DOCUMENTS

The following documents contain supplemental information to guide the user in the application of this document. These reference documents may or may not be specifically cited within the text of this document.

NSTS 1700.7B	Safety Policy and Requirements for Payloads Using the Space Transportation System
NSTS 1700.7B /ISS Addendum	Safety Policy and Requirements for Payloads Using the International Space Station
NSTS/ISS 13830	Payload Safety Review and Data Submittal Requirements For Payloads Using the: Space Shuttle – International Space Station
NSTS/ISS 18798	Interpretations of NSTS/ISS Payload Safety Requirements
KHB 1700.7	Space Shuttle Payload Ground Safety Handbook
KHB 1710.2	Kennedy Space Center Safety Practices Handbook
K-SS-09.5.3	ISS KSC Resupply and Return Cargo Ground Processing Plan
KHB 8800.7	Waste Management Handbook
KHB 1860.1	KSC Ionizing Radiation Protection Program
KHB 1870.1	KSC Sanitation Handbook
KHB 1040.1	KSC Comprehensive Emergency Preparedness Plan
JSC 26895	Guidelines for Assessing the Toxic Hazard of Spacecraft Chemicals and Test Materials

3.0 DEFINITIONS, CATEGORIES AND CLASSIFICATIONS

3.1 NON-RECOVERABLE CARGO

Non-recoverable cargo is comprised of trash and waste which is to be removed from the ISS and which is not required to be returned for any purpose. Non-recoverable cargo shall be accommodated for removal in the transport or logistics vehicles after new cargo is transferred from them. Transport and logistics vehicles may be expendable vehicles that are destroyed upon re-entry or non-expendable vehicles that return to Earth.

3.1.1 TRASH

Trash consists principally of used or defective hardware, expired consumables, or payload generated items no longer required for use in the ISS and are not significant contributors to the decay of the habitable environment.

3.1.2 WASTE

Waste consists principally of chemicals, radioactive materials, batteries, sharps, and biologically/biomedically active products and consumables of no further use

to the ISS crew and not required to be returned. In order to maintain a hygienic environment, waste and associated by-products should not be left on-board longer than necessary. Waste shall not be stowed in the principle crew living and working area as defined in SSP 50261-01, Generic Groundrules, Requirements, and Constraints.

Waste that has unique handling and disposal requirements per NASA, International, Federal, State, or Local regulations, and which has the potential to do physical harm to personnel, hardware or the environment is considered to be hazardous in nature and must be handled in accordance with review and certification by the appropriate safety review panel. Appropriate handling may include specialized containment, storage, transportation, isolation, stabilization and/or labeling.

3.1.3 PROHIBITION AGAINST 'CONTROLLED MATERIALS AS NON-RECOVERABLE CARGO

Controlled materials, including 'protected' documentation or controlled substances such as certain pharmaceuticals or proprietary experimental products, are considered to be return items that must be returned through different processes from the non-recoverable cargo return processes.

3.2 TRASH AND WASTE GENERATION RATE

For the purpose of planning and analysis, the trash/waste generation rate of 2.6 cubic feet per day shall be used for a crew of three.

3.3 INTEGRATED ASSESSMENTS

3.3.1 GENERATION/ALLOCATION ASSESSMENT

The Generation Allocation Assessment evaluates resource requirements vs defined allocations based on the data provided in the Trash/Waste Manifest Questionnaire. This assessment will determine whether the planned trash/waste generation of new requirements will fall within or exceed the approved total allocation. This assessment shall track available resources and trash/waste generation throughout the on-orbit phase.

3.3.2 HARDWARE SUPPLY ASSESSMENT

The Hardware Supply Assessment shall ensure an adequate supply of nominal and contingency trash/waste hardware, thus assuring habitability and protection of the on-orbit environment.

3.4 TRASH AND WASTE SOURCES

Sources of ISS non-recoverable cargo include:

- Flight crew and crew provisions
- Systems and subsystems
- Station Detailed Test Objectives (SDTO)
- Payloads and utilization
- Flight operations tools

3.5 TRASH/WASTE CLASSIFICATION FOR RETURN TO EARTH

Trash and Waste is classified for return to Earth in accordance with the following nomenclature.

TRASH/WASTE CATEGORY	CLASS CODE	TRASH/WASTE DEFINITIONS
Batteries	BA	All types of batteries (i.e. Ni-Cad, Alkaline)
Biological Biomedical	BB	Any solid or liquid that may present a threat of infection to humans, including non-liquid tissue, body parts, blood, blood products, body fluids, and laboratory wastes that contain human disease-causing agents. Also to include used absorbent material saturated with blood, blood products, body fluids, excretions, or secretions contaminated with visible blood or blood products that have dried.
Sharps	SH	Payload and crew-generated needles, syringes, or any intact or broken objects that are capable of puncturing, lacerating, or otherwise penetrating the skin (i.e., glass, scalpels, hard broken plastic, syringes, etc.).
Chemical Hazardous	CH	Any trash of a solid, liquid, or semi-solid form contaminated with a chemical substance that requires special handling during disposal.
Radioactive	RA	Solid, liquid, or gaseous materials that are radioactive or become radioactive and for which there is no further use.
Normal Refuse	NR	Any and all material that has been determined to be trash that does not meet any of the definitions above. For ground handling, Normal Refuse is that material which has been determined to be trash that does not meet any definitions and/or criteria of regulated wastes under any Federal, State, or Local agencies.

