Bendix

Aerospace Systems Division

Crew Engineering Evaluation of the Array E - LMS Experiment Crew Engineering Model

NO.	REV. NO.
ATM-960	

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A. INTRODUCTION

On January 22, 1971 the BxA Crew Engineering Group performed a 1G, space-suited deployment test of the Array E - LMS Experiment.

For this purpose a Crew Engineering Model was designed and fabricated from unreleased drawings.

The Crew Model was equipped with an Engineering Model type UHT carry socket. The 15° bubble level and the breakseal were simulated by mockups.

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B. HARDWARE USED

- LMS Crew Engineering Model
- Array E SP #1 Volume Model (wooden and foam core mockups) with LMS tie-down bracket mockups.
- UHT

C. TEST FACILITIES

Crew Engineering Laboratory, Plant 2.

D. TEST PROCEDURE

As described in the present Array E deployment procedure, the LMS Experiment was removed from SP #1 and deployed by the space-suited engineer in the following steps.

1. The subject engaged the UHT in the 45° LMS carry socket (See Picture No. 1.)
2. Using the UHT the subject lifted the LMS experiment from the SP #1 Mockup and carried it out to the simulated deployment site.
3. Before lowering the experiment to the floor the test subject rotated the LMS approximately 90° using the UHT.
4. The test subject then lowered the LMS to the floor (See Picture No. 2).
5. The subject simulated leveling (± 15°) with the UHT, and removed the UHT from the socket.
6. The UHT was engaged in the sensor breakseal UHT socket and breaking of the seal was simulated. (See Picture No. 3).
7. Breakseal removal from the UHT, using the thermal glove, was carried out. (See picture No. 4).
8. Releveling of experiment, if required, would be the final step.

E. RESULTS AND CONCLUSIONS

1. The 45° UHT carry socket is acceptable for UHT engagement and experiment removal from SP #1, but a means of preventing movement of the LMS on the brackets during UHT engagement must be provided.

2. A 90° swivel socket replacing the fixed 45° UHT carry socket would eliminate the unusual crew task of rotating the UHT before lowering the LMS to surface - (See Test Procedure Paragraph D. 3).

   However this modification adds two additional crew tasks - release of the swivel socket using a lanyard/pull ring assembly and rotation of the experiment using the thermal glove. Although the swivel socket has greater precedence than the 45° socket in previous experiment designs, there is no technical reason, other than possibly crew preference, for using the swivel socket rather than the 45° socket, and increase difficulty in disengaging the UHT.

