

APPROVAL SHEET FOR SUSPENDED LOAD OPERATIONS

SLO-KSC -2008-002

TITLE ELM-ES Crane Operation,
ELM-ES / Payload Installation

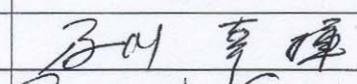
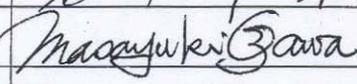
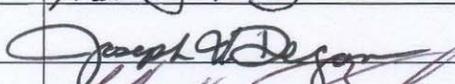
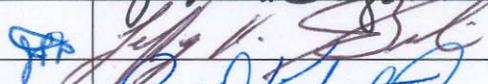
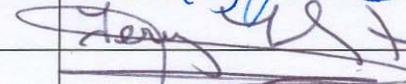
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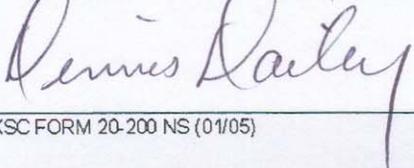
REQUIRED APPROVAL

CONTRACTOR _____ DESIGN _____ R & QA _____ OPERATIONS _____ SAFETY

NASA _____ DESIGN _____ R & QA _____ OPERATIONS _____ SAFETY

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NASA SUSPENDED LOAD OPERATION ANALYSIS/APPROVAL (SLOAA)

OPERATION:

1. To assemble ELM-ES Hanger to ELM-ES two Primary trunnions and keel trunnion.
2. To adjust Turnbuckle of ELM-ES Hanger
3. To check the physical interface of between ELM-ES Scuff plate and Assembly / Inspection Stand.
4. To disassemble ELM-ES Hanger from ELM-ES two Primary trunnions and keel trunnion.
5. To check the connect condition of UCM umbilical Connector.

SUPPORTING DOCUMENTS:

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

1. JTP-654004 ELM-ES / Payload Installation
2. JTP-654010 ELM-ES Crane Operation
3. SAA21CRS1-001, 30 Ton High Bay Bridge Crane-Space Station Processing Facility (SSPF)

GENERAL DESCRIPTION:

1. 【ELM-ES hanger Assembly】

1-1 ELM-ES hanger Assembly to Primary and Keel trunnion

See Figure 1-1.

Operator1: Assemble ELM-ES hanger to ELM-ES Primary trunnion by hands under ELM-ES Hanger. (Operator2&3: Standby)

Operator2: Assemble ELM-ES hanger to ELM-ES Primary trunnion by hands under ELM-ES Hanger. (Operator1&3: Standby)

Operator3: Assemble ELM-ES hanger to ELM-ES Keel trunnion by hands under ELM-ES Hanger. (Operator1&2: Standby)

1-2 Turn Buckle Adjustment

See Figure 1-2.

Operator1: Adjust turnbuckle under ELM-ES Hanger. (Operator2: Standby)

Operator2: Adjust turnbuckle under ELM-ES Hanger. (Operator1: Standby)

1-3 Physical Interface Check between ELM-ES Scuff plate and Assembly / Inspection Stand

See Figure 1-3.

Operator1: Check the physical interface between ELM-ES Scuff plate and Assembly / Inspection Stand under ELM-ES Hanger when lifting ELM-ES from Assembly / Inspection Stand. (Operator2&3: Standby)

Operator2: Check the physical interface between ELM-ES Scuff plate and Assembly / Inspection Stand under ELM-ES Hanger when lifting ELM-ES from Assembly / Inspection Stand. (Operator1&3: Standby)

Operator3: Check the physical interface between ELM-ES Scuff plate and Assembly / Inspection Stand under ELM-ES Hanger when lifting ELM-ES from Assembly / Inspection Stand. (Operator1&2: Standby)

2. 【ELM-ES hanger Disassembly】

2-1 ELM-ES hanger Disassembly

See Figure 1-1.

