APPROVAL SHEET FOR SUSPENDED LOAD OPERATIONS

SLO-KSC -2008-001

TITLE: BM INTERFACE ADAPTER Attachng/Detaching, VE Transfer (LTA to ISS/ISS to LTA Position

DOCUMENT NUMBER/TITLE: JTP-624603, JTP-624606

PREPARED BY: JAXA JEM Development Project / S&MA DATE: Sep. 5 2008

REQUIRED APPROVAL

CONTRACTOR _____ DESIGN _____ R & QA _____ OPERATIONS _____ SAFETY

NASA _____ DESIGN _____ R & QA _____ OPERATIONS _____ SAFETY

TYPE OR PRINT NAME	SIGNATURE	ORG.	DATE
Koki Oikawa		JAXA JEM Prj	Sep. 5. 2008
Masayuki Ozawa		JAXA S&MA	Sep. 5, '08
Joe Degano		Boeing/SHEA	9-11-08
Jeffrey Bispham		Boeing/L&H	9-11-08
Paul Kirkpatrick		NASA GSRP	9/11/08
Jeff Beach		NASA Safety	9/12/08
Joe Torsani		KSC LDEM	12 SEP 08

CONTRACTOR DIRECTOR OF SAFETY

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NASA SUSPENDED LOAD OPERATION ANALYSIS/APPROVAL (SLOAA)

OPERATION:

1. To attach and detach BM Interface Adapter to/from JEM-EF (EF) BM.
2. To transfer Vision Equipment (VE) from LTA/ISS position to ISS/LTA position.

SUPPORTING DOCUMENTS:

The associated operational procedure/systems assurance analysis is as follows:

1. JTP-624603 BM INTERFACE ADAPTER Attaching/Detaching
2. JTP-624606 VE Transfer (LTA to ISS/ISS to LTA Position)
3. SAA21CRS1-001, 30 Ton High Bay Bridge Crane-Space Station Processing Facility (SSPF)

GENERAL DESCRIPTION:

●BM Interface Adapter Attachment and Detachment

1. 【BM Interface Adapter Attachment】

1-1 Transfer of BM Interface Adapter

(Condition)

After BM Interface Adapter is transferred to EF by High Bay Crane. See Figure1-1.
This task requires using UpRight and Stairs. See Figure1-2.

Operator1&2: Close and attach BM Interface Adapter near to EF BM by hands on UpRight or stairs. (BM Interface Adapter has self-alignment function.)

1-2 BM Interface Adapter Attachment

See Figure 1-3.
Operator1: Tighten nuts for 3 places by replacing stand-position under the load.
Nut for Bolt#4 from stand position under EF.
Nut for Bolt#1 from stand position on UpRight.
Nut for Bolt#2 from stand position on UpRight.
Operator2: Tighten nut for Bolt#3 from stand position on Stairs.
Operator3: Tighten bolts for four places from front using socket with extension on Stairs. See Figure 1-3.
Inspector: Watch whole operation sequences

2. 【BM Interface Adapter Detachment】

2-1 BM Interface Adapter Detachment

See Figure 1-3.

Operator1: Loosen nuts for 3 places by replacing stand-position under the load.
Nut for Bolt#4 from stand position under EF.
Nut for Bolt#1 from stand position on UpRight.
Nut for Bolt#2 from stand position on UpRight.

Operator2: Loosen nut for Bolt#3 from stand position on Stairs.

Operator3: Loosen bolts for four places from front using socket with extension on Stairs.
See Figure 1-3.

Inspector: Watch whole operation sequences

2-2 Transfer of BM Interface Adapter

Transfer BM Interface Adapter from EF by High Bay Crane. See Figure1-1.

Operator1&2: Detach and support BM Interface Adapter from EF BM by hands on UpRight or stairs.

