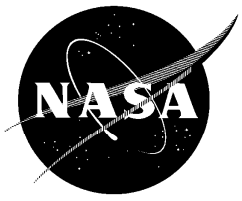
Problem Reporting and Corrective Action for the Space Station Program

International Space Station Program

Revision L

June 2009

National Aeronautics and Space Administration
International Space Station Program
Johnson Space Center
Houston, Texas Contract No.: NNJ04AA01C



REVISION AND HISTORY PAGE

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G	Revision G reflecting NASA/ISS Prime Contractor technical clarification agreements (Reference SSCD 000907, EFF 3/16/98)	03-06-98
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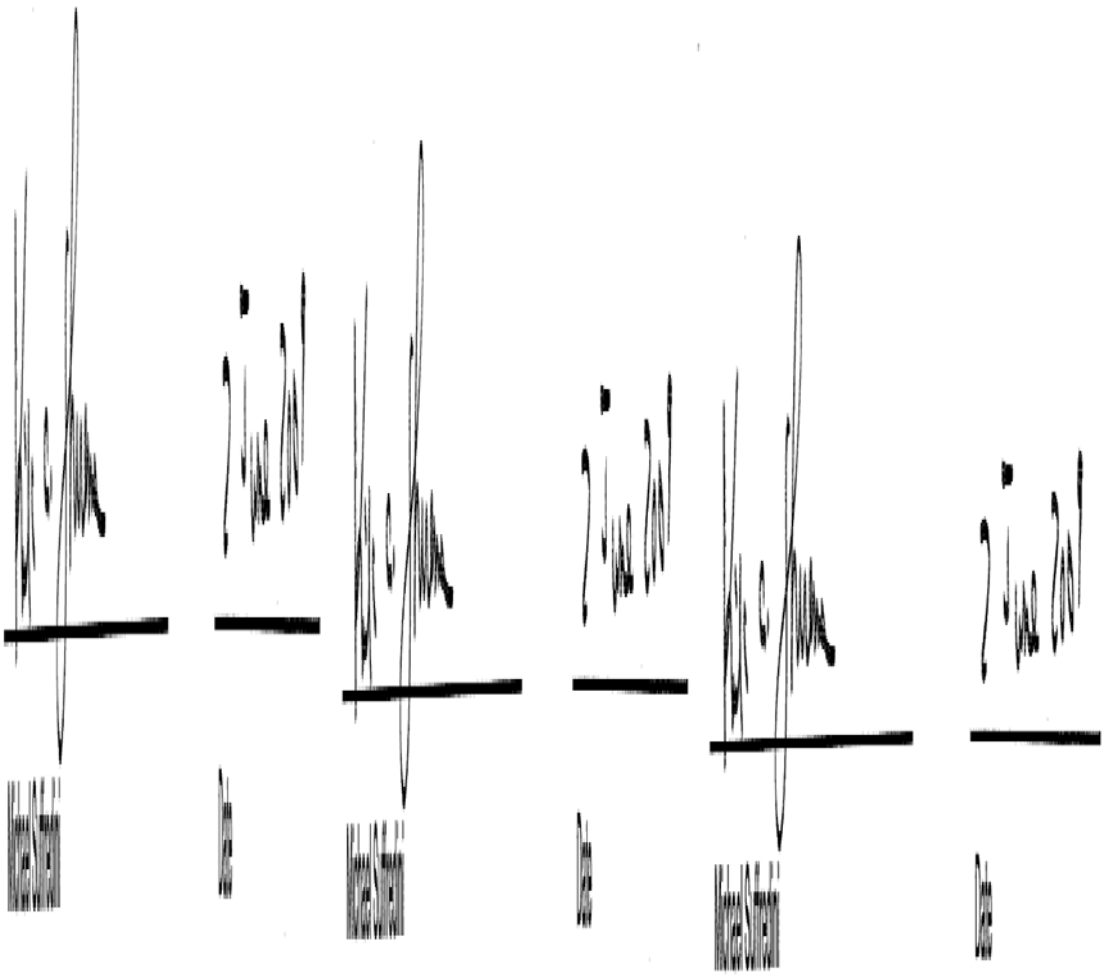