3.5.1 WET NORMAL REFUSE

Untreated wet normal refuse is considered potentially hazardous. Based upon the results of tests and evaluations conducted in support of NASA manned space flights, the following potential hazards are shown in the table 3.3.1:

TABLE 3.3.1 RESULTS OF HAZARD ANALYSIS OF THE EVALUATION TEST, ADAPTED FROM STS-35 TRASH EVALUATION FINAL REPORT, JSC-SP-90-2, DECEMBER, 1990

HAZARDOUS CONDITION	CAUSE	EFFECT	ASSESSMENT*	CONTROL

Eye Irritation	Offgassing fumes	Personal Injury	III/C	Personnel wear eye goggles
Skin Irritation	Contact	Personal Injury	III/B	Personnel wear protective gl and other equipment as requ
Noxious odors	Fermentation and decay	Personal discomfort	IV/A	Personnel wear carbon-filtra masks

* Risk assessment code per NSTS 22254, Methodology for Conduct of Space Shuttle Program Hazard Analyses:
III: Marginal, IV: Negligible
A: Frequent, B: Probable, C: Occasional

4.0 HARDWARE

The Joint Trash/Waste Hardware Catalog, SSPXXXX **<TBD 4-1>** shall identify all available hardware for use on ISS. This document shall contain data for users to identify hardware for use by a system/subsystem or payload and will facilitate the manifesting process with critical data.

4.1 PROGRAM PROVISION OF TRASH/WASTE STOWAGE DEVICES

Standard stowage devices shall be made available for on-orbit and return based upon manifest approval of systems and payloads. A pantry of standard trash/waste stowage devices is maintained by JSC-OC/Logistics and Maintenance. The pantry of standard trash/waste stowage devices shall accommodate both planned and off-nominal operations.

4.2 NON-STANDARD CONTAINMENT

Trash/waste that is incompatible with standard ISS trash/waste management containers shall be contained in special handling devices that shall be provided by the system/payload manager responsible for the system/payload that generates the trash/waste. These containers shall then be incorporated into the standard ISS complement for future users.

5.0 US FUNCTIONS

4.3 TRASH/WASTE INTEGRATION GROUP

The Trash/Waste Integration Group (TWIG) defines the overall policy for trash and waste management on the ISS. It works with all systems/payloads that generate trash to define a coherent and viable plan to ensure acceptable habitability on ISS. This team is the focus for discussion of all trash/waste issues for the ISS Program and coordinates with the International Partners such that a single plan is implemented.

4.4 STOWAGE INTEGRATION GROUP

The Stowage Integration Group manages overall stowage policy on the ISS. They maintain cognizance of the on-orbit configuration to plan for stowage of new hardware and supplies.

The SI function is responsible for integrating trash/waste cargo into a lay-out plan incorporating applicable ISSP requirements, specific flight cargo manifests and cargo engineering data, thus providing consistant crew interfaces, and optimized utilization of program allocated resources, such as volume, mass, and crew time (SSP50200-3, section 4.2.1.5).

4.5 SAFETY AND MISSION ASSURANCE

The ISS integrated on-bit safety process definition is responsibility of the NASA/OE Safety and Mission Assurance (S&MA) Panel. That process is identified in SPIP Volume 1, section 6.0.

4.5.1 GROUND

It is the responsibility of the organizations developing the hardware to perform the hazard analysis for the individual cargo items. Each hazard analysis shall include all applicable phases of the mission (pre-launch, launch, accent, on-orbit (transfer and in-place operations), descent, landing and post landing). The CI integrated safety function has no on-orbit safety responsibility for the cargo that will be transferred on-orbit from the Cargo Element and stowed on the ISS Vehicle. (SSP50200-03)

4.5.2 FLIGHT

The S&MA Operations Team is responsible for assuring ISS Safety – of – Flight (SOF) during all on-orbit operations, and simultaneously performs a segment level task of assuring the S&MA of the USOS elements. The scope of this support includes all ISS crew and integrated vehicle hardware/software in-flight and supporting ground systems

4.6 MANIFEST WORKING GROUP

The Manifest Working Group assesses requests for up and/or down manifest on US vehicles and reviews manifests submitted by IPs which define what hardware is being sent to or removed from ISS.

4.7 FLIGHT CONTROL TEAM

4.7.1 CREW SYSTEMS

The MOD crew systems team shall be responsible to train each Expedition crew for US trash hardware. During on-orbit operations, this team is on call for questions related to trash hardware and handling.

4.7.2 INTEGRATED STOWAGE OFFICER (ISO)

The MOD ISO team shall track stowage of the trash pantry and trash/waste on ISS.

4.7.3 OPS PLANNERS

The MOD Ops Planning team shall obtain periodic updates for pantry status and general locations of trash on a weekly basis.

4.8 GFE HARDWARE CURATOR

The GFE Hardware Curator resides in the ISS Program Office, GFE Flight Projects Office. Mail code is OX. This organization is responsible for ensuring that all current GFE Trash Hardware is certified for flight and that new requirements are being evaluated and implemented for future increments.

4.9 LOGISTICS AND MAINTENANCE CURATOR

The Logistics and Maintenance (L&M) curator resides in the ISS Program Office. Mail Code OC7. This team will provide manifest support as resupply of standard trash hardware is required. They will oversee the trash hardware catalog and provide an interface with the IP/Ps.

4.10 INCREMENT MANAGEMENT TEAM

The Increment Management Team (IMT) has the responsibility to integrate and prioritize the consolidated set of increment requirements and to resolve issues between the planning teams.