These tasks are completed in the following JTP-624603 sequences:

- BM INTERFACE ADAPTER Attaching/Detaching

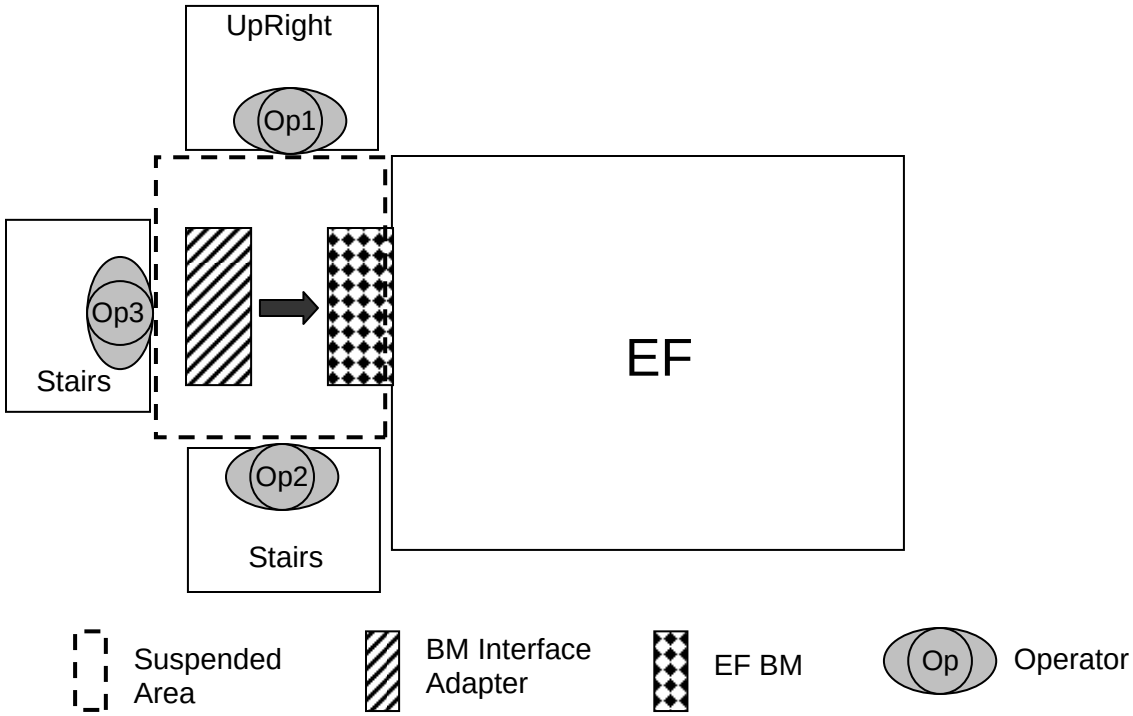


Figure 1-1 Operator layout for BM Interface Adapter Attachment/Detachment

UpRight (Tiger)

Stairs (6.5feet)

Stairs (4feet)