Operator1: Disassemble ELM-ES hanger from ELM-ES Primary trunnion by hands under ELM-ES Hanger. (Operator2&3: Standby)

Operator2: Disassemble ELM-ES hanger from ELM-ES Primary trunnion by hands under ELM-ES Hanger. (Operator1&3: Standby)

Operator3: Disassemble ELM-ES hanger from ELM-ES Keel trunnion by hands under ELM-ES Hanger. (Operator1&2: Standby)

3. 【EF Payload Installation】

3-1 EF Payload Installation

See Figure 3-1.

Operator1: Install EF Payloads to ELM-ES, check the connect condition of UCM umbilical connector under the Payload Handling jig and EF Payload.

These tasks are completed in the following JTP-654010 sequences:

- Attachment of ELM-ES Hanger to ELM-ES
- Adjustment of ELM-ES Hanger's turnbuckle
- Transfer of ELM-ES to Assembly / Inspection Stand from Container Base Unit
- Gap check of between scuff plate and Assembly / Inspection Stand
- Detachment of ELM-ES Hanger from ELM-ES

These tasks are completed in the following JTP-654010 sequences:

- Attachment of ELM-ES Hanger to ELM-ES
- Adjustment of ELM-ES Hanger's turnbuckle
- Gap check of between scuff plate and Assembly / Inspection Stand
- Transfer of ELM-ES to CEWS from Assembly / Inspection Stand
- Detachment of ELM-ES Hanger from ELM-ES

These tasks are completed in the following JTP-654004 sequences:

- Install of SEDA-AP to ELM-ES PAM#2 from dolly
- Install of MAXI to ELM-ES PAM#3 from dolly
- Install of ICS-EF to ELM-ES PAM#1 from dolly



Trunnion (Primary Trunnion)

Note: Operator layout will be changed at KSC so as to be on proper position as below.

