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TCD20030029A
3 March 2003

Contract No. NAS8-00114
H-32844D
Final Report

bd Systems, Inc.
Final Technical Progress Report
Contract No. NAS8-00114
Purchase Order No. H-32844D, Task Order 14
International Space Station (ISS)
Expedite the Process of Experiments to Space Station
(EXPRESS) Racks Software Support
Reporting Period: March 1, 2002 to February 28, 2003

Review of Work Accomplished

bd Systems personnel accomplished the technical responsibilities for this reporting period, as planned. A close working relationship was maintained with personnel of the MSFC Avionics Department Software Group (ED14), the MSFC EXPRESS Project Office (FD31), and the Huntsville Boeing Company. Work accomplishments included the support of SRB activities, ATB activities, ESCP activities, participating in technical meetings, coordinating issues between the Boeing Company and the MSFC Project Office, and performing special tasks as requested.

Special Tasks

Numerous special tasks were performed during this period to support the development of flight software for the EXPRESS Project.

- Coordinated a review of HHR SPRs with the payload operations organization to assess Boeing's recommended disposition.
- Participated in an EXPRESS Operations working group to rank SPRs in order of priority to be implemented in sustaining software releases.
- Participated in a panel assessment of the HHR software development and certification. The panel consisted of software personnel from MSFC (ED14), ARC, and bd Systems. Discussions were held with personnel from the Boeing Company and the MSFC HHR project office. The panel provided recommendations to the MSFC HHR project office to be used in the development of flight software.
- A review of the EXPRESS Pallet Interface Definition Document (IDD) was performed and meeting were attended to support IDD issues for the LaRC experiment
- A task to review ARC comments to SRS documents for the HHR BRIC and Laptop was completed. The purpose of the review was to screen the comments and determine if requirements were violated. The screening results were provided to the MSFC HHR Project Office, the comments relating to requirement violations were passed on to Boeing for evaluation.
- Participated in the Integrated Baseline Review (IBR) for the BRP HHR project. The IBR consisted of 16 teams to review 16 disciplines. Two teams, software and electrical were supported. The teams met with the Boeing manager for each discipline and reviewed schedules, accomplishments, and risks. The reviews indicated that software and electrical disciplines are being managed to plan and no significant issues were discovered.
- Provided SPRs and the ESCP SPR Microsoft Excel Spreadsheet to the BRP HHR Project Office at the Ames Research Center (ARC) as requested.

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- The assessment of the BRP HHR SPR database was continued and the ESCP SPR Microsoft Excel Spreadsheet was updated per the database. Presently, there are 134 open BRP HHR SPRs. SPRs from the Boeing database were accessed and provided to the BRP HHR Project Office at the Ames Research Center (ARC) as requested. Also, the ESCP SPR Microsoft Excel Spreadsheet was provided to the ARC and MSFC Project Offices.
- A two day BRP HHR Technical Interchange Meeting (TIM) was attended at MSFC. Participates were personnel from MSFC, ARC, Boeing, and bd Systems. Discussions for an integrated test of the HHR Qualification Rack and one of the habitant payloads, and plans to integrate SPR fixes into new software releases were held.
- Several working meeting between MSFC, Boeing, and bd Systems was supported to discuss HHR SPRs that are requirement violators. A total of 94 SPRS were discussed and the disposition as listed below was agreed upon by all involved parties:

Disapproved	26
PIDS Violators	33
No PIDS Violators	35
Total	94

- Support was provided to the MSFC Project Office for the Software Preliminary Design Review (PDR) for the Life Sciences Glovebox (LSG). The Ishikawajima-Harima Heavy Industries Co. Ltd. (IHI) is developing this software, for the National Aerospace Development Agency of Japan (NASDA). NASA is providing oversight of the LSG Program and the ARC provided the lead role for the review with participation from JSC and MSFC. ARC provided a web based Review Item Discrepancy (RID) database. bd Systems personnel submitted 6 RIDs to the database.
- Support to the MSFC Project Office was begun in preparation for negotiating ECP 1326 with Boeing. This proposal provides for 3 software releases (March 03, September 03, and March 04) that address open SPRs. SPRs that are PIDS violators will implemented in the first 2 software releases. SPRs that are not PIDs violators and SPRs opened after the initial 94 SPRs will be implemented in the third software release. This support will be on going until final negotiations of ECP 1326 are completed (planned for mid March 2003).