Figure 1-2 UpRight and Stairs

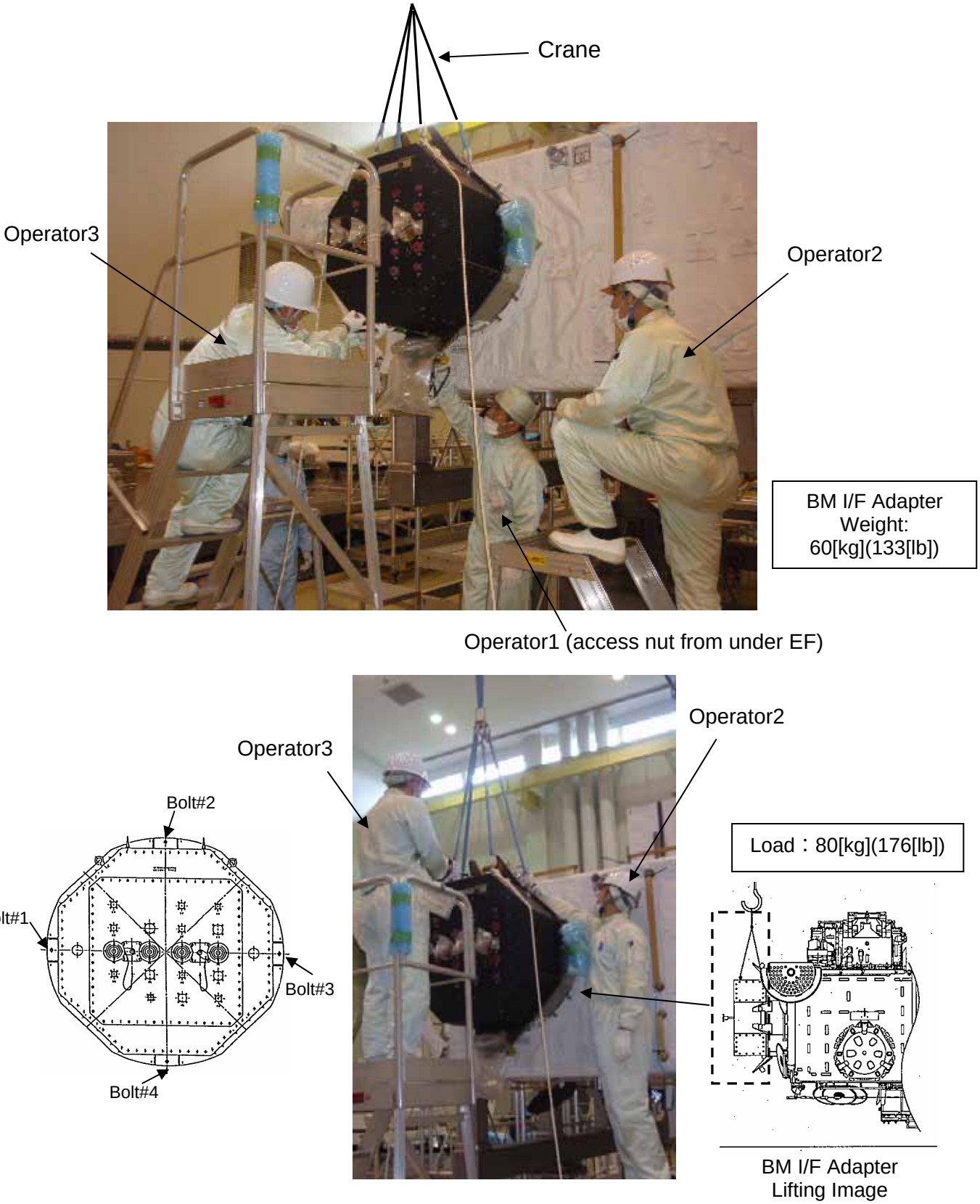


Figure 1-3 BM Interface Adapter Attachment/Detachment

GENERAL DESCRIPTION:

●VE Transfer to ISS/LTA position from LTA/ISS position
Note: All operators handle VE under lifting device.

1. 【VE Transfer to ISS/LTA from LTA/ISS position】

1-1 Setup of Vision Equipment Lifting Kit on VE

See Figure2-1.

(Condition) After High Bay Crane is connected to Vision Equipment Lifting Kit.

Operator1: Hold support plate of lifting kit (passive side) on VE under the load.
Operator3: Attach the other support plate of lifting kit (active side) to passive side by holding bars under the load.
Operator2&4: Hold support plate of lifting kit (active side) by holding bars and watch clearance between VE and Vision Equipment Lifting Kit under the load.
Any Operator (One): Loosen EVA bolts on VE under the load.
Inspector: Watches whole operation sequence.

2. 【Installation of VE in ISS/LTA position】

2-1 VE Installation on Attach Plate

See Figure2-1

(Condition) After VE is transferred to ISS/LTA from LTA/ISS position by High Bay Crane.