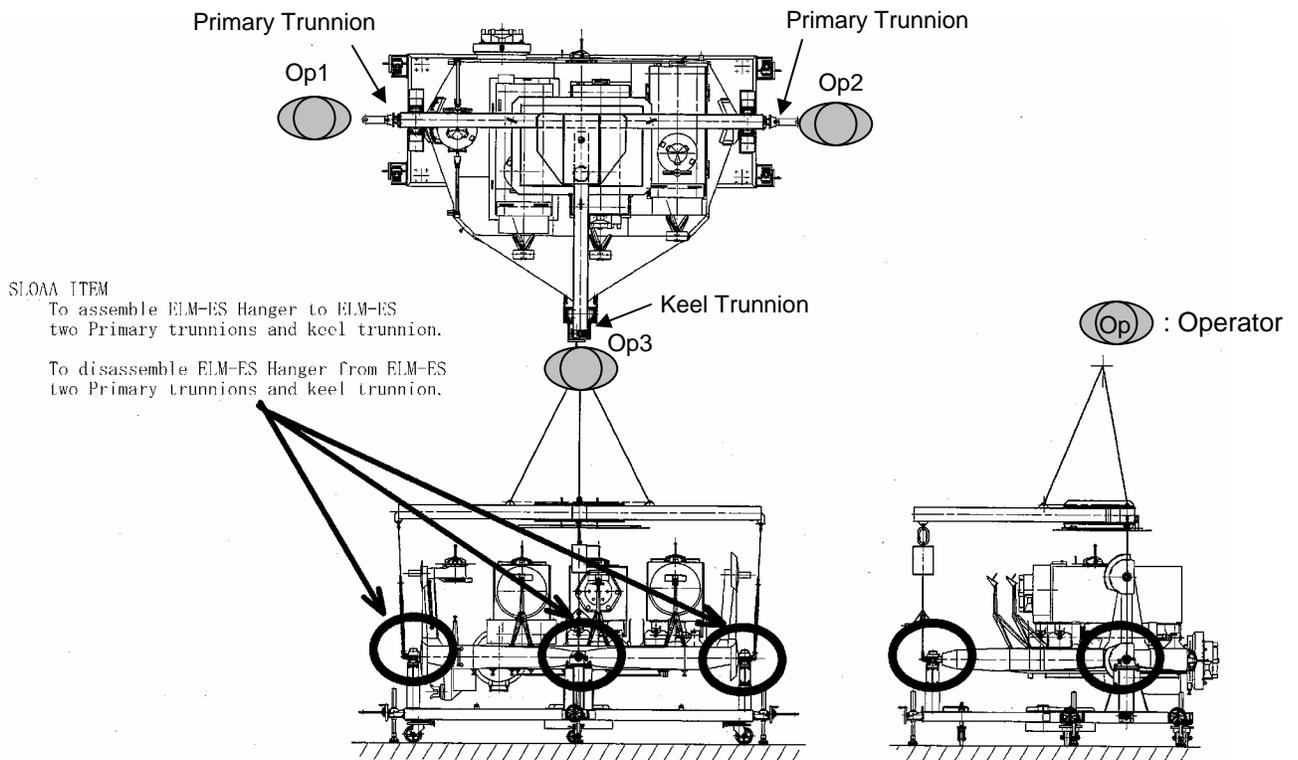
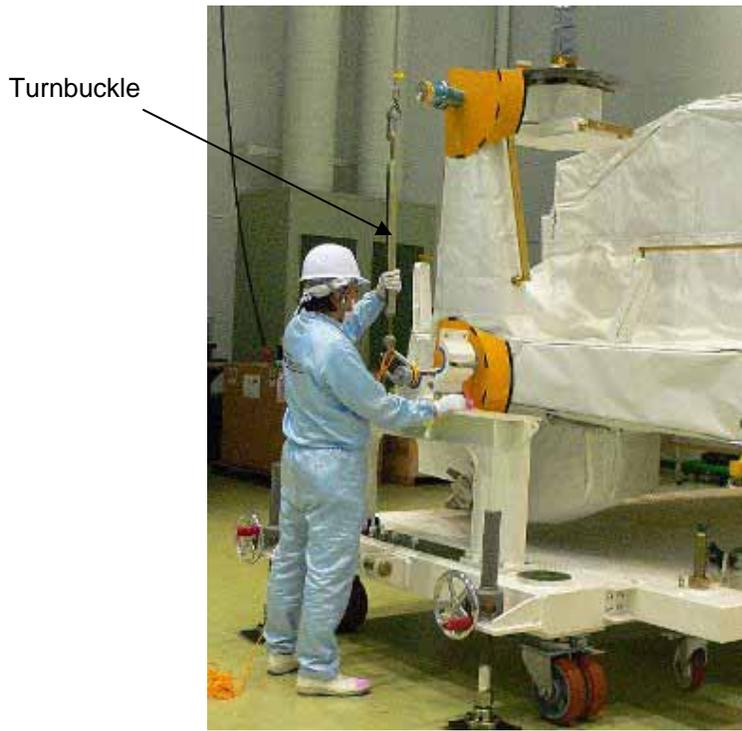


Figure 1-1 ELM-ES hanger Assembly to Primary and Keel trunnion



SLOAA ITEM

To assemble ELM-ES Hanger to ELM-ES
two Primary trunnions and keel trunnion.

To disassemble ELM-ES Hanger from ELM-ES
two Primary trunnions and keel trunnion.