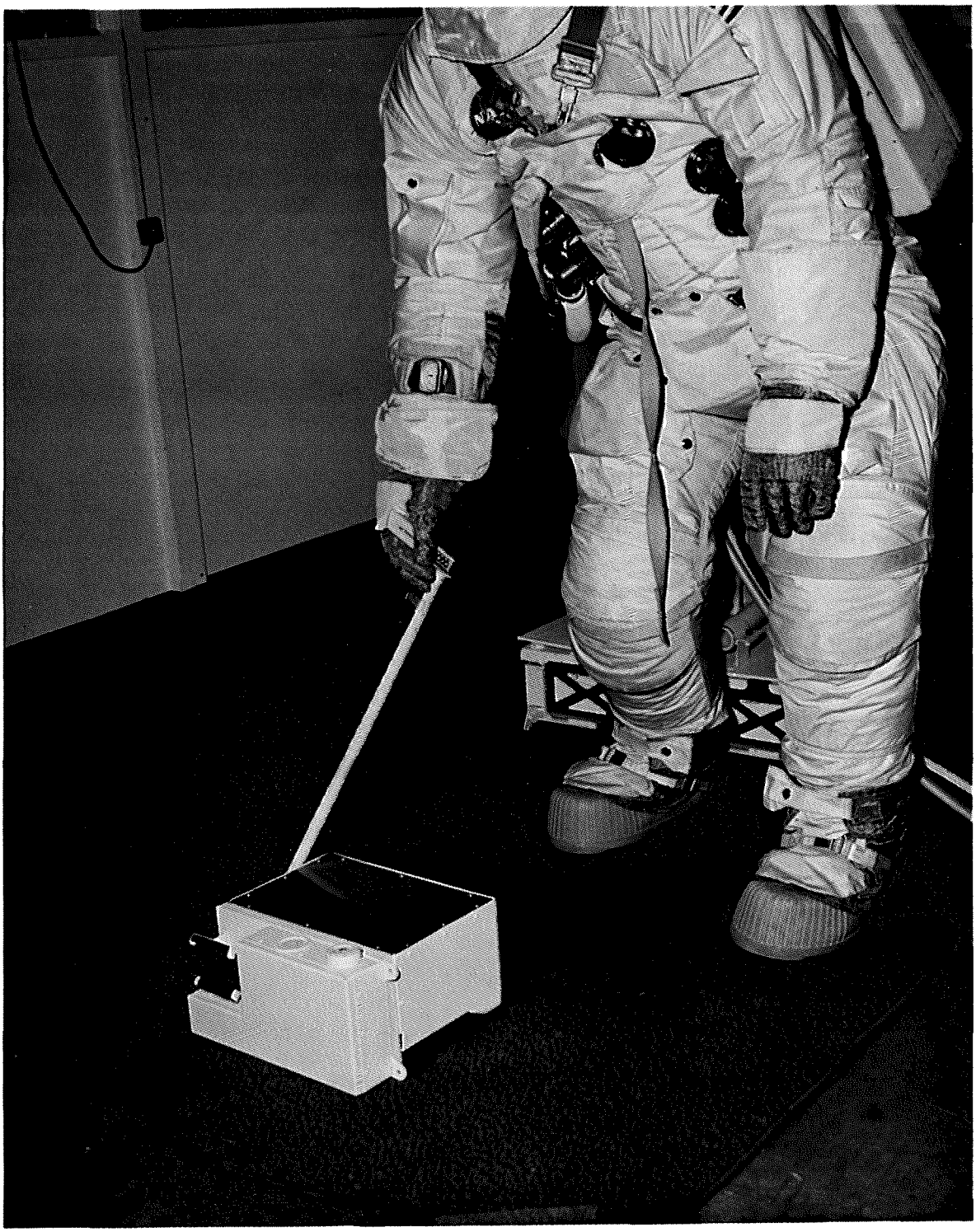
3. The present UHT carry socket location should be changed to increase the work height for the astronaut following lowering of the experiment to the lunar surface.

   The present work height of approximately 18 inches (See Picture No. 5) does not meet the minimum work height requirements for an astronaut performing lunar surface tasks (See Fig. No. 1 Page 9). By moving the socket to the other side of the package the work height at Central Station would be about 27.5 inches, which is quite acceptable, and the work height at the deployment site would be about 25 inches which is significantly beneath the 28 inch minimum but may well be permissible due to the relative simplicity of the task being carried out (i.e., UHT disengagement, but not fine leveling or alignment).

