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THE USE OF PLAID IN THE SPACE STATION FREEDOM VIEWING ANALYSIS

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INTRODUCTION

The focus early in the Space Station Freedom Program was on identifying viewing requirements for both direct viewing (windows) and indirect viewing (closed-circuit television). These requirements now reside in NASA 's Program Definition and Requirements Document (PDRD), Section 3: Space Station Systems Requirements.

Currently, an analysis is being conducted to address the feasibility of viewing for Space Station Freedom. The goal of this analysis is to determine the optimum location for the windows and closed-circuit television cameras in order to meet the established requirements. Additionally all viewing provisions must adequately support Space Station assembly and on-board operations once the Station is operable.

PLAID, a three-dimensional graphics system developed at NASA/Johnson Space Center, was selected for use as the primary tool in this analysis. PLAID provides the capability to simulate the assembly of the Space Station Freedom, as well as to examine operations on the Station as it evolves. In addition, it is used as a tool to analyze general out-the-window viewing conditions for all Space Station components, and provides the ability to integrate an anthropometric scale-modeled person (representing a crewmember) with the Station's interior architecture.

PROCESS

Candidate window and camera locations were selected, and relevant viewing requirements were identified. Using the PLAID system, a geometric model of each Space Station Freedom element and the overall configuration were created reflecting the current Station architecture, both internal and external. Proposed window locations were included in these models.

Anthropometric models of crewmembers, provided by PLAID, were used in a simulation of out-the-window viewing. Pictured in Figure 1 is a 95th-percentile male crewmember. This system also enabled the users to analyze the interface occurring between the crewmember and the Space Station structure itself. Represented in Figure 2 are two 50th-percentile male crewmembers involved in a Space Station cupola viewing task. Figure 3 depicts a 50th-percentile male crewmember in the wardroom area.

Using these tools, the analysts were able to identify precisely how well each requirement is satisfied by a proposed window location. Optimum window placements were determined by integrating the view available from a particular position with various other factors such as operations requirements, off-duty and on-duty activity viewing needs, anthropometric clearance, optimum traffic flow, and window accessibility.

CONCLUSION

The PLAID system, through graphic analysis, has provided a means to optimize window and camera placement on Space Station Freedom and to determine if viewing requirements have been met.

The system has the capability to accurately depict:

(1) the window and/or camera view as seen through a specified eyepoint at each candidate location.

(2) the clearance limitations imposed by the Space Station architecture and anthropometry of crewmembers.

Combining these two factors, window and camera locations have been selected in order that viewing stations will provide adequate views which meet the specified requirements and will be comfortable to use.

ACKNOWLEDGEMENTS

This viewing analysis could not have been accomplished without the NASA Graphics Analysis Facility and the Lockheed Software Systems Section.

REFERENCES

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2. Mount, Frances E. and James L. Lewis, "Space Station Viewing Requirements", 1986 SAE Aerospace Technology Conference and Exposition, Long Beach, California, 1986.