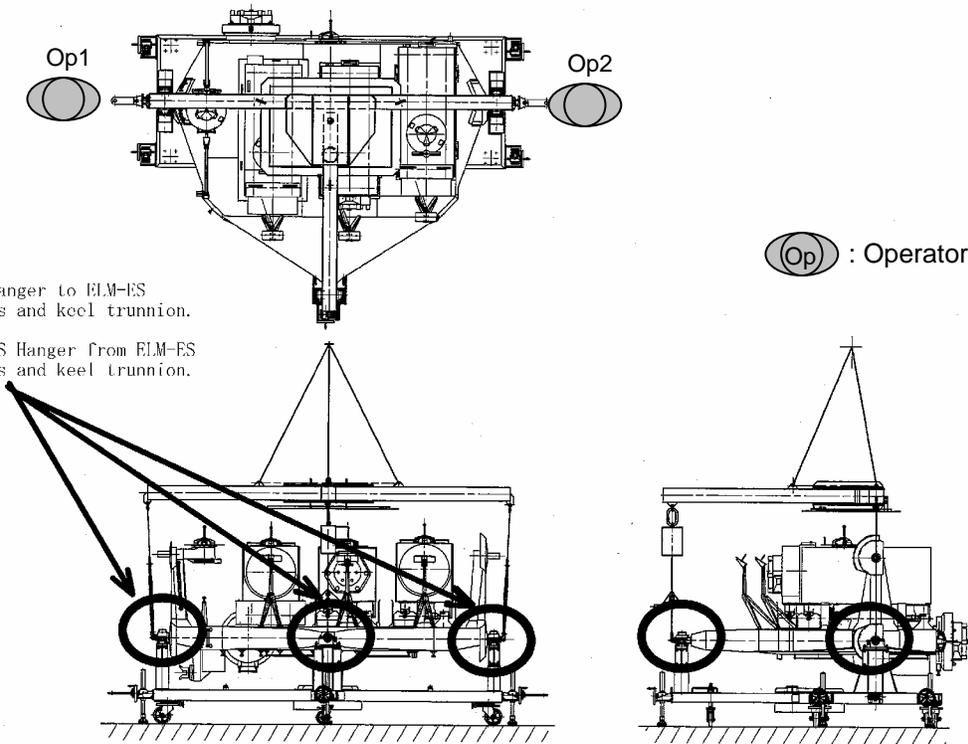


Figure 1-2 Turn Buckle Adjustment

Primary Trunnion
(2places for both side)



Scuff plate

Assembly / Inspection Stand

SLOAA ITEM

To assemble ELM-ES Hanger to ELM-ES
two Primary trunnions and keel trunnion.

To disassemble ELM-ES Hanger from ELM-ES
two Primary trunnions and keel trunnion.

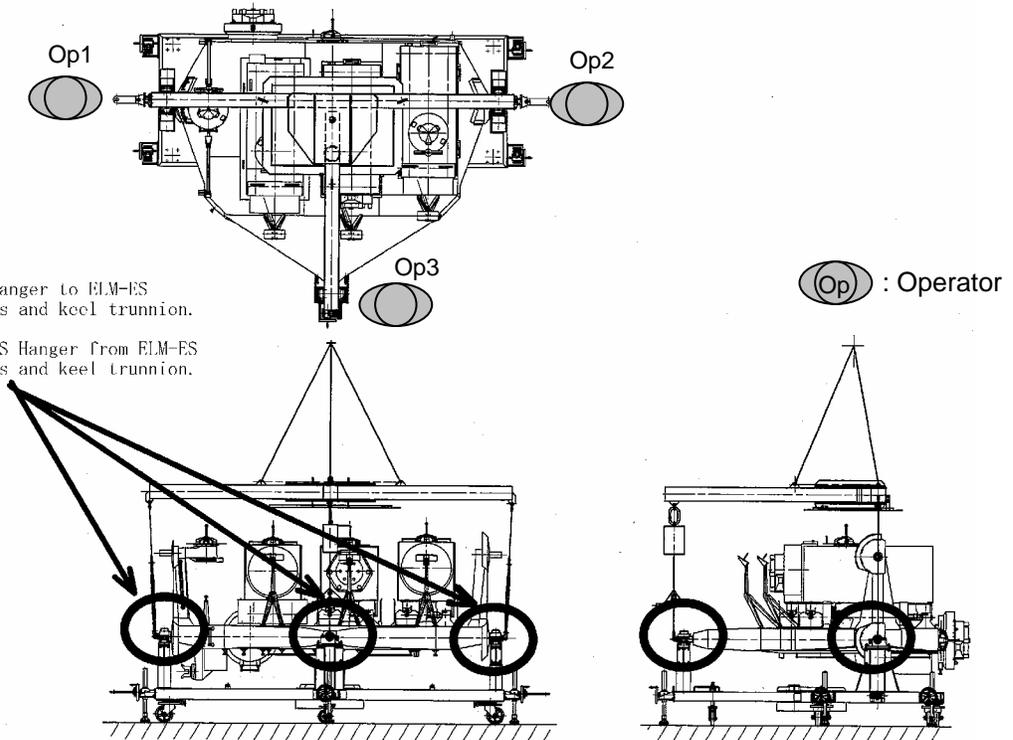
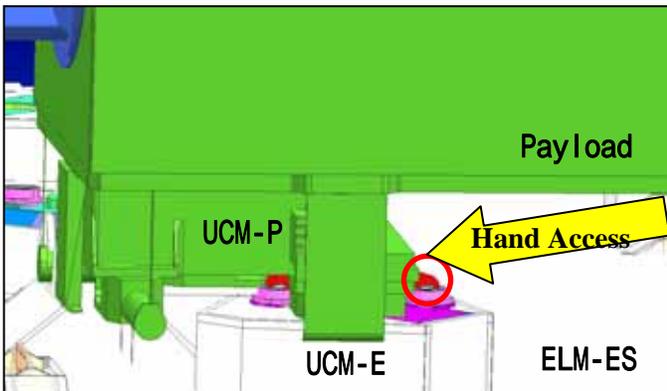
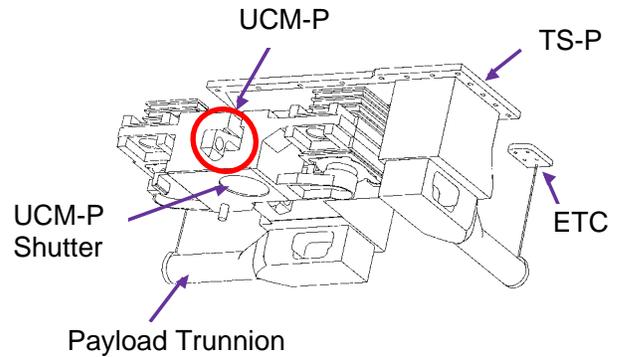