4.11 LAUNCH PACKAGE TEAM

The Launch Package Manager defines the priority for return of trash in the orbiter. This team also provides an interface with hardware providers to aid in evaluating systems/payload hardware which generates trash

4.12 FLIGHT CREW OFFICE

The Flight Crew Office representative shall provide crew input for planning. This representative shall attend the Trash/Waste Integration Group meetings. She will collect crew consensus on acceptability of new hardware and trash.

4.13 EVA PROJECT OFFICE

The EVA Project Office will provide data for quantities of trash being generated by EVA equipment and the category of this trash

4.14 PAYLOAD OFFICE

The Payload organization provides data regarding trash generated by each payload and what categories this trash will include.

4.15 KSC GROUND PROCESSING TEAM

The KSC Trash Ground Processing Team has responsibility for the physical de-integration of trash and/or waste flight hardware during post- launch operations. All operations of this team will be governed by established KSC requirements derived from ISS Program. (KSS 9.5 and KSS 9.5.3.).

5.0 RUSSIAN FUNCTIONS

5.1 RUSSIAN TRASH TEAM

Russian team that coordinates with TWIG for ISS trash/waste planning.

5.2 LIFE SUPPORT TEAM

Russian Team responsible for trash/waste hardware containers. Provides data for provisioning and verifies certification of Russian hardware.

5.3 FLIGHT CONTROL TEAM

5.3.1 INTEGRATED STOWAGE

TBS – Need input

5.3.2 RS OPS Plan

TBS – Need input

5.4 SAFETY

The Safety organization will coordinate with US Safety representatives to aid in certifying trash/waste hardware for use and return in all vehicles and elements

5.5 OTHER RUSSIAN TEAMS???

For example, payload teams, hardware curators, etc. Need input

6.0 PRE-FLIGHT PLANNING PROCESSES

6.1 SYSTEM/PAYLOAD MANAGER RESPONSIBILITIES FOR TRASH/WASTE STOWAGE HARDWARE

System/payload managers are responsible for identifying their specific standard trash stowage device requirements from the Trash/Waste Hardware catalog, and for requesting these devices be manifested.

Where standard trash stowage devices do not accommodate a user's needs, the user shall provide unique trash stowage devices. The user has responsibility to ensure that these unique containers are certified by the appropriate safety panel prior to manifesting.

6.2 MANIFEST

6.2.1 MANIFEST RESPONSIBILITY

The manifest of all trash or waste containers to be used on-orbit, whether standard and provided by the ISS Program, or special and provided by the system/payload, is coordinated by the TWIG to ensure optimal use of available hardware. Input regarding type of bags and quantity required is supplied to the TWIG. The representative for crew provisioning shall develop and submit the manifest request for US hardware. The Russian Trash team Team will obtain requests for Russian hardware via the weekly Joint Trash telecon and provide this data to the Russian Manifest Team. The Russian Manifest will coordinate this input with the MWG.

6.2.2 MANIFEST APPROVAL

The TWIG shall appoint a representative to be a member of the Manifest Working Group (MWG). The TWIG will be responsible for following up any positive responses from the trash/waste generation box on the MR.

The MWG proceeds with its review and approves the completed MR form, including the data submitted in the Trash/Waste Manifest Questionnaire, Appendix B. the MR shall be forwarded for concurrence by the Increment and Launch Package Managers for the respective time increment or flight. Following concurrence, the manifest is submitted to JSC-OC/Mission Integration and Operations Control Board for approval.
Trash/waste hardware required for ISS shall be defined in the program manifest, SSP 5410X, Annex 1, Increment Definition and Requirements Document (IDRD), in accordance with SSP 50200-02, Space Station Program Implementation Plan Volume 2 (SPIP-02).

6.3 ALLOCATIONS

Allocations are established by JSC-OC/Increment Managers for the on-orbit phase, and by JSC-OC/Launch Package Managers for US return logistics carriers, or by JSC-OM/Launch Package Managers for Russian disposal logistics carriers (e.g. Progress).

System/payload managers are responsible for ensuring their allocations include their required standard and unique trash and waste stowage, for on-orbit and for return or disposal, including stowage devices.

A dedicated stowage volume for trash and waste shall be specified and documented for each increment. Dedicated trash and waste stowage volume shall comply with habitability stowage constraints as defined in SSP 50261-01, Generic Groundrules, Requirements and Constraints. The required dedicated volume shall be based on intervals between logistics vehicle undockings according to the assembly sequence, based on the specific crew size and without provision for skip cycle stowage capacity.

Total Trash/waste generation must remain within the allocated volume. This volume shall be as far from the primary crew living and working locations as practical, and must not be used for the nominal stowage of other items.

6.4 STOWAGE INTEGRATION (SI)

On-orbit location or placement of trash or waste is planned pre-increment by TWIG together with the SI Manager and IP. This plan is approved by the JSC-OC Mission Integration and Operations Office, and tracked real-time by MOD Inventory Stowage Officers.

The SI Group is responsible for integrating trash/waste cargo into a lay-out plan incorporating applicable ISSP requirements, specific flight cargo manifests and cargo engineering data, thus providing consistent crew interfaces, and optimized utilization of program allocated resources, such as volume, mass, and crew time (SSP50200-3, section 4.2.1.5).

The SI Manager may determine that the available stowage volume does not meet user requirements or is less than the IDRD allocation. In such a case, exceedences or other requirement anomalies affecting the Cargo Integration (CI) process are brought to the attention of the CI mission manager. The SI Function supports issue resolutions and trade-off evaluations (SPP50200-03, section 4.2.1.7). When a resolution is reached, the outcome is updated in the appropriate SSCCDS to reflect the changes (Day-to-Day movement of on-orbit equipment is not reflected in the SSCCD).