Operator1&2: Support VE to install on attach-plate of ISS/LTA position under the load.
Operator3: Watch clearance between VE and attach-plate of ISS/LTA position.
Operator4: Standby
Inspector: Watch whole operation sequence.

2-2 EVA Bolt Tightening

Operator1: Tighten EVA bolts under the load. See figure2-2.
Operator2 to 4: Stand by.
Inspector: Watch whole operation sequence, and perform torque check following operation procedure.

2-3 Disassembly of Vision Equipment Lifting Kit

See Figure2-1

Operator1: Hold support plate of lifting kit (passive side) on VE.

Operator3: Detach the other support plate of lifting kit (active side) from passive side by holding bars.

Operator2&4: Hold support plate of lifting kit (active side) by holding bars and watch clearance between VE and Vision Equipment Lifting Kit.

Inspector: Watch whole operation sequence.

2-4 Reassembly of Vision Equipment Lifting Kit

(Condition) After VE is set in ISS/LTA position and Lifting Kit is moved from above VE.

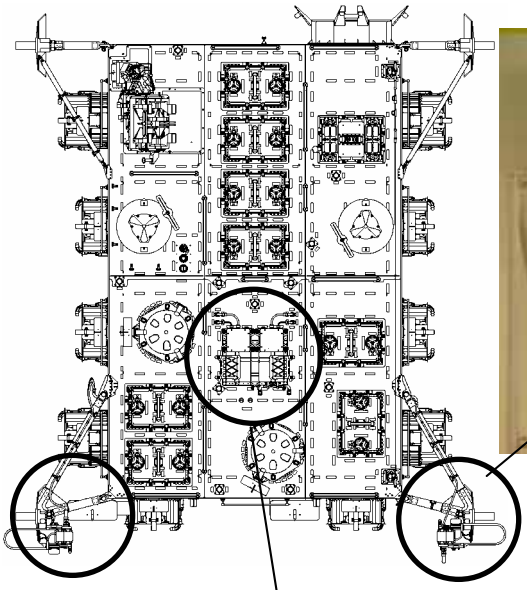
Operator1&2: Reassemble Vision Equipment Lifting Kit.

Operator3&4: Stand by.

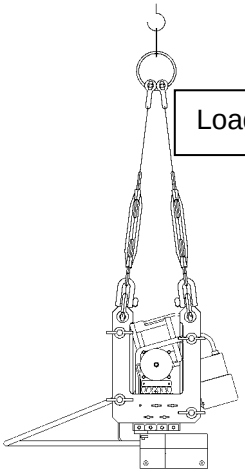
Inspector: Watch whole operation sequence.

These tasks are completed in the following JTP- 624606 sequences:

- VE Transfer LTA to ISS Position
- VE Transfer ISS to LTA Position



For both ISS position



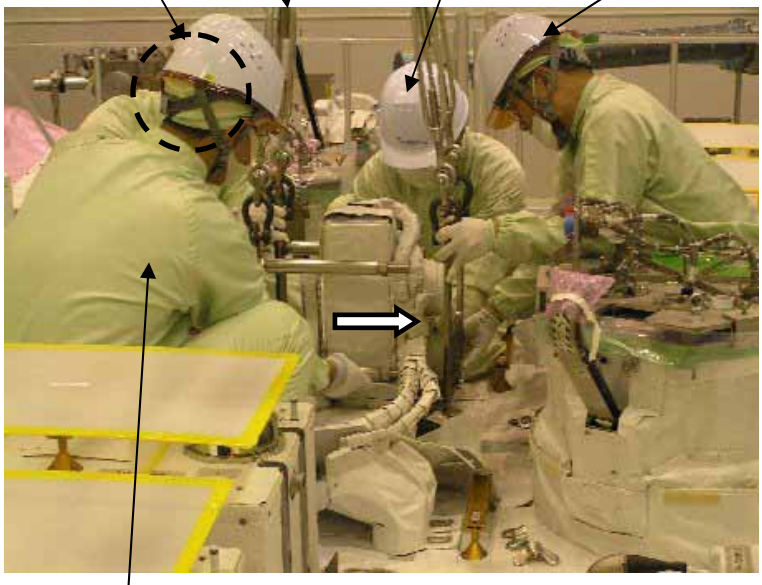
Load：62[kg] (136[lb])