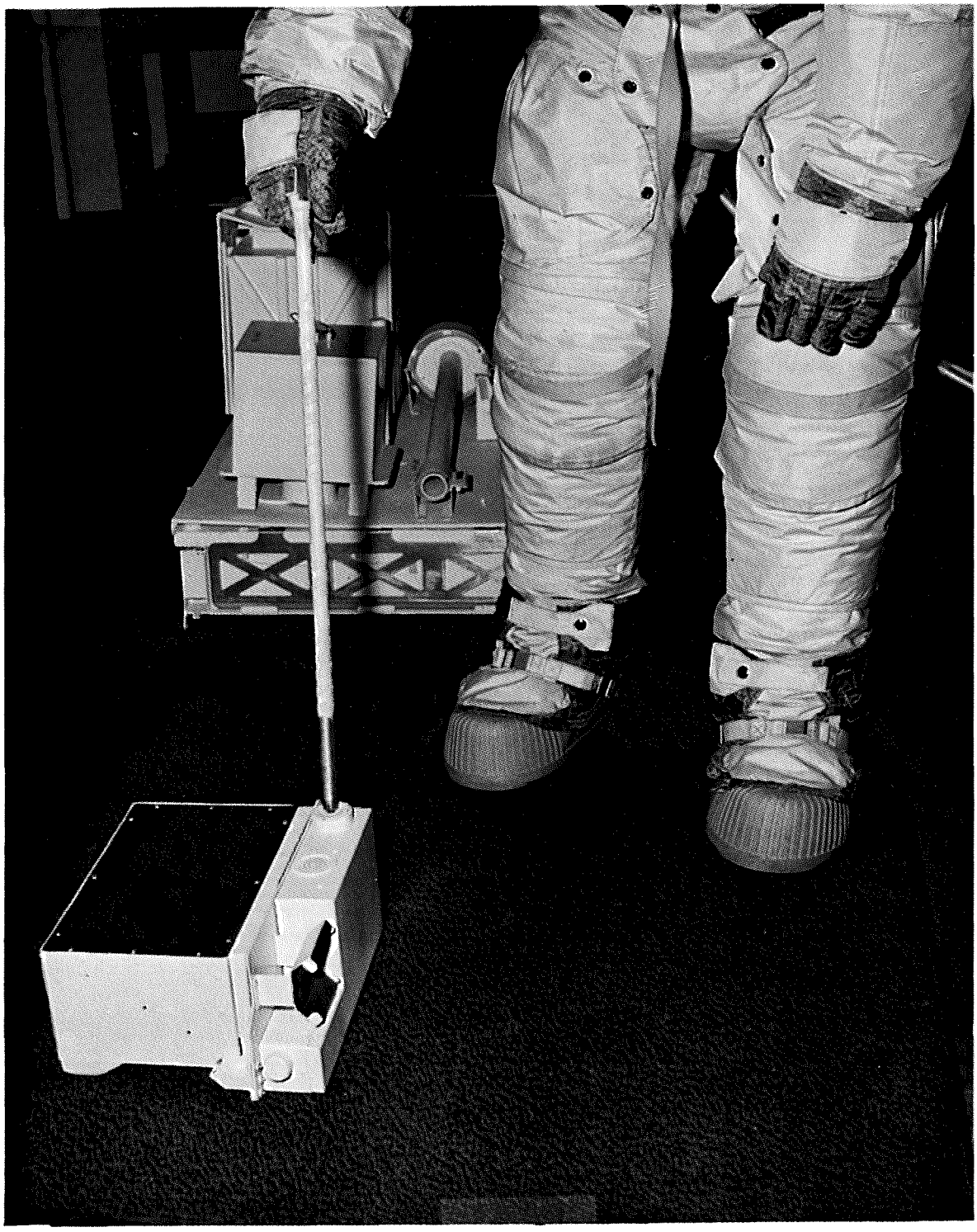
4. Breakseal engagement and removal was found acceptable, however additional evaluation should be conducted with the Engineering Model of the breakseal.

Additional crew engineering tests will be performed to verify the conclusions and recommendations in this report after liaison with the LMS design personnel.