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INTERNATIONAL SPACE STATION PROGRAM

PROBLEM REPORTING AND CORRECTIVE ACTION FOR THE SPACE STATION PROGRAM

CONCURRENCE

JUNE 2009

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INTERNATIONAL SPACE STATION PROGRAM

PROBLEM REPORTING AND CORRECTIVE ACTION FOR THE SPACE STATION PROGRAM

LIST OF CHANGES

JUNE 2009

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

Board Name	Entry Date	Change	Paragraph(s)
	October 26, 1994	F	1.3, 3.1, 3.2, 3.2.1, 3.2.2, 3.3, 4.1.3, 4.1.3.1, 5.0, 5.3, 5.4, 6.1, 6.3, A.1, B.1
	May 6, 1998	G	All
	September 30, 1999	H	2.1, 3.1, 3.2.2, 3.2.3, 3.3, 3.3.1, 3.3.2, 4.2, 5, 9, A.1, B.1
	February 29, 2000	J	All
	August 22, 2006	Revision K	All
	June 2009	Revision L	All

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1.0 INTRODUCTION

1.1 PURPOSE

The purpose of this document is to define the requirements of the International Space Station (ISS) Problem Reporting and Corrective Action (PRACA) system. ISS PRACA provides a closed-loop process for the reporting, processing, dispositioning, and documenting corrective action(s). The goal is to assure that all reportable problems are evaluated and the appropriate corrective actions taken in a timely and cost effective manner.

The ISS PRACA process for hardware problems is addressed herein. The PRACA requirements and the process for software problems is documented in SSP 50200-01-AnxD, Station Program Implementation Plan Volume 1: Station Program management Plan Annex D: Avionics & Software Office Plan.

1.2 SCOPE

These requirements cover the reporting, processing and dispositioning of all problems on equipment/hardware for the International Space Station Program.

The requirements in this document apply to all elements and sites involved in the manufacture, assembly, handling, testing, use, or repair of ISS hardware, payloads, or GSE equipment with the following exceptions:

A. Requirements for the International Partners/Participants (IP/Ps) are defined in National Aeronautic and Space Administration (NASA)/IP/P Bilateral Safety & Mission Assurance (S&MA) Requirements documents and NASA/IP/Ps Bilateral Data Exchange Agreements, Lists and Schedules documents,

B. Johnson Space Center (JSC) GFE shall follow the PRACA requirements and processes established in JSC 28035, JSC Government-Furnished Equipment (GFE) Problem Reporting and Corrective Action (PRACA) Requirements,

C. Software problems shall follow the PRACA requirements and processes established in SSP 50200-01-AnxD,

D. Payload problems are only required to utilize PRACA for common hardware used by Payloads and the ISS Vehicle (for other problems they use the Payload Anomaly Report (PAR) Process.

2.0 DOCUMENTS

2.1 APPLICABLE DOCUMENTS

The following documents of the date and issue shown include specifications, models, standards, guidelines, handbooks, and other special publications. “Current Issue” is shown in parentheses in place of the specific date and issue when the document is under International Space Station Control Board control or the JSC document control system. The status of documents identified by “Current Issue” may be determined from the International Space Station Program Baseline Activity Index and Status Report.

JSC 28035	JSC Government-Furnished Equipment (GFE) Problem Reporting and Corrective Action (PRACA) Requirements
SSP 30234	Failure Modes and Effects Analysis and Critical Items List Requirements for Space Station
SSP 41173	Space Station Quality Assurance Requirements
SSP 50200-01-AnxD	Station Program Implementation Plan Volume 1: Station Program management Plan Annex D: Avionics & Software Office Plan

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.

N/A

3.0 PROBLEM REPORTING

3.1 INTRODUCTION

The ISS PRACA process has been established as a management tool utilizing nonconformance data. The ISS program allows for management of nonconformances through local nonconformance systems with the PRACA process selectively incorporating those nonconformances that meet defined and specific criteria. The following sections will define those criteria used to identify hardware reportable problems.