VE Lifting Image

Operator3

Operator4

Operator1



Operator2

For LTA position

Support plate (active side)

Support plate (passive side)

Bars (4places)

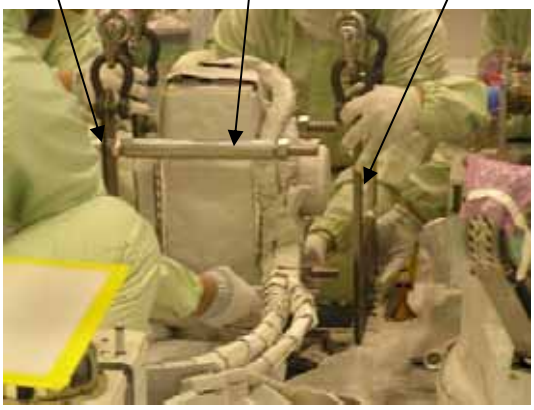


Figure 2-1 Operator layout for VE Transfer to ISS/LTA from LTA/ISS position

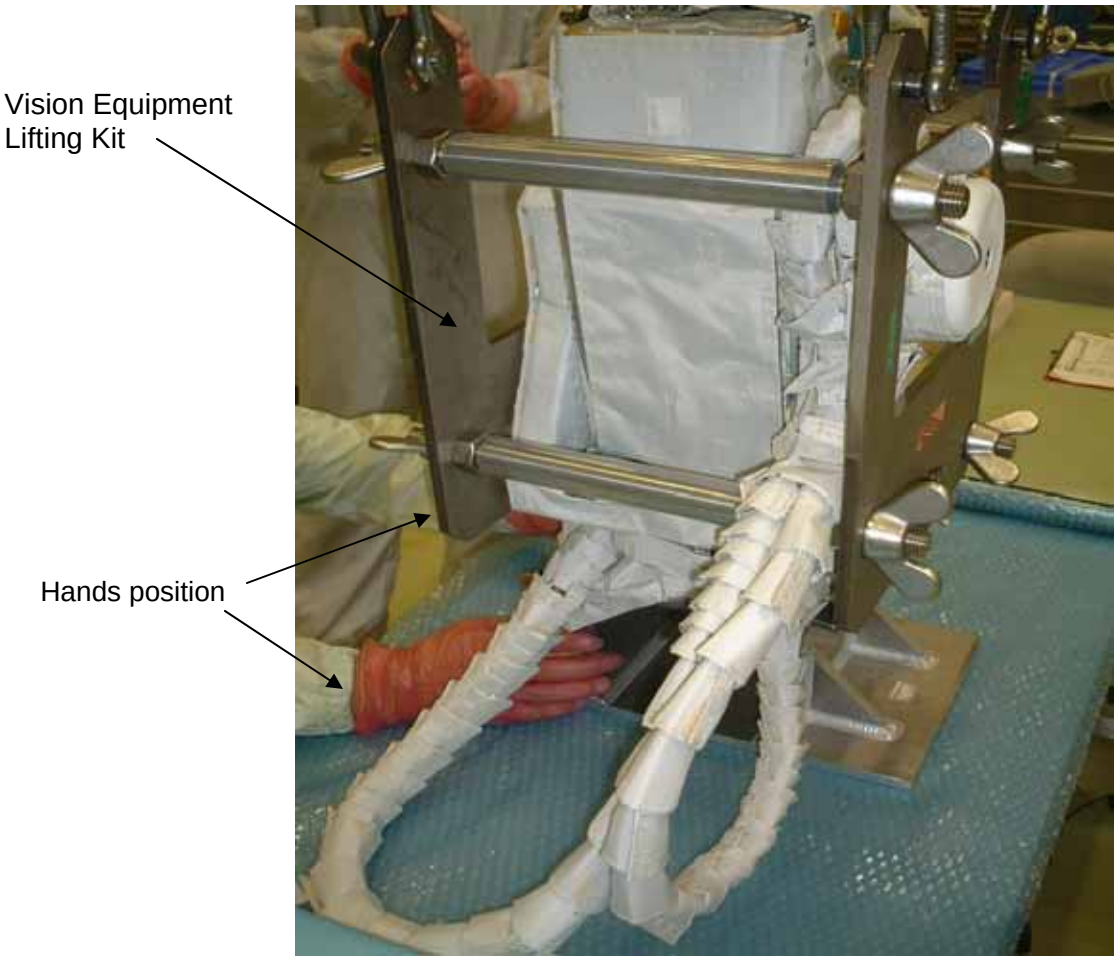


Figure 2-2 Hand position of EVA Bolt Tightening

Note: The location of VE will be changed at KSC so as to be on either LTA or ISS position.

RATIONAL/ANALYSIS:
The suspended load tasks comply with the NASA Alternate Safety Standard for Suspended Load Operations as follows:

Alternate Standard Requirement #1a:
These operations cannot be conducted without placing personnel or hands under the suspended

-BM Interface Adapter during BM Interface Adapter Attachment and Detachment operations. See Figure 1-1.

-Vision Equipment Lifting Kit and VE during lifting device assembling.

It has been determined that there are no design, procedural, or operational means to eliminate personnel exposure to a suspended load, without exposing flight hardware to unacceptable damage.

Alternate Standard Requirement #1b:

1. The possible use of a secondary support system to catch the load in the event of a crane failure was analyzed. It was determined use of a secondary support system was not feasible because of positioning of
   -the BM Interface Adapter under the crane. See Figure 1-2.
   -the Vision Equipment Lifting Kit under the crane. See Figure 2-1.

Alternate Standard Requirement #1c:

●BM Interface Adapter Attachment and Detachment

1. The maximum number of personnel allowed under the load during backup operation of nut on BM Interface Adapter and support of BM Interface Adapter is one. See Figure 1-2.

●VE Transfer from LTA/ISS position to ISS/LTA position

1. The maximum number of personnel allowed under the load during assembling of Vision Equipment Lifting Kit on VE is four. See Figure 2-1.