Figure 1-3 Physical Interface Check between ELM-ES Scuff plate and Assembly / Inspection Stand

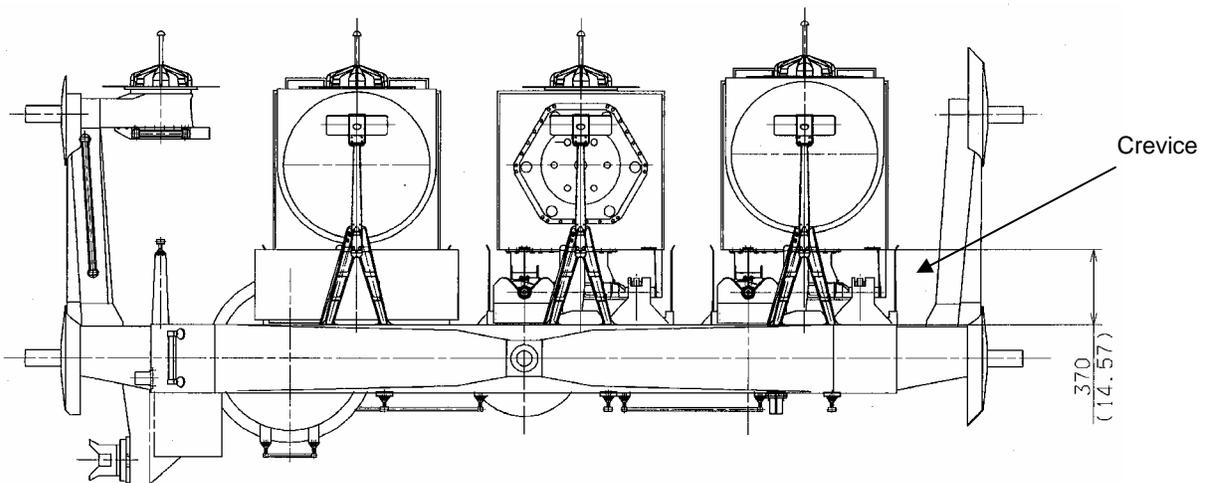


Hand Access Point



Detail of PAM-PU

Note: Round point is fine adjustment mechanism for UCM.
The operation to check the connect condition of UCM umbilical connector requires SLOAA, because there is a possibility that worker accesses the round point by hand to adjust UCM connection.
But It is no fear that worker squeezes his hand because he does not insert his hand between contacting faces.