6.5 HARDWARE DEVELOPMENT/NEW TECHNOLOGY

As lessons learned and history is accumulated, it is possible that new design and/or new technology will be needed. New users custom hardware may require development.

As requirements for new hardware are recognized and defined by the TWIG, the GFE Trash Hardware Curator will task the NASA Engineering Directorate (EA) to design new flight hardware if no COTS hardware is adequate and follow through completed certification for flight. Approval for the design and development of new hardware will be provided by the GCB.

6.6 STATION RESUPPLY

The ISS Logistics and Maintenance Crew Provisioning group shall obtain data defining the standard trash supply. The MOD ISO team will collect data regarding the realtime use of trash/waste provisions. The TWIG will assess this data and provide updates to the Crew Provisioning team to update the resupply manifesting effort.

6.7 CREW TRAINING

A training class titled, “ISS Habitability Equipment and Procedures” is provided to all Expedition crews. A refresher is provided, as required, when significant changes have occurred. This class will include a review of available trash/waste hardware and operational constraints and information. The Crew Systems group shall coordinate with the TWIG to ensure that the latest data is provided to the crew. The ISSP Cargo Planning and Imagery Office will provide hardware for use in the class.

6.8 TRASH/WASTE SAFETY CERTIFICATION

6.8.1 FLIGHT CERTIFICATION

The GFE Trash Hardware Curator (OX) shall be responsible to ensure that all GFE trash hardware is certified for launch and landing on all vehicles, and on-orbit use in all segments of the ISS. This includes current and new hardware.

Systems or payloads hazardous items that may end up in trash must be identified through the manifesting process, in the trash/waste manifest questionnaire, by the source owner.

Hazardous materials will be assessed by the JSC toxicologist for toxic hazard potentials to the crew. The toxicity ratings shall be maintained by JSC-SD in a computerized hazardous materials database (ToxTable.fp3).

Flight safety reviews conducted by the SRP, PSRP, and SMART shall include verification that owners/providers of ISS systems, payloads, and GFE have provided adequate containment for their hardware during all operational phases,

including generation of waste/trash items. Containment requirements for individual items will be based on their toxicity rating or intrinsic physical hazard (sharps, radioactive, etc) as determined by the flight safety review process. Owners/providers of ISS systems, payloads, and GFE are responsible for providing all necessary hardware to adequately contain the waste/trash they generate, or for coordinating with the TWIG to assure that adequate standard trash hardware is available for their items.

6.8.2 GROUND CERTIFICATION

Ground safety reviews are conducted to protect personnel, facilities, equipment, other payloads, the Shuttle, the flight crew, the general public, public and private property, and the environment from injury or damage during ground processing operations. The GSRP evaluates the design of ground support equipment and the ground processing
operations performed in accordance with KHB 1700.7. Ground safety data packages are submitted for the GSRP review in accordance with NSTS 13830 or SSP 30599.

6.9 TRASH/WASTE CERTIFICATION OF FLIGHT READINESS (COFR)

The Trash/Waste Integration Group shall assess the integrated trash/waste components and configurations as a requirement for certification for flight and stage readiness and will report results to OC and OE.

6.10 INTEGRATED ASSESSMENTS

6.10.1 GENERATION/ALLOCATION ASSESSMENT

The TWIG shall perform a preliminary assessment of trash/waste generation rates vs defined stowage allocations based on data provided in the Trash/Waste Manifest Questionnaire. The Generation/Allocation Assessment shall be included in each Increment Plan and used to determine that adequate stowage for trash/waste stowage has been allocated. The TWIG shall also track available resources and trash/waste generation throughout each on-orbit phase, updating the assessment as actual generation rates become known.

6.10.2 HARDWARE SUPPLY ASSESSMENT

The TWIG shall perform a preliminary hardware supply assessment of trash/waste hardware usage vs trash/waste hardware manifested to ensure an adequate supply of nominal and contingency trash/waste hardware. The Hardware Supply Assessment shall be included in each Increment Plan.

6.11 TRASH/WASTE HANDLING REQUIREMENT DEVELOPMENT

The Trash/Waste Integration Group is responsible for the development of flight requirements. JSC-DA (MOD) and KSC/Launch Site Support Managers (LSSM) are responsible for developing flight and ground handling procedures.

The system or payload manager(s) shall support the appropriate JSC-DA/Mission Operations representative in developing proper trash/waste handling procedures, timeline requirements, and training and operational documentation for mission-specific and system-unique or payload-unique cases. They shall also support the development and verification of procedures, flight rules, operational requirements, and the conduct of crew training for system-unique or payload-unique operations. The system or payload manager(s) shall work with the KSC/Launch Site Support Manager in the definition of system-unique or payload-unique ground handling operations.

6.12 INCREMENT ANNEX TO TRASH/WASTE MANAGEMENT PLAN

Beginning with Increment 1, an increment-specific annex to this plan shall be developed and approved bilaterally. This document will provide detailed planning for the International Space Station (ISS) for each increment concerning trash/waste container hardware, stowage provisions and removal.

6.13 JOINT TRASH TELECON

There will be a weekly telecon to discuss on-going trash assessments and analysis. This forum will be used to exchange information and answer questions each team might have.

6.14 IDRD INPUT

The TWIG shall provide an input to the IDRD relating to trash return on various vehicles. This input will be based on the assessments of trash vs. allocation.