2. The maximum number of personnel allowed under the load during loosening and tightening EVA bolts on attach-plate is one for each operation. See Figure 2-2.
3. The maximum number of personnel allowed under the load during disassembling of Vision Equipment Lifting Kit on VE is four. See Figure 2-1.
4. The maximum number of personnel allowed under the load during re-assembling of Vision Equipment Lifting Kit after VE installation is four. See Figure 2-1.

Alternate Standard Requirement #1d:

●BM Interface Adapter Attachment and Detachment

1. Having backup nut will be accomplished as quickly and safely as possible to minimize exposure time.

   To have backup for one nut under suspended load: 10 minutes

●VE Transfer from LTA/ISS position to ISS/LTA position

1. Assembling of Vision Equipment Lifting Kit on VE will be accomplished as quickly and safely as possible to minimize exposure time.
   To assemble Vision Equipment Lifting Kit on VE under suspended load: 30 minutes

2. Loosening and tightening EVA bolts on attach-plate will be accomplished as quickly and safely as possible to minimize exposure time.
   To loosen and tighten EVA bolts on VE attach-plate under suspended load: 15 minutes

3. Disassembling of Vision Equipment Lifting Kit on VE will be accomplished as quickly and safely as possible to minimize exposure time.
   To disassemble of Vision Equipment Lifting Kit on VE under suspended load: 15 minutes

4. Re-assembling of Vision Equipment Lifting Kit after VE installation will be accomplished as quickly and safely as possible to minimize exposure time.
   To reassemble of Vision Equipment Lifting Kit under suspended load: 15 minutes

Alternate Standard Requirement #2: Suspended load operations are reviewed and approved on a case-by-case/specific need basis - see General Description and Alternate Standard Requirement #1.