Picture No. 1
LMS Mounted on SP #1 Mockup - UHT Engagement in LMS Carry Socket

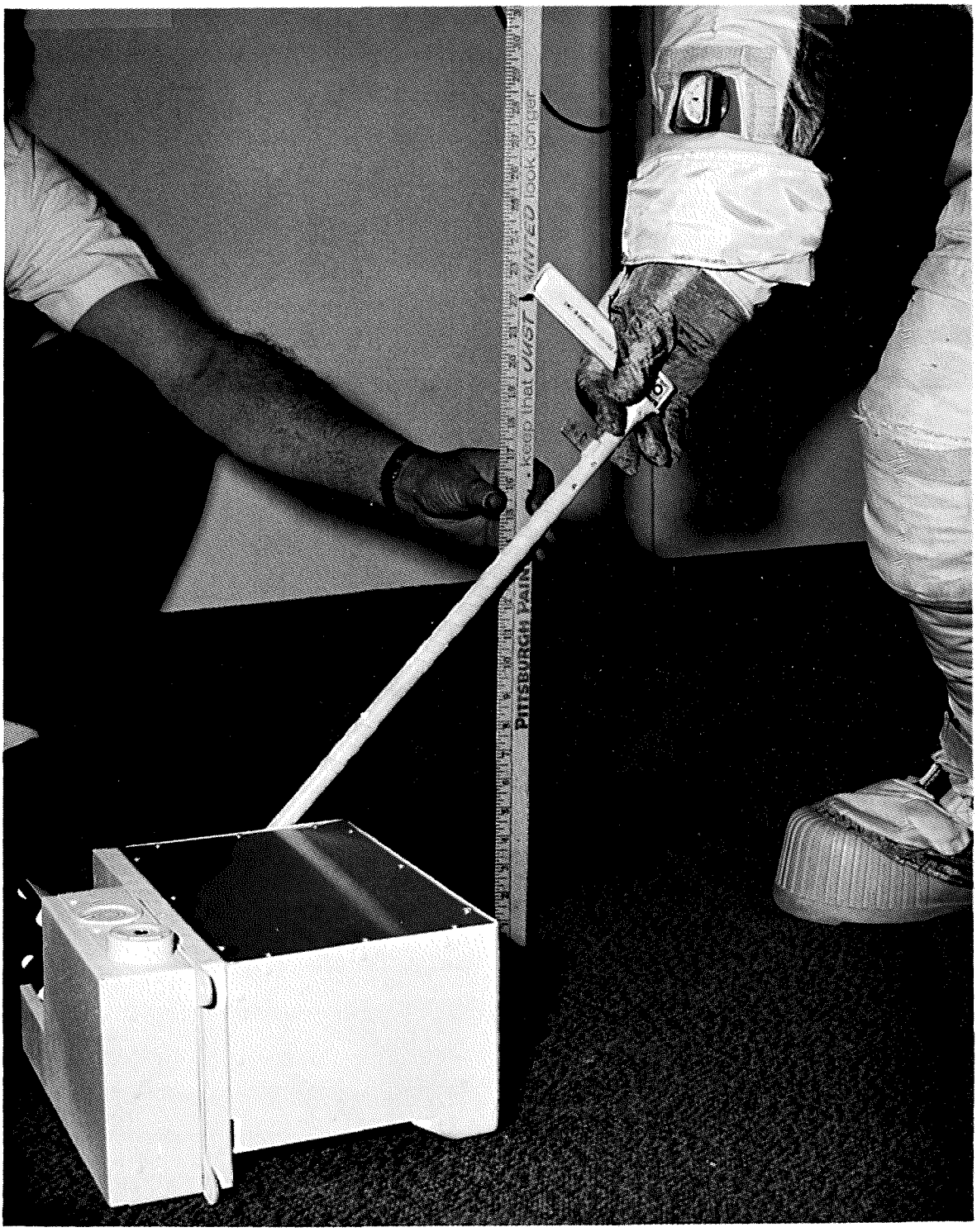


Picture No. 2
Astronaut Lowers LMS to Floor

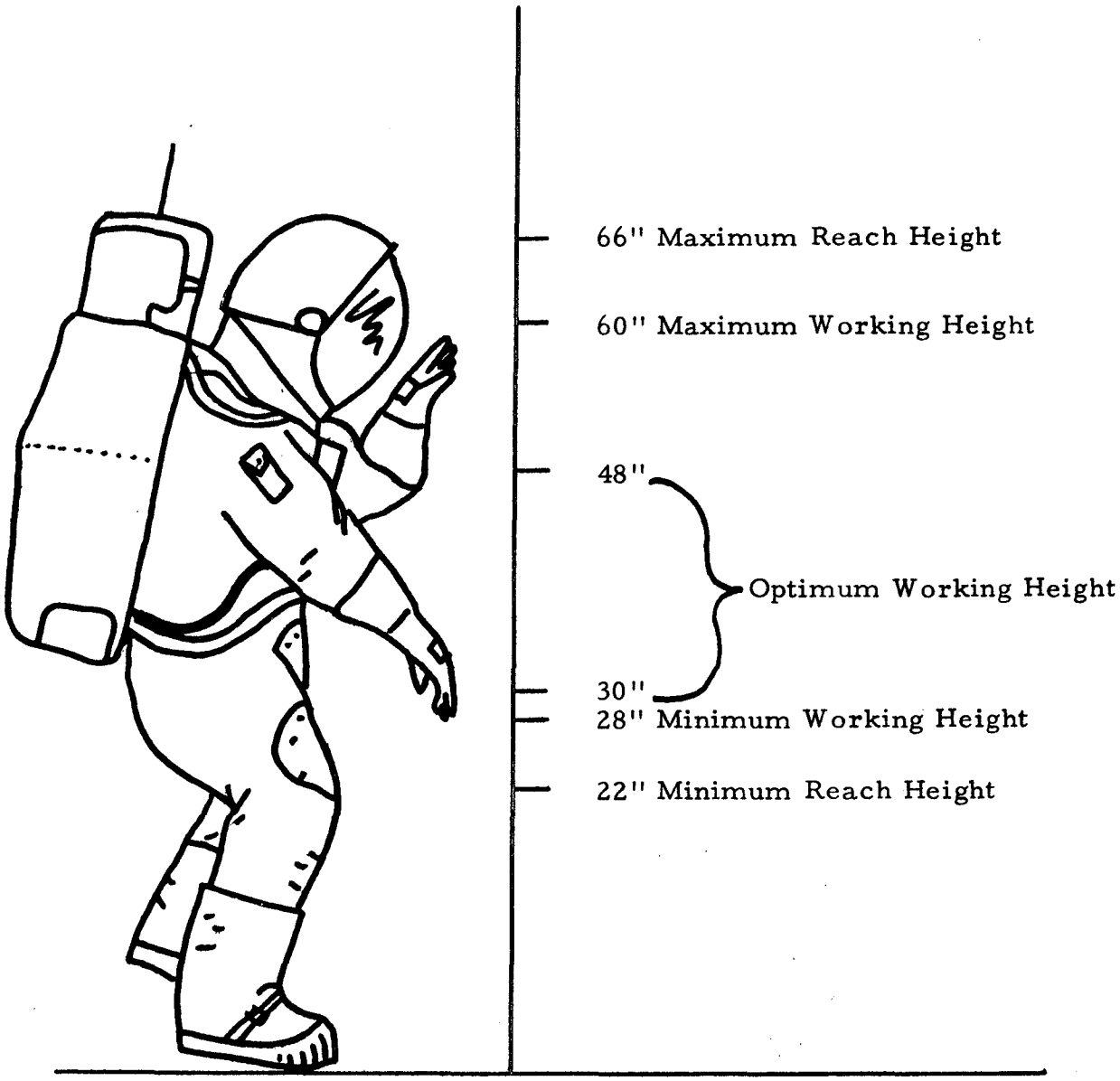


Picture No. 3
Astronaut Engages UHT in Breakseal and Simulates Breaking

Picture No. 4
Breakseal Removal from UHT



Picture No. 5
Evaluation of the present Astronaut Work Height



REACH AND WORK HEIGHTS FOR STANDING ASTRONAUT
PERFORMING LUNAR SURFACE TASKS

Figure 1