7.0 ON-ORBIT PROCESSES

7.1 CONTAINMENT

The systems/payload manager is responsible for pre-planning treatment, processing, and/or containment of waste to render it safe so that it will not impair crew health/safety.

The Tox/Haz Database shall be updated as required and shall be accessible by the crew on-orbit, and by medical personnel in the Mission Control Center-Houston (MCC-H), Mission Control Center-Moscow (MCC-M***) and GSRP operations at KSC.***

7.1.1 HAZARDOUS TRASH/WASTE CONTAINMENT

All hazardous trash/waste must be contained according to certification requirements approved by the JSC-OE/Safety Review Panel. The KSC/Ground Safety Review Panel shall be provided data for trash/waste containers which may be disposed of via the shuttle.

Multiple types of hazardous trash/waste may be accumulated in a single outer container as long as different hazardous trash/waste categories are individually contained.

Hazardous trash or waste that falls into multiple hazard categories shall require multiple containment methods.

7.2 SEGREGATION OF TRASH/WASTE

Segregation of trash/waste shall be implemented in order to assist the flight crew and ground personnel in maintaining cognizance of the stowage configuration to permit safe and efficient disposal of trash and waste. Hazardous items shall be segregated, contained, and labeled according to the hazardous trash/waste classifications identified in paragraph 3.2.

7.3 HANDLING

7.3.1 BATTERY TRASH/WASTE HANDLING

Basic cell design of the alkaline batteries use a metal cell can (except 9-volt that is metal-jacketed) construction and is covered with a plastic film label that covers the space between positive and negative areas of the battery near the negative terminal. The label minimizes the probability that air borne contaminants or metal contacts can bridge between the negative terminal and the positive steel cover.

Crewmembers will be instructed to inspect the batteries for damage prior to disposal. If a battery is damaged or has the plastic label removed at the negative terminal end, it is to be taped. The 9-Volt batteries are to be taped over both terminal ends to adequately preclude short-circuiting once placed in a Ziploc Bag. The crew is to place small quantities of similar cells into a Ziploc bag to ensure that different cells contained within the Ziploc bag do not increase the chance for short-circuiting by contact with each other.

7.3.2 BIOLOGICAL TRASH/WASTE HANDLING

Need actual handling requirements for BB waste.

7.3.3 SHARPS TRASH/WASTE HANDLING

Sharp containers that become trash shall be disposable in their entirety without physical examination.

7.3.4 CHEMICAL TRASH/WASTE HANDLING

Individual chemical trash/waste types (based on chemical properties and not on hazard levels) must be contained in separate containment barriers unless the multiple chemical types have been certified by the JSC-OE/Safety Panel to be compatible when stored in proximity to one another. The hazardous trash/waste label shall be annotated to identify the specific chemical type(s) contained.

7.3.5 RADIOACTIVE TRASH/WASTE HANDLING

Radioactive trash/waste must be packaged, labeled and handled in accordance with requirements established by the KSC Radiation Protection Officer/JSC Radiation Health Office and approved by JSC-OE/Safety Review Panel. An assessment for these hazards will be made on a case by case basis.

7.3.6 NORMAL REFUSE TRASH/WASTE HANDLING

Normal wet refuse shall be kept segregated from normal dry refuse. If wet refuse is placed into a normal/dry refuse container, the container shall now be labeled as wet refuse.

Where practical, food and other waste that can biologically degenerate over time shall be stabilized or passivated through design of the system such as use of biocides or through environmental conditioning such as refrigeration, evacuation or sealing. Solid food should be segregated from liquids to the extent possible. Where treatment cannot be accommodated, individual waste items shall be placed in containers such as ziploc bags, and the bag compressed to the extent practical in order to eliminate air. Specific implementation shall be developed on a case by case basis through the design and certification process.

7.4 DEPLOYMENT OF TRASH/WASTE HARDWARE WHILE IN USE

The Trash/Waste Hardware Catalog shall identify any special deployment instructions for each bag or container.

7.5 LABELING

7.5.1 INSTALLATION OF LABELS

A Trash/Waste label has been provided for use on trash/waste containers. This label may be affixed to the containers via adhesive or tied depending on the

container. The Expedition crew shall select the most appropriate method. An example of the label is provided in Appendix x. The official version will be located in the JSC Decal Handbook.

7.5.2 BAR CODE OPERATIONS

There are labels with and without bar codes. Those with bar codes would be used on the outer most container being stowed. Those with bar codes may be used to allow the ground to assist with the location of trash containers containing trash/waste with unique disposal requirements or during early increments for location of containers when not contained in specific locations. For bags which are planned for Progress, a label on the exterior bag is not required. For bags which are planned to be returned via shuttle, and some margin for excessive unplanned trash generation, there is a requirement to identify the outer bags with a trash label. However, use of labels and bar coding for all bags is recommended prior to sufficient dedicated and planned stowage locations during early increments.

7.5.3 NON-HAZARDOUS TRASH/WASTE LABELING

For normal refuse, the labels allow identification of wet or dry status. It should be noted that wet normal refuse may become hazardous over time and should be stored as hazardous.

7.5.4 HAZARDOUS TRASH/WASTE LABELING

All hazardous trash/waste containment shall be labeled using the label shown in Figure 5.2.2. The outermost containment barrier for a particular trash/waste category shall be appropriately labeled as a battery hazard, biological/biomedical hazard (biohazard), sharps hazard, chemical hazard, and/or radiation-emitting hazard. Chemical hazards shall be identified with the chemicals in addition to circling the chemical logo.