Alternate Standard Requirement #3: Only those suspended load operations approved by the NASA Safety and Mission Assurance Division Chief will be permitted. The NASA Safety and Mission Assurance Division will maintain a list of approved suspended load operations.

Alternate Standard Requirement #4: The work authorizing documents are written to allow only required personnel under the suspended load. The work authorizing documents are available on site for inspection during the operation.

Alternate Standard Requirement #5: A new suspended load operation not covered by this SLOAA, deemed necessary due to unusual or unforeseen circumstances where real time action is required, shall be documented and approved by the NASA Safety and Mission Assurance Division Chief.

Alternate Standard Requirement #6: The suspended load operations addressed in this analysis involve the 30 ton SSPF bridge crane. The crane is designed, tested, inspected, maintained, and operated in accordance with the NASA Standard for Lifting Devices and Equipment, NASA-STD-8719.9.

The SSPF Highbay 30 ton crane hoists are equipped with two magnetic holding brakes, each capable of holding the load up to the crane's rated capacity. Each brake's ability to hold the rated load (30 tons) is verified annually. The cranes are designed to meet a 5 to 1 safety factor based on ultimate strength for the hoist load bearing components. The 30 ton cranes are load tested annually at 100% of their rated capacities. Detailed preventive maintenance is performed monthly, quarterly, semiannually, and annually on the cranes to ensure proper operation. Nondestructive testing of the crane hooks is performed annually.

Alternate Standard Requirement #7: An SAA has been completed on the 30 ton bridge crane in the SSPF. The SAA includes a Failure Modes and Effects Analysis/Critical Items List (FMEA/CIL) and a hazard analysis (see supporting documents). No critical single failure points were identified during this analysis

Alternate Standard Requirement #8: Visual inspections for cracks or other signs of damage or anomalies are performed on the hoist hooks, hoist beams, hoist cables, hoist rod assemblies, and hoist fittings, and crane functional checks are performed before each operation per NASA-STD-8719.9.

Alternate Standard Requirement #9: Trained and licensed crane operators shall remain at the hoist controls while personnel are under the load.

Alternate Standard Requirement #10: Appropriate safety control areas are established before initiating operations. Only the minimum number of people will be permitted in this area.

Alternate Standard Requirement #11: A pretask briefing and a safety walkdown of the area will be conducted prior to the lift to ensure that all systems and personnel are ready to support. All participants are instructed on their specific tasks and warned of potential hazards. Following any crew change, the new personnel are instructed by the task leader on their specific tasks and warned of any hazards involved.

These tasks described above are completed in following procedure;

JTP-624603

- BM INTERFACE ADAPTER Attaching/Detaching

JTP- 624606 sequences:

- VE Transfer LTA to ISS Position
- VE Transfer ISS to LTA Position

Alternate Standard Requirement #12: The person beneath the suspended load will be in voice contact with the hoist operator and/or task leader. Upon loss of communication, the operation shall stop immediately, personnel shall clear the hazardous area, and the load shall be safed. Operations shall not continue until communications are restored.

Alternate Standard Requirement #13: Personnel working beneath the load shall be in continuous sight of the hoist operator and/or task leader.

Alternate Standard Requirement #14: The NASA Safety and Mission Assurance Division shall conduct periodic reviews to ensure the continued safety of suspended load procedures.

Alternate Standard Requirement #15: The NASA Safety and Mission Assurance Division will provide copies of approved SLOAAs, a list of approved suspended load operations, a list of cranes/hoists used for suspended load operations and copies of the associated FMEA/CIL and hazards analyses to NASA Headquarters.

APPROVAL: DATE:

Maynette Smith 9/12/08

Maynette Smith

Chief, ISS/Payload Processing Safety and Mission Assurance Division
Kennedy Space Center