3.2 REPORTABLE PROBLEMS

A nonconformance shall be classified as a “reportable problem” when it meets the criteria of paragraphs 3.2.1, 3.2.2, 3.2.3, and 3.2.4.

3.2.1 HARDWARE APPLICABILITY

A problem is a nonconformance involving the following hardware classifications:

A. Flight (including qualification/proto-flight/flight like hardware but not Flight Equivalent Unit (FEU)),

B. Flight spare,

C. Flight Support Equipment (FSE),

D. Orbital Support Equipment (OSE),

E. Ground Support Equipment (GSE) (that portion which functionally or physically interfaces with flight hardware).

3.2.2 PRACA REPORTING RESPONSIBILITIES

The cognizant engineering organization shall submit and release reportable problems to the ISS PRACA within 48 hours (two business days) of notification.

Should a nonconformance occur which potentially jeopardizes the flight crew’s safety, ground crew’s safety, or mission success, then the NASA System Problem Resolution Team (SPRT) co-chair shall be notified as soon as possible but not to exceed twenty four (24) hours after occurrence/detection. The NASA SPRT co-chair is responsible for notifying the ISS Program Office of the situation and, if appropriate, the Mission Evaluation Room manager.

3.2.3 DEVELOPMENT LIFE CYCLE PHASE FOR PRACA REPORTABILITY

Nonconformances meeting the criteria in paragraphs 3.2.1 and 3.2.2 are reportable problems when they are determined to meet one or more of the following timeline criteria:

A. Orbital Replacement Unit (ORU)/Line Replacement Unit (LRU)/ Shop Replacement Unit (SRU) qualification testing,

B. ORU/LRU/SRU acceptance testing,

C. First instance of primary/secondary structure qualification testing has started,

D. A subsequent activity to paragraphs 3.2.3 (a) through 3.2.3 (c).

3.2.4 ON-ORBIT REPORTABLE CRITERIA

On-orbit nonconformances are reported as Mission Evaluation Room (MER) Items for Investigation (IFIs). These nonconformances shall be elevated to PRACA when:

A. The nonconformance has been determined to affect the fleet of available hardware and hardware is available for rework for corrective action/recurrence control,

B. The hardware (HW) in question has been scheduled to return to earth for further investigation,

C. The responsible SPRT desires a PRACA to document the on-orbit status.

3.3 NON-REPORTABLE CRITERIA

Problems and nonconformances may be excluded unless directed by ISS Program Office (PO), from being reported into the ISS PRACA when it is determined that the non-reportable criteria is applicable during the initial reporting period (refer to section 3.2. 2). When, after further review, a reported problem meets the following criteria it may be closed in the ISS PRACA as a non-reportable problem and the nonconformance shall be dispositioned per local nonconformance resolution processes. Non-reportable criteria are not applicable for nonconformances identified as an adverse trend.

3.3.1 GROUND NON-REPORTABLE CRITERIA

The following non-problem criteria address the general cases involving manufacture, testing, and depot maintenance of hardware not on-orbit. These non-problem criteria include the following:

A. Operator error. If adequate procedure and training exist and no suspected overstress,

B. Test set-up error. If adequate procedure and training exist and no suspected overstress,

C. Cosmetic defects (no affect on form, fit or function),

D. Defects dispositioned by an approved standard repair,

E. Nonflight-like hardware,

F. Nonconformances in hardware designated as Criticality 3 per SSP 30234, Failure Modes and Effects Analysis and Critical Items List Requirements for Space Station,

G. Factory/ facility equipment (factory/facility equipment does not include GSE) that interfaces with flight, FSE, flight spares, or OSE hardware. As long as no suspected overstress or effect on form, fit, or function to flight, FSE, flight spares, or OSE hardware occurred.