For all trash/waste that will be returned via shuttle, the hazardous trash/waste outer container label shall indicate all types of hazards contained within that bag.

7.6 TOXICITY IDENTIFICATION FOR TRASH/WASTE

The degree of toxicity for any trash or waste which poses a significant health threat to exposed personnel shall be identified by the following coding scheme as defined in JSC 26895, Guidelines for Assessing the Toxic Hazard of Spacecraft Chemicals and Test Materials.

Toxicity/Hazard Level

0	Non-hazard
1	Critical Hazard
2	Containable, Catastrophic Contact Hazard
3	Containable, Catastrophic, Systemic Hazard
4	Non-containable, Catastrophic Systemic or Contact Hazard

When multiple types of contained hazardous trash/waste are accumulated in a single hazardous trash/waste container, the outermost container label shall indicate the highest level of toxicity contained (0-4).

7.7 STOWAGE

7.7.1 STOWAGE WITHIN RECOVERABLE CARGO

It is anticipated that a limited amount of trash can be re-stowed into volumes from which the hardware/consumables was removed. Expended items that are returned to a pantry or experiment volume and which are not introduced into on-orbit trash/waste containers are considered recoverable cargo and will not be categorized as trash/waste or non-recoverable cargo. Requirements for the handling, safing and labeling of these items shall be followed, as they would be if they were considered non-recoverable cargo.

7.7.2 STOWAGE CONTAINMENT

Waste or trash shall be contained in appropriately certified containers prior to stowage in any device or location that is not a certified containment barrier.

7.7.3 TRASH/WASTE HARDWARE STOWAGE LOCATION

Trash/Waste Hardware should be co-located in centralized locations. Although there may be more than one location for a specific type of container, the plan is to add manifested bags from all users to the central locations. When the bag is needed, the procedures shall notify the crew to select the bag from the pantry for use in the payload or system task.

The Cargo Planning and Imagery Group shall provide recommended stowage locations for trash/waste to the Expedition Crew. This recommendation will be based on the agreed to allocations and currently available stowage. Once identified, the MOD ISO team shall track these locations as trash/waste bins. Trash/waste shall nominally be contained within standard stowage locations. Exceptions during early increments shall be identified in the Increment Specific Trash/Waste Management Plans.

7.8 PERIODIC STATUS TO GROUND

The Ops Planners will status the crew on a weekly basis to acquire updated information on trash/waste hardware and current real-time generation. This will assist the Crew Provisioning team's ability to ensure that an adequate supply of bags is on-board and planning for

9.0 DISPOSITION

7.9 PRIORITIZATION FOR REMOVAL

In order to minimize the quantity of noxious and hazardous trash/waste on the orbiting facility, the nominal priority for removal of trash and waste is:

1) hazardous trash/waste,
2) urine (e.g. EDV's),
3) solid human waste (e.g. KTO's),
4) wet trash, and
5) dry trash.

However, in cases where trash/waste is being disposed of via the shuttle, and a Progress is available simultaneously, the plan will be to remove the least hazardous trash on the orbiter to minimize ground safety and handling concerns. This is true even though the orbiter shall depart prior to the Progress.

7.10 PRIORITIZATION FOR USE OF VEHICLES TO CARRY TRASH/WASTE

All trash/waste shall be planned for removal from ISS via Expendable vehicles (Progress for early assembly operations) or Space Shuttle [Multi-Purpose Logistics Module (MPLM) or Middeck]. Expendable vehicles shall be the first priority for trash/waste removal.

7.11 RADIOACTIVE TRASH/WASTE REMOVAL

According to NRC regulations, we may release the container containing the urine if the effluent concentration of the radioactive waste does not exceed the concentration provided by NRC. The limiting concentration varies from 10^-6 to 10^-3 _Ci/ml, depending on the type of the radioactive material. One can burn the waste once the effluent concentration is below the limit,

The NRC regulation does not permit disposal of radioactive waste by incineration, except for some special cases. If Progress were a US spacecraft, we would need to apply to NRC for approval of the procedure of burning the wastes if the effluent concentration is over the limit mentioned above. The Russians may have a different regulation.

The NASA Chief Radiation Safety Officer must evaluate any trash or waste that is identified as a radiation emitter prior to disposal on an expendable vehicle.

JSC Form-44 is required to be submitted for each case in order to define radioactive material and procedures to label, isolate, remove etc. (Contact Mark Weyland with Lockheed to see how form is accessed.)

7.12 DOWN MANIFEST PLANNING

All items being disposed of from the ISS shall be manifested for disposal on a specific return or expendable vehicle.

The initial step in this process is the identification of trash/waste to be disposed of. Candidate flights for disposal may be identified. The JSC-OC/Requirements Integration Panel (RIP) may be consulted to identify candidate disposal options.

Once specific manifest data is available and candidate disposal options are identified, a manifest request shall be developed by the responsible system manager/payload manager and submitted to the JSC-OC/Manifest Working Group. The request shall include identification of the stowage/packaging requirements. Physical allocation parameters, such as mass and volume, must include the trash/waste contained in the required trash/waste stowage or containment devices.

Trash/Waste manifest data is to be submitted to the JSC-OC/Manifest Working Group in accordance with the data fields in the Trash Manifest Questionnaire, Appendix B. Manifest requests for trash disposal should be submitted in adequate time to support the mission integration schedule. Manifest requests for trash disposal on the shuttle shall be submitted by fifteen months prior to return flight. Manifest approval occurs at L –12 months. Assistance in completing the Questionnaire can be obtained from the Trash/Waste Integration Group.