Unit: mm (inch)

Figure 3-1 (1/2) EF Payload Installation

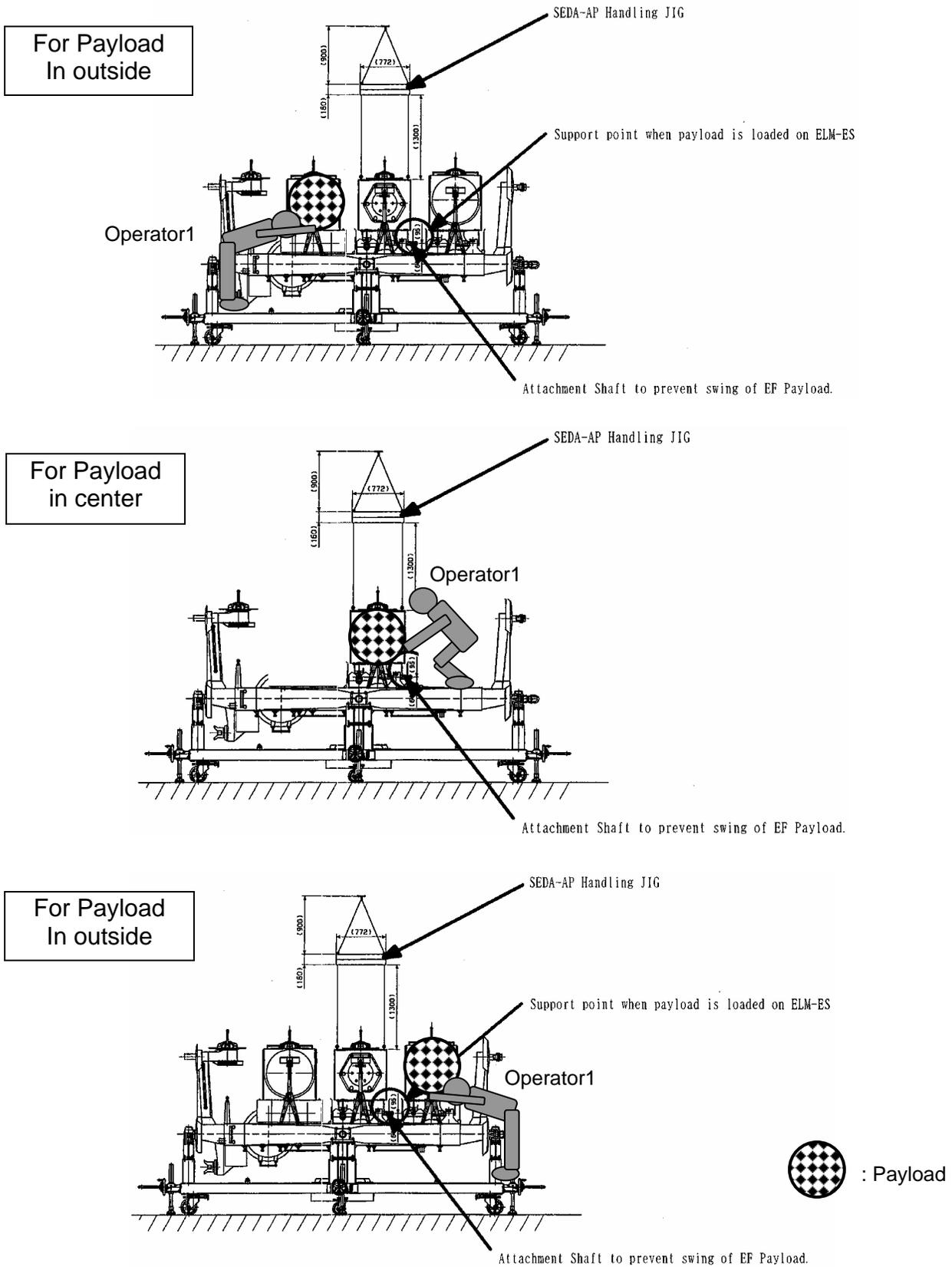


Figure 3-1 (2/2) Operator Layout EF Payload Installation

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. See Figure1-1, Figure 1-2, Figure 1-3 and Figure3-1.