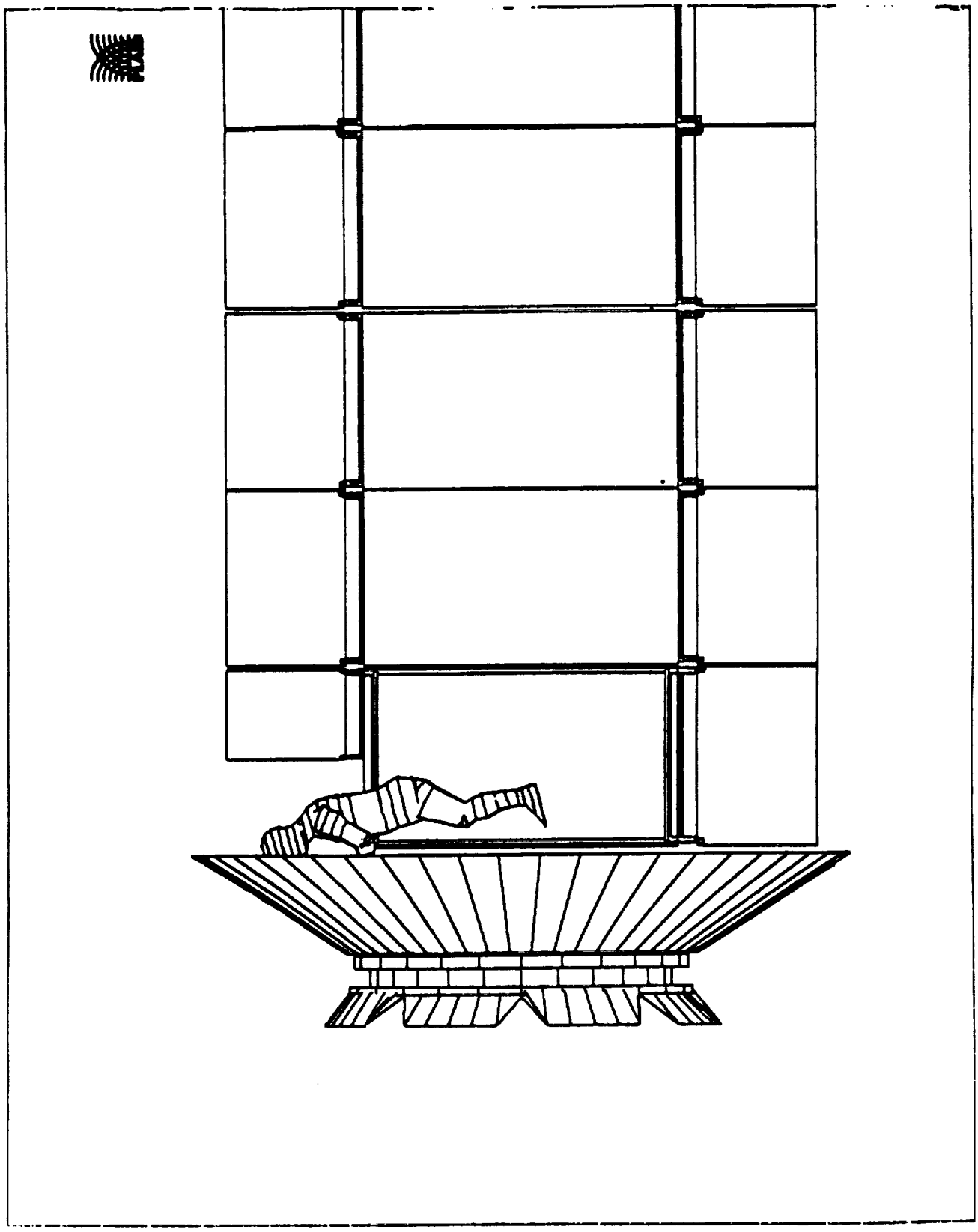

Figure 1

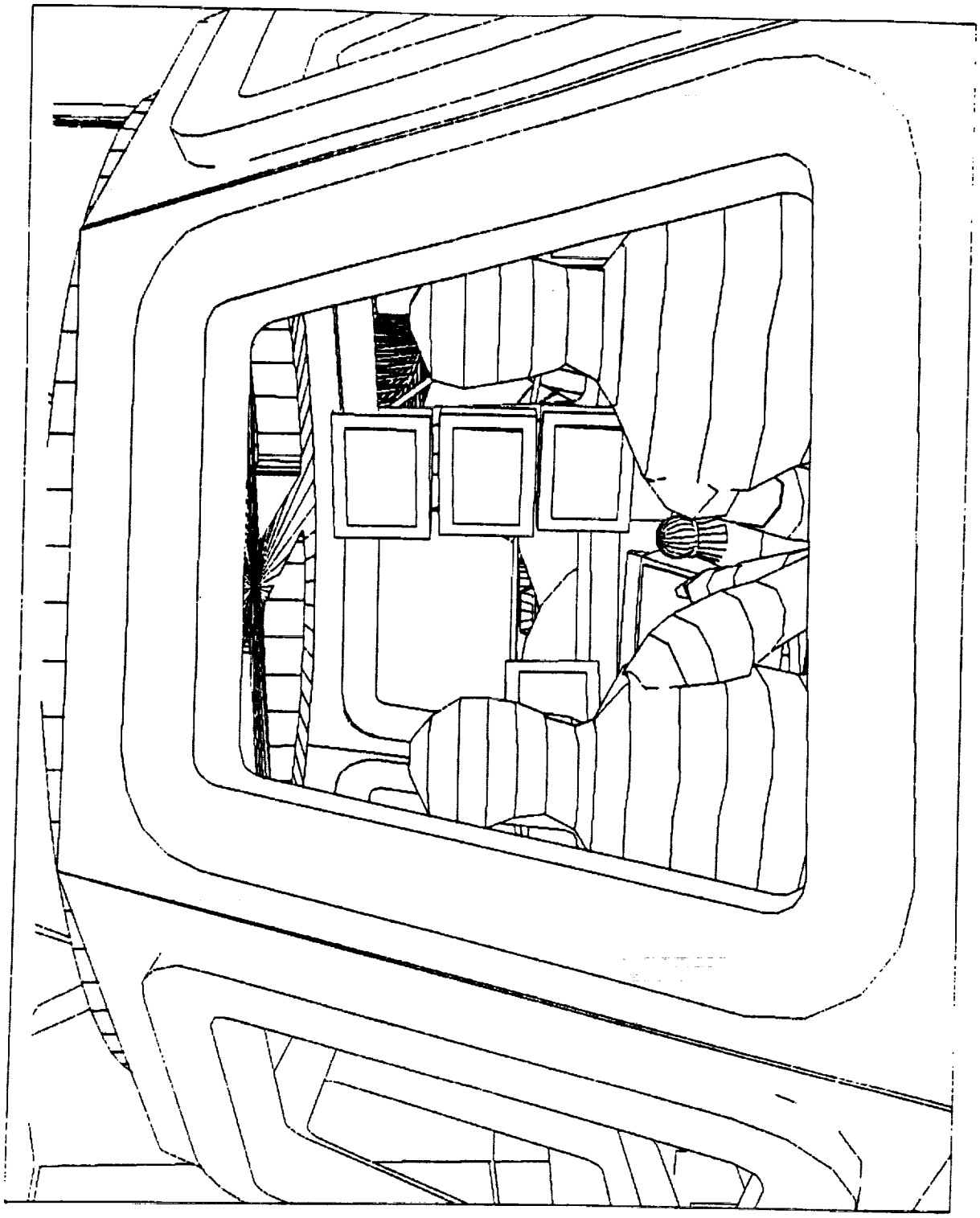

Figure 2