7.13 PROGRESS TRASH/WASTE DISPOSAL

The Progress vehicle is the primary method of eliminating trash and waste from the ISS. For this reason, it is critical that a consistent flow of vehicles is available at the ISS throughout the life of the station.

The total volume available for trash/waste disposal is defined as 5.8 cubic meters.

With the exception of some trash/waste having radiation constraints, there is no limits to the number or type of trash to be disposed of on Progress as long as the weight and cg constraints are maintained.

7.14 INCREMENTAL STOWAGE OF TRASH/WASTE ON PROGRESS

There are a number of Progress vehicles planned during each increment. Trash will be loaded into Progress after cargo removal. Progress vehicles may contain both new logistics and trash/waste at the same time during it's docked phase.

Each Progress vehicle will be evaluated uniquely to determine if cargo is completely or partially unloaded prior to re-loading trash **<TBR 9-1>**. On Type M vehicles (3P), it is possible to transfer urine from the EDVs into the water tanks (Rodnik) to preserve volume and recycle the EDVs.

7.15 SHUTTLE

An MOA with the Space Shuttle Program has been signed which provides an agreement to bring back trash/waste on the shuttle. Any trash/waste which shall be transported to the ground must be properly labeled to ensure safe conditions for ground handling. A note to the transfer load master on each cue card shall ensure that this label is in place. It is the ISSP position that the orbiter will remove as much of the trash from ISS as capabilities exist.

7.16 GROUND HANDLING

KSC shall use standard ground handling procedures for disposing of trash/waste returned from ISS. The ground processing team can assume that proper containment and labeling was completed on-orbit prior to transfer to the shuttle vehicle. They shall be prepared to handle any anomalous conditions which may occur during transport.

7.17 TRASH/WASTE JETTISON

Any trash/waste to be jettisoned from ISS must preclude inadvertent collision with ISS or other vehicles and requires analysis of orientation, change in velocity, ballistic number, size (in order to permit tracking), containment approved for the applicable environmental conditions and schedule/assembly sequence considerations. Each trash jettison incident must be pre-planned individually and requires the approval of the JSC/OE-Safety Review Panel and the ISS Program Manager.

APPENDIX A

ACRONYMS AND ABBREVIATIONS

ASI	Agenzia Spaziale Italiana
ATV	Automated Transfer Vehicle
BA	Battery
BB	Biological/Biomedical
cm	centimeter
CG	Center of Gravity

CH	Chemical
COT	(Russian) device used for containing fluids extracted from solid waste
CSA	Canadian Space Agency
DR	Depress Rate
ECLS	Environmental Control and Life Support
EDV	Etkost (Container) Dlya (for) Vodiy (Water)
EPS	Electrical Power System
ESA	European Space Agency
EVA	Extravehicular Activity
FACB	Flight Activities Control Board
FOS	Factors of Safety
GFE	Government Furnished Equipment
HIV	Human Immunodeficiency Virus
HTV	H-II Transfer Vehicle
ICD	Interface Control Document
ICK	Insert Contaminant Kit
IDRD	Increment Definition and Requirements Document
IP	International Partner
ISS	International Space Station
JSC	Johnson Space Center
KHB	Kennedy Handbook
KSC	Kennedy Space Center

lbs.	pounds
LL	Landing Load
LMSO	Lockheed Martin Space Operations
LSS	Life Support System
LSSM	Launch Site Support Manager
MCC	Mission Control Center
MCC-H	Mission Control Center - Houston
MCC-M	Mission Control Center - Moscow
min	minute

MIOCB	Mission Integration and Operations Control Board
MOD	Mission Operations Directorate
MPLM	Multi-Purpose Logistics Module
MR	Manifest Request
NASA	National Aeronautics and Space Administration
NASDA	National Space Development Agency of Japan
NR	Normal Refuse (Wet and Dry)
NRD	Normal Refuse Dry
NRW	Normal Refuse Wet
NSTS	National Space Transportation System
OSCAR	On-Orbit Stowage Capabilities and Requirements
p	pressure
PALS	Program Automated Library System
psi	pounds per square inch
psia	pounds per square inch absolute
R&R	Resupply and Return
RA	Radiation
RIP	Requirements Integration Panel
RR	Repress Rate
RSA	Russian Space Agency
SDTO	Space Station Detailed Test Objective
SFOG	Solid Fuel Oxygen Generator
SH	Sharps
SLSD	Space and Life Sciences Directorate
SPIP	Space Station Program Implementation Plan
SWC	Solid Waste Container
T	Temperature
TBD	To Be Determined
TBR	To Be Resolved
TWIG	Trash/Waste Integration Group

U.S.	United States
UCB	Urine Containment Bag
V	Volt
VIPeR	Vehicle Integration Performance and Resources

WCS Waste Control System

APPENDIX B

Trash/Waste Manifest Questionnaire

Please fill in the following table. Items which are required to be recovered for any purpose are not considered to be trash or waste.

Item dimensions must be measured with the trash item in the disposal configuration. All measurements must include any required containment packaging (e.g., dimensions for water bags should be measured when the water bag contains the quantity of water specified for disposal). For items of variable disposal dimensions, use the worst-case disposal dimensions. Return issues as defined in this table are hazards which result from exposing the trash item to the environment in question.