H. Nonconformances written to address documentation errors,

I. Nonconformances written to facilitate planning, inspection, assembly, or other activities,

J. Nonconformances written to record general observations/information,

K. Preventative maintenance inspection was delayed or missed,

L. Leakage exceeding specification requirements occurred as a result of system assembly or reassembly which is resolved by routine procedures (recycling, line adjustment, etc.) and no recurrence control is required,

M. Hardware item has exceeded its shelf life prior to installation,

N. Documentation errors or squawks occurred which did not affect the hardware performance nor invalidate any test,

O. Nonconformance was or will be repaired by a Standard Repair Procedure (SRP) approved by the ISS Program and no recurrence control is required.

3.3.2 IP/P INTEGRATION ISSUES

NASA and the International Partners/Participants (IP/Ps) will notify each other when an anomaly has occurred that may impact the hardware, or may otherwise require bilateral or multilateral coordination to resolve the anomaly. NASA as the integrator is responsible for maintaining an awareness of all integrated anomalies and ensuring that all affected Partners are aware of the anomalies.

Criteria are listed below for determining whether or not a hardware anomaly or its resolution is an integration impact. If any of the following is true, the anomaly should be determined to have integration impacts.

A. Affects a functional/physical interface between:

   1. ISS and other Visiting Vehicles (including the Shuttle Orbiter)

   2. United States (U.S.) On-orbit Segment and another IP/P's system(s)

   3. IP/P's cargo item (e.g., orbital replacement unit and associated flight-support equipment FSE and another IP/P's associated FSE or transport vehicle

B. Affects the ISS common environment

C. Involves common hardware as defined in the IP/NASA bilateral/multilateral agreements

D. Results in the loss of a critical safety function and/or redundancy as defined in any ISS Program baseline hazard report or failure modes and effects anslysis/critical items list

NASA's role as overall ISS integrator requires that it needs to maintain a technical cognizance (i.e., depth of penetration) over ISS systems and hardware to ensure that other IP anomalies do not affect overall integrated hardware performance. NASA and the sustaining contractor shall participate in the failure disposition process to the extent that the problem and its effect on the overall vehicle functionality are understood. If the

SPRT does not agree with the IP problem resolution, the SPRT can present the PRACA to the appropriate Level 1 board for disposition.

4.0 PRACA MANAGEMENT AND IMPLEMENTATION

SPRTs shall be established and chartered by the ISS Program Office. The SPRTs are responsible for:

A. Evaluating records to identify trends,

B. Evaluating records for PRACA reportability,

C. Identifying the flight(s)/stage(s) affected; classifying the problem's level,

D. Developing Test, Teardown, and Evaluation (TT&E) and/or failure analyses plans to identify the root cause,

E. Determining the corrective action(s) necessary to prevent recurrence of the problem,

F. Ensuring the verification of the implementation and effectiveness of the corrective action(s) and recurrence control(s),

G. Ensuring the data entered into PRACA Data System (PDS) is accurate and complete to support future failure history investigations and trending efforts,

H. Review and approval of all presentation documentation prior to presentation to boards, panels or working groups, program or otherwise, and

I. Assuring closure of all open PRACA's for the respective systems, in accordance with applicable closure requirements.

5.0 PROBLEM CLOSURE DEFINITION

All disposition options below shall follow the requirements of paragraph 3.7.5, Disposition under Program Baseline Control of SSP 41173, Space Station Quality Assurance Requirements.

5.1 FLIGHT CONSTRAINT REVIEW DISPOSITION

In the interest of safety and risk management, a flight constraint review disposition must be provided whenever the occasion arises where the nonconforming article, or similar articles to the nonconforming article are going to be used or flown prior to the completion of the problem investigation and resolution. The flight constraint review disposition provides the objective evidence used to “clear” an open problem for flight readiness reviews or other management reviews.

5.2 CLOSURE

Final closure of the Problem Report (PR) shall be withheld until all paper and actions associated with disposition and recurrence control/corrective action have been closed. As an example, directive actions associated with a Change Request (CR) must have closure, not just an approved CR.

