



**Aerospace
Systems Division**

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Evaluation of the Use of the
Lunar Support Leg to Lift
the LSM from Pallet No. 1

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This is an unscheduled ATM dealing with the test and evaluation of the Lunar Surface Magnetometer (LSM) removal concept proposed by NASA (ARC)/Philco. Following vibration testing of the LSM at BxA, a Mission and Crew Engineering test subject evaluated the use of the topmost Lunar Support Leg to lift the LSM from Pallet I.

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A. Test Description

1. Hardware - Philco structural model of the Lunar Surface Magnetometer, Mission and Crew Engineering mockup of the Tie-Down Release Tool, and Prototype model of Pallet I.
2. Facilities - Shirt sleeve manipulation, conducted with the uninflated space suit glove.
3. Procedures - The Tie-Down Release Tool was used to unfasten the two Calfax fasteners which attach the Sensor Boom Retaining Collar to ALSEP Pallet No. 1. Since the foam inserts were glued together within the Sensor Boom Retaining Collar, assistance was required to deploy the topmost Lunar Support Leg. The EGFU Release Tool was next pulled upward, rotated 1/4 turn CCW, removed from the EGFU, and discarded. Finally, the topmost Lunar Support Leg was used as a handle to lift the LSM from the pallet.

B. Results and Recommendations

No difficulty was encountered in the release of the Calfax fasteners, the deployment of the Lunar Support Leg, or the operation and removal of the EGFU Release Tool. However, the Lunar Support Leg and the EGFU Release Tool are stowed about 18 inches from the lunar surface, and working at this height could cause balance problems for the suited astronaut. The removal of the Sensor Boom Retaining Collar could not be evaluated because it was glued together with dental cement so that it would survive the vibration testing.

The use of the topmost Lunar Support Leg to lift the LSM from the pallet was unsatisfactory for several reasons. Firstly, there was a tendency for the glove to slip along the surface of the leg, preventing a firm grip. When the concept of using the leg as a handle was first discussed, a request was made that the surface be knurled to prevent such slippage, but this was never done. Secondly, there was some concern that the forces generated by the astronaut on the leg could break the detent or the hinge that attaches the leg to the EGFU. Thirdly, the leg is not over the center of gravity and the angle at which the leg projects from the EGFU makes the task of lifting the LSM off the pallet extremely difficult. Since the LSM must be lifted straight up to clear the pins that hold the EGFU on



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the pallet, the angle of the leg with respect to the pins offers the astronaut absolutely no indication of whether or not he is lifting straight up or binding against the pins. Hence, the astronaut must exert a constant upward force on the leg, shaking it back and forth in a random manner until the force exerted just happens to be in the right direction so that the EGFU can be lifted off the pins. Fourthly, the tolerances between the pins and the EGFU hard points are too tight to permit ready removal of the LSM from the pallet even with the use of a dry lubricant. In summation, from the astronaut viewpoint, a suitable handle should be located over the CG and looser tolerances should be provided.

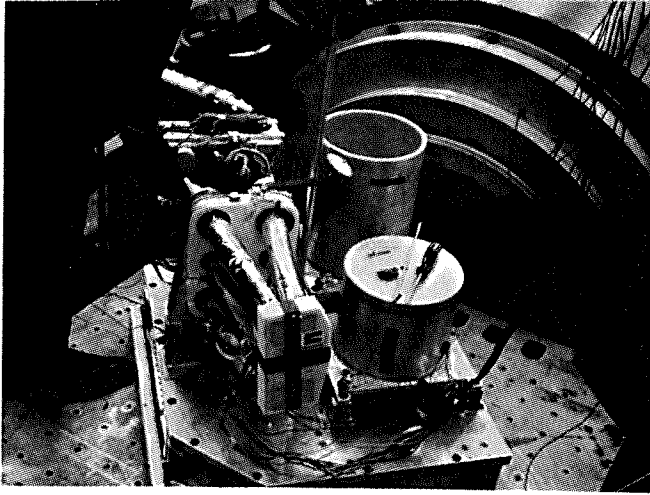


FIGURE #1

Tie-Down Release Tool being used to release the Calfax fasteners which attach the Sensor Boom Retaining Collar to ALSEP Pallet No. 1.

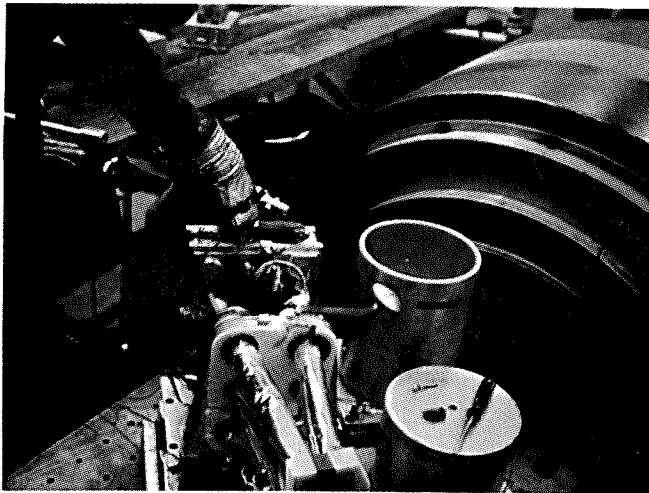


FIGURE #2

EGFU Release Tool being used to release the EGFU from Pallet No. 1.

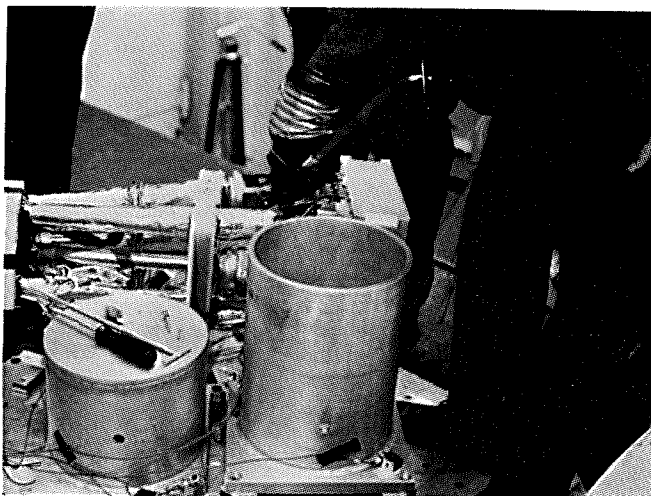


FIGURE #3

Topmost Lunar Support Leg being used to lift the Magnetometer Experiment from Pallet No. 1.