Trash Item Description	Trash Item Dimensions <u>At Disposal</u> (cm) L x W x H Or L x Diameter	Quantity Per Increment	Hard/ Compressible (H/C)	Trash /Waste Categories (choose all that apply to your trash/waste) Battery (BA) Biological Biomedical (BB) Chemical (CH) Radiation (RA) Sharps (SH) Normal Refuse Dry (NRD) Normal Refuse Wet (NRW)	Return Issues Landing Loads (LL) Pressure (P) Depress Rate (DR) Repress Rate (RR) Temperature (T)	C
1.						
2.						
3.						
4.						
5.						

Trash Manifest Questionnaire Landing Loads

Landing Loads = MPLM loads in SSP 57000 3.1.1.3 and Middeck loads in NSTS-21000-IDD-MDK 4.1-4.2.

(8.8 g) x (300 lb) x (1.4 factor of safety) = 3696 lb in three orthogonal directions for M1 bag in RSP in MPLM

(8.8 g) x (200 lb) x (1.4 factor of safety) = 2464 lb in three orthogonal directions for M2 bag in RSP in MPLM

(8.8 g) x (159 lb) x (1.4 factor of safety) = 1959 lb in three orthogonal directions for RSR locker

(20 g) x (60 lb) = 1200 lb in three orthogonal directions for Middeck locker (FOS included in g factor)

(20 g) x (204 lb) = 4080 lb in three orthogonal directions for Middeck seat bags

(20 g) x (240 lb) = 4800 lb in three orthogonal directions for A/L bags

Pressure = 0 psia (SSP 57000 3.9.4) to 16 psia (NSTS-21000-IDD-MDK 6.1).

Depress Rate = 9.0 psi/min. (NSTS-21000-IDD-MDK 6.1).

Repress Rate = 9.0 psi/min. (NSTS-21000-IDD-MDK 6.1).

Temperature = 32 deg F to 120 deg F. (NSTS-21000-IDD-MDK 6.1).

APPENDIX C

BOARDS AND PANELS

Multi-lateral Mission Integration and Operations Control Board (MMIOCB)

The MMIOCB is the primary management forum in which multi-lateral Mission Operations and Mission Integration issues are addressed and management decisions made. It is an executive-level body chartered by the Space Station Program Control Board (SSPCB) and has responsibility for baseline configuration control of delegated portions of the NASA ISS Operations and Mission Integration baselines.

Space Station Control Board (SSCB)

The SSCB is an executive level board which establishes the top level Program baseline and dispositions any changes affecting the baseline, other cost, technical and schedule issues, affecting the International Partners, which exceed the delegated authority or cannot be resolved or dispositioned at a lower level board.

Requirements Integration Panel (RIP)

The Requirements Integration Panel (RIP) is the responsible forum for defining ISS Program requirements. ISS Program requirements are documented in the Increment Definition and Requirements Document (IDRD) and in the Generic Groundrules, Requirements and Constraints (GGR&C) Document.

FliGHT Safety Review PanelS (SRP, PSRP, SMART)

Flight Safety Review Panels include the SRP (for elements and systems), PSRP (for payloads), and SMART (for GFE). Panels are responsible for conducting safety reviews to verify that all ISS trash hardware meets applicable flight safety requirements. Additionally, as part of the flight safety review process, Panels will assess all systems, payloads, and GFE to verify that all waste/trash items generated by them are appropriately contained and identified before entering the trash/waste stream. Assessments will consider launch, on-orbit and in case of shuttle, return of trash/waste and trash hardware

Ground Safety Review Panel (GSRP)

The Ground Safety Review Panel (GSRP) is an ISS Program and Shuttle Program
panel that is tasked to ensure that ISS flight elements, ISS experiments, Government Furnished Equipment and Shuttle payloads are processed safely both pre-launch and post-flight at Kennedy Space Center and contingency or alternate landing sites.

Flight Crew Equipment Configuration Control Board (FCECCB)

TBD

GFE Control Board (GCB)

The GCB will provide direction to engineering for development of new trash/waste hardware.

JOP

This panel is operated by MOD and provides guidance to the flight control team for on-orbit planning and operations. A review of the Trash planning will be provided to MOD to ensure that operationally capabilities are not exceeded.

Russian Board(s)

TBS

Appendix D - open work

Table D-1 lists the specific To Be Determined (TBD) items in the document that are not yet known. The TBD is inserted as a placeholder wherever the required data is needed and is formatted in bold type within brackets. The TBD item is numbered based on the section where the first occurrence of the item is located as the first digit and a consecutive number as the second digit (i.e., **<TBD 4-1>** is the first undetermined item assigned in Section 4 of the document). As each TBD is solved, the updated text is inserted in each place that the TBD appears in the document and the item is removed from this table. As new TBD items are assigned, they will be added to this list in accordance with the above described numbering scheme. Original TBDs will not be renumbered.

TABLE D-1 TO BE DETERMINED ITEMS

TBD	Section	Description
4-1	4.0	Trash/Waste Hardware Catalog has not been baselined yet

Table D-2 lists the specific To Be Resolved (TBR) issues in the document that are not yet known. The TBR is inserted as a placeholder wherever the required data is needed and is formatted in bold type within brackets. The TBR issue is numbered based on the section where the first occurrence of the issue is located as the first digit and a consecutive number as the second digit (i.e., **<TBR 4-1>** is the first unresolved issue assigned in Section 4 of the document). As each TBR is resolved, the updated text is inserted in each place that the TBR appears in the document and the issue is removed from this table. As new TBR issues are assigned, they will be added to this list in accordance with the above described numbering scheme. Original TBRs will not be renumbered.

TABLE D-2 TO BE RESOLVED ISSUES

TBR	Section	Description
9-1	9.6	Need resolution on balance of Progress unloading vs. loading of trash/waste