ESCP Activities

The ESCP weekly meetings were supported. Subject material reviewed included action items from previous ESCP meetings, the Boeing SPR database, and plans for software releases for EXPRESS, WORF, HHR, and HRF.

Several software events and releases occurred during this period. Discussions and documentation relating to these events and releases were participated in and reviewed.

- Software Release 3 (SR3) for EXPRESS/WORF/HRF
- HHR SPRs
- HHR informal testing of initial software release.
- HHR Software Release 5 (SR5)
- HHR Software Release 6 (SR6)
- HHR Software Release 7 (SR7)

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- HHR Software Release 8 (SR8)

The Microsoft Excel Spreadsheet that is used to track ESCP actions of SPRs was developed and maintained. This spreadsheet logs ESCP actions, imports information from the Boeing SPR database; logs comments from MSFC, ARC, and bd Systems personnel; and merges the data into a unified reference file. This reference file is used to track Boeing's actual and proposed disposition of SPRs for all racks (HHR, EXPRESS, WORF, and HRF).

SRB Activities

During this reporting period, bd Systems personnel participated in Boeing's Software Review Board (SRB) meetings. Software Problem Reports (SPRs), software build activities, software load requests, and the schedule of events for the PSIVF, RSTB, and ATB are discussed and dispositioned by the SRB. Major achievements accomplished during this reporting period are listed below:

- Planned the schedule of the ATB and RSTB to support the analysis of open HHR SPRs.
- Planned the schedule of the ATB and RSTB to support development of test procedures for the Software Release 5 (SR5) FQT.
- The schedule for the ATB and RSTB was planned to support the HHR regression testing of the 7-12-02 software version.
- Planned the schedule of the ATB and RSTB the development of test procedures for the Software Release 6 (SR6) FQT.
- The PSIVF schedule was planned to support development of flight products.
- The PSIVF schedule was planned to support formal software regression testing of sustaining Software Release 3 (SR3) for the EXPRESS 8/2 without ARIS rack.
- The PSIVF schedule was planned to support formal software regression testing of sustaining Software Release 3 (SR3) for the EXPRESS 8/2 with ARIS rack
- Planned the PSIVF schedule to support formal FQT of Software Release 3 (SR3) for the Window Observation Research Rack (WORF) rack.

PSIVF Activities

Participated in the planning and review for activities to develop software in the Payload Software Integration and Verification Facility (PSIVF).

- Flight software products development and testing.
- Development and formal regression testing of Software Release (SR3) for the EXPRESS/WORF/HRF racks.
- Investigation of on-orbit anomalies (as documented by Payload Anomaly Reports).
-

ATB/RSTB Activities

Participated in the planning and review of the schedule of software activities in the Avionics Test Bed (ATB) and Rack Software Test Bed (RSTB).

- Development of the RSTB laboratory.
- HHR initial software release testing.
- HHR Software Release 5 (SR5) development and testing.

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- HHR Software Release 7-12-02 (SR7-12-02) development and testing.
- HHR Software Release 6 (SR6) development.
- Analysis of HHR SPRs.

Meetings Supported
Several meeting were attended and supported in the performance of tasks for this reporting period.

- Supported an audit of Boeing's development and testing of the BRP Habitant Holding Rack (HHR) software. This audit was led by MSFC.
- Supported meetings to review the development of BRP HHR software. ED14 and ARC led this review.
- Supported meetings to discuss on-orbit operational activities and anomalies of racks on-orbit.
- Supported meetings to discuss sustaining activities for the EXPRESS/WORF/HRF racks.
- Prepared the presentation charts for the ED14 monthly EXPRESS project review.
- Attended the ED14 bi-weekly group meetings.
- Attended the FD31 weekly group meetings.
- Supported weekly BRP HHR telecommunications between Boeing, MSFC, and ARC.
- Supported BRP HHR TIMs at MSFC.
- Supported the Boeing Software Review Board (SRB) meetings.

On-Orbit Status
Six Experiment Racks (5 EXPRESS and 1HRF) have been installed on the International Space Station. Key events for the racks are listed below.