APPENDIX A - ACRONYMS AND ABBREVIATIONS

CR	Change Request
EOL	End of Life
FEU	Flight Equivalent Unit
FMEA	Failure Modes and Effects Analysis
FSE	Flight Support Equipment
GFE	Government Furnished Equipment
GSE	Ground Support Equipment
HW	hardware
IFI	Items for Investigation
IP/P	International Partner/ Participant
ISS	International Space Station
JSC	Johnson Space Center
LRU	Line Replacement Unit
MER	Mission Evaluation Room
MRB	Material Review Board
NASA	National Aeronautic and Space Administration
ORU	Orbital Replacement Unit
OSE	Orbital Support Equipment
PAR	Payload Anomaly Report
PDS	PRACA Data System
PO	Program Office
PR	Problem Report
PRACA	Problem Reporting and Corrective Action
S&MA	Safety and Mission Assurance
SE	Sustaining Engineering
SPRT	System Problem Resolution Team
SRP	Standard Repair Procedures
SRU	Shop Replacement
TT&E	Test, Teardown and Evaluation
U.S.	United States

APPENDIX B - GLOSSARY OF TERMS

Definitions of technical terms related to the ISS PRACA system are as follows:

ACCEPTANCE TESTING

Tests to determine that a part, component, subsystem, or system is capable of meeting performance requirements prescribed in purchase specifications or other documents specifying what constitutes the adequate performance capability for the item in question. Refer to SSP 41173.

ADVERSE TREND

A problem detected during trend analysis by the design or user cognizant organization for hardware nonconformance, which has been shown to need recurrence control.

ANOMALY

An unexpected event, hardware damage, a departure from past experience, established procedures or performance, or a deviation of system, subsystem, and/ or hardware performance outside certified design/ performance specification limits.

APPROVED STANDARD REPAIR

Specific repair instructions as documented on the nonconformance record and approved by the Material Review Board (MRB) prior to the repair activity.

CLOSED PROBLEM

A problem is closed when NASA concurs with the problem analysis (including determination of the cause) and the corrective action to preclude recurrence of the problem is implemented or acceptable rationale is provided for not implementing corrective action.

COGNIZANT ENGINEERING ORGANIZATION

The organization that has design accountability. The Cognizant Engineering Organization is part of any MRB associated with the hardware.

CORRECTIVE ACTION

An action(s) taken to eliminate the root cause of a problem to prevent its recurrence.

FAILURE

The inability of a system, subsystem, component, or part to perform its specified function within specified limits, under specified conditions, and for a specified duration.

FLIGHT CONSTRAINT

Unacceptable risk to mission or safety that causes a constraint to be placed on the applicable flight.

FLIGHT EQUIVALENT UNIT

Hardware utilized to functionally demonstrate or simulate flight hardware operations. Hardware configuration does not necessarily match flight configuration.

FLIGHTLIKE HARDWARE

Non-flight equipment which is built to the following:

A. Manufacturing processes, which are identical or significantly similar to those, utilized in flight equipment.

B. Contain parts or assemblies which are identical or significantly similar* in design to flight hardware (includes manufacturing processes at the piece part level).

C. Equipment whose design (electrical or mechanical) is identical or significantly similar* to flight equipment when such design is critical to functional performance.

*Significantly similar is defined as commonality between parts, processes, or design such that the differences have no impact on the final performance of the equipment (e.g., solder, SN60 vs. SN63, has no difference to eventual equipment performance)

GOVERNMENT-FURNISHED EQUIPMENT

Equipment in the possession of, or directly acquired by, the government from suppliers other than the ISS Prime Contractor and subsequently made available to the ISS Program.

GROUND SUPPORT EQUIPMENT

Ground-based equipment functionally designed to support flight hardware servicing, checkout, test, movement, alignment, protection, or calibration. GSE will be delivered to the government.

INTERNATIONAL PARTNER/PARTICIPANT

Those non-U.S. space agencies that formally participate in the ISS Program.

NONCONFORMANCE

A condition of any article or material in which one or more characteristics do not conform to requirements. Includes failures, discrepancies, defects, malfunctions and problems.