- ELM-ES Hanger during assembling ELM-ES Hanger to ELM-ES.
- ELM-ES Hanger during adjusting turnbuckle of ELM-ES Hanger.
- ELM-ES Hanger during gap check between Scuff plate and Assembly / Inspection Stand.
- ELM-ES Hanger during disassembling ELM-ES Hanger from ELM-ES.
- SEDA-AP Handling Jig during SEDA-AP install to ELM-ES.
- MAXI Handling Jig during MAXI install to ELM-ES.
- ICS-EF Handling Jig during ICS-EF install to ELM-ES.

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:

The possible use of a secondary support system to catch the load in the event of a crane failure was analyzed.

Since there is a crevice, worker can evacuate immediately and avoid damage during EF Payload Installation. See Figure 3-1.

- the ELM-ES Hanger under the crane.
- the Bottom of EF Payload under the crane.

Alternate Standard Requirement #1c:

1. The maximum number of personnel allowed under the load during attaching ELM-ES Hanger to ELM-ES is one.
2. The maximum number of personnel allowed under the load during adjusting turnbuckle of ELM-ES Hanger is one.
3. The maximum number of personnel allowed under the load during checking physical interface between Scuff plate and Assembly / Inspection Stand is one.
4. The maximum number of personnel allowed under the load during detaching ELM-ES Hanger from ELM-ES is one.
5. The maximum number of personnel allowed under the load during checking the connect condition of UCM umbilical Connector is one.

Alternate Standard Requirement #1d:

1. Assembling of ELM-ES Hanger on ELM-ES will be accomplished as quickly and safely as possible to minimize exposure time.
To assemble of ELM-ES Hanger on ELM-ES under suspended load: 5 minutes
2. Adjusting Turnbuckle of ELM-ES Hanger will be accomplished as quickly and safely as possible to minimize exposure time.
To adjust operation under suspended load: 15 minutes
3. Disassembling of ELM-ES Hanger on ELM-ES will be accomplished as quickly and safely as possible to minimize exposure time.
To disassemble of ELM-ES Hanger on ELM-ES under suspended load: 5 minutes
4. Checking of physical interface between scuff plate and Assembly / Inspection Stand will be accomplished as quickly and safely as possible to minimize exposure time.
To check of physical interface under suspended load: 15 minutes
5. Checking of connect condition of UCM umbilical Connector will be accomplished as quickly and safely as possible to minimize exposure time.
To check of connect condition of UCM umbilical Connector under suspended load:
3 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.

These tasks are completed in the following JTP-654010 sequences:

- Attachment of ELM-ES Hanger to ELM-ES
- Adjustment of ELM-ES Hanger's turnbuckle
- Transfer of ELM-ES to Assembly / Inspection Stand from Container Base Unit
- Gap check of between scuff plate and Assembly / Inspection Stand
- Detachment of ELM-ES Hanger from ELM-ES

These tasks are completed in the following JTP-654010 sequences:

- Attachment of ELM-ES Hanger to ELM-ES
- Adjustment of ELM-ES Hanger's turnbuckle
- Gap check of between scuff plate and Assembly / Inspection Stand
- Transfer of ELM-ES to CEWS from Assembly / Inspection Stand
- Detachment of ELM-ES Hanger from ELM-ES

These tasks are completed in the following JTP-654004 sequences:

- Install of SEDA-AP to ELM-ES PAM#2 from dolly
- Install of MAXI to ELM-ES PAM#3 from dolly
- Install of ICS-EF to ELM-ES PAM#1 from dolly

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.

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.

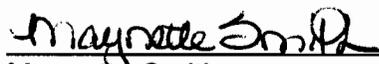
Alternate Standard Requirement #13: Personnel working beneath the load shall be in continuous sight of the hoist operator and/or task leader.

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

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