- The EXPRESS Rack 1 (ER1) was activated on 4-24-2001.
- The Human Research Facility 1 (HRF1) rack was activated on 5-18-2001.
- The EXPRESS Rack 2 (ER2) was activated on 5-24-2001.
- The EXPRESS Rack 5 (ER5) was launched on ISS mission 7A.1 on 8-10-01.
- The EXPRESS Rack 4 (ER4) was launched on ISS mission 7A.1 on 8-10-01.
- The EXPRESS Rack 4 (ER4) was activated on 8-21-2001.
- The EXPRESS Rack 1 (ER1) was loaded with Software Release 2 on 9-07-2001.
- The EXPRESS Rack 2 (ER2) was loaded with Software Release 2 on 9-19-2001.
- The EXPRESS Rack 4 (ER4) was loaded with Software Release 2 on 10-24-2001.
- The ISS crew for increment 4 was launched on ISS mission UF1 on 12-5-2001.
- The EXPRESS Rack 3 (ER3) was launched on ISS mission UF2 on 6-5-2002.
- The ISS crew for increment 5 was launched on ISS mission UF2 on 6-5-2002.
- The ISS crew for increment 6 was launched on ISS mission 11A on 11-23-2002.
- The Human Research Rack (HRF1) was loaded with   Software Release 2 on 12-6-2002.
- The EXPRESS Rack 5 (ER5) was loaded with Software Release 3 on 1-18-2003.
- The EXPRESS Rack 1 (ER1) was loaded with Software Release 3 on 1-20-2003.
- The EXPRESS Rack 4 (ER4) was loaded with Software Release 3 on 1-24-2003.
- The EXPRESS Rack 3 (ER3) was loaded with Software Release 3 on 1-27-2003.

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The racks are operating and providing platforms for on-orbit science experiments. The software is performing very well. Future software releases will implement SPRs and provide a more robust rack software operating systems.

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Acronyms

ARC	Ames Research Center
ARIS	Active Rack Isolation System
ATB	Avionics Test Bed
B-RIC	Biological Research Project Rack Interface Controller
BRP	Biological Research Project
C-RIC	Commercial Rack Interface Controller (derivative of the B-RIC)
CD(s)	Compact Disc(s)
COTR	Contracting Officers Technical Representative
CSCI(s)	Computer Software Configuration Item(s)
CWC(s)	Collaborative Work Commitment(s)
DCMA	Defense Contract Management Agency
DCPCG	Dynamically Controlled Protein Crystal Growth (UAB Experiment)
ECP	Engineering Change Proposal
ER(s)	EXPRESS Rack(s)
ESCP	EXPRESS Software Control Panel
EXPRESS	Expedite the Process of Experiments to Space Station
FAI	First Article Inspection
FEU(s)	Functional Equivalent Unit(s)
FQT	Functional Qualification Testing
GSE	Ground Support Equipment
HHR	Habitant Holding Rack
HRDL	High Rate Data Link
HRF	Human Research Facility
IA	Independent Assessment
IBR	Integrated Baseline Review
ID	Identification
IHI	Ishikawajima-Harima Heavy Industries Co. Ltd.
IDD	Interface Definition Document
IPR(s)	Interim Problem Report(s)
ISS	International Space Station
IT	Information Technology
IV&V	Independent Verification and Validation
JSC	Johnson Space Center
KSC	Kennedy Space Center
LaRC	Langley Research Center
LOD	Letter of Delegation
LSG	Life Sciences Glovebox
MSFC	Marshall Space Flight Center
NASA	National Aeronautics and Space Administration
NASDA	National Aerospace Development Agency of Japan
NC	Non Compliant
ON(s)	Operations Note(s)
OPMS	On-Line Project Management System (Oracle database)
ORD	Operational Readiness Date

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Acronyms
(Continued)

PAR(s)	Payload Anomaly Report(s)
PEP	Payload Experiment Processor
PEP	Performance Evaluation Profile
PIFL	Payload Integrated Flight Load
POIC	Payload Operations & Integration Center
PR(s)	Problem Report(s)
PSCP	Payload Software Control Panel
PSIVF	Payload Software Integration & Verification Facility
RIC(s)	Rack Interface Controller(s)
RID	Review Item Discrepancy
RSTB	Rack Software Test Bed
S&MA	Safety & Mission Assurance
SPR(s)	Software Problem Report(s)
SQA	Software Quality Assurance
SRB	Software Review Board
SSPCM(s)	Solid State Power Control Module(s)
TBD	To Be Determined
TBE	Teledyne Brown Engineering
TCP/IP	Transport Control Protocol/Internet Protocol
TIM	Technical Interchange Meeting
TRR	Test Readiness Review
UF	Unified Flight
WEI	Wildwood Electronics Inc.
WORF	Window Observation Research Rack