NONFLIGHT LIKE HARDWARE

Hardware which, although similar to flight equipment, does not contain parts, processes, or design which are identical or significantly similar* to those utilized in flight hardware.

*Significantly similar is defined as commonality between parts, processes, or design such that the differences have no impact on the final performance of the equipment (e.g., solder, SN60 vs. SN63, has no difference to eventual equipment performance).

ON-ORBIT ANOMALY

An on-orbit anomaly may be detected during on-orbit International Space Station stage operations.

OVERSTRESS

A value of any stress parameter in excess of the upper or lower limit of the normal working range or in excess of rated value.

PAYLOAD

Any space equipment, flight hardware, or material designed to conduct either coherent sets of experiments (e.g., "Facility Class" instruments) or individual experiments and payload support equipment.

PRIMARY STRUCTURE

Provides carriage for the major structural loads of the element (e.g., Node, Lab, Truss, etc.)

PROBLEM

A nonconformance which is, or is suspected of being, a failure, an unsatisfactory condition, an unexplained anomaly, or an overstress occurring during or subsequent to production acceptance testing or qualification testing (i.e. after manufacturing or development).

PROBLEM REPORTING AND CORRECTIVE ACTION

A management system for identifying, reporting, analyzing for cause, remedying, and preventing recurrence of problems.

QUALIFICATION TEST

Those tests conducted as a part of the certification program to demonstrate that design and performance requirements can be realized under specified conditions.

RECURRENCE CONTROL

Action taken to prevent repetition of a nonconformance. This action may involve one or more of the following:

A. Design change,

B. Manufacturing method/procedure/process change,

C. Facility/test equipment change,

D. Test, inspection or operating procedure change,

E. Training or certification of personnel,

F. Maintenance procedure change,

G. Limit time or cycle of component,

H. Transportation, handling or shipping change,

I. Software change or firmware change.

RESPONSIBLE ORGANIZATION

The Hardware Developer, Payload Developer, or the organization responsible for the Sustaining Engineering (SE) of the hardware.

ROOT CAUSE

The underlying reason for, or cause of, one or more nonconformances or deficiencies identified through investigations and studies which, when corrected, will prevent or reduce the recurrence of the realized or potential nonconformance(s) deficiency(ies).

SAFETY CRITICAL GSE

GSE necessary to support the program, the failure of which could cause loss of vehicle system or loss of personnel capability. In addition, GSE used in direct contact with hypergolic, cryogenic, explosive, flammable, toxic, corrosive, or harmful material or fluids, equipment using ordinance devices, or devices used for ordinance checkout, equipment using high internal pressure, high electrical energy, high flow volume, high temperature or radiant energy, equipment with high-speed dynamic components in its operation, and hoisting equipment, are considered safety critical. This definition also includes electrical equipment that operate in areas where flammable gases and/or vapors may be present, or where electrical equipment is utilized for control of safety critical GSE. This also includes personnel rescue equipment.

SEVERITY

To be provided

SYSTEM PROBLEM RESOLUTION TEAM

A defined group whose purpose is to streamline the process of managing PRACA reportable problem dispositions by integrating NASA/ISS Prime Contractor/IP/P authority into a single entity capable of providing the final disposition of a reportable problem in an effective and timely manner.

UNSATISFACTORY CONDITION

Any nonconformance for which engineering resolution is required and which requires recurrence control beyond the specific article under question. Included in this definition are:

A. Conditions which cannot be corrected to the specified configuration using standard repair procedures; or

B. An event which could lead to a failed condition but does not affect the function of the article such as contamination, corrosion, workmanship, process escape, etc.

UNEXPLAINED ANOMALY

An anomaly that cannot be repeated (phantom or ghost) or for which a cause cannot be determined.

APPENDIX C - OPEN WORK

Table C-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 C-1 TO BE DETERMINED ITEMS

TBD	Section	Description

Table C-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 C-2 TO BE RESOLVED ISSUES

TBR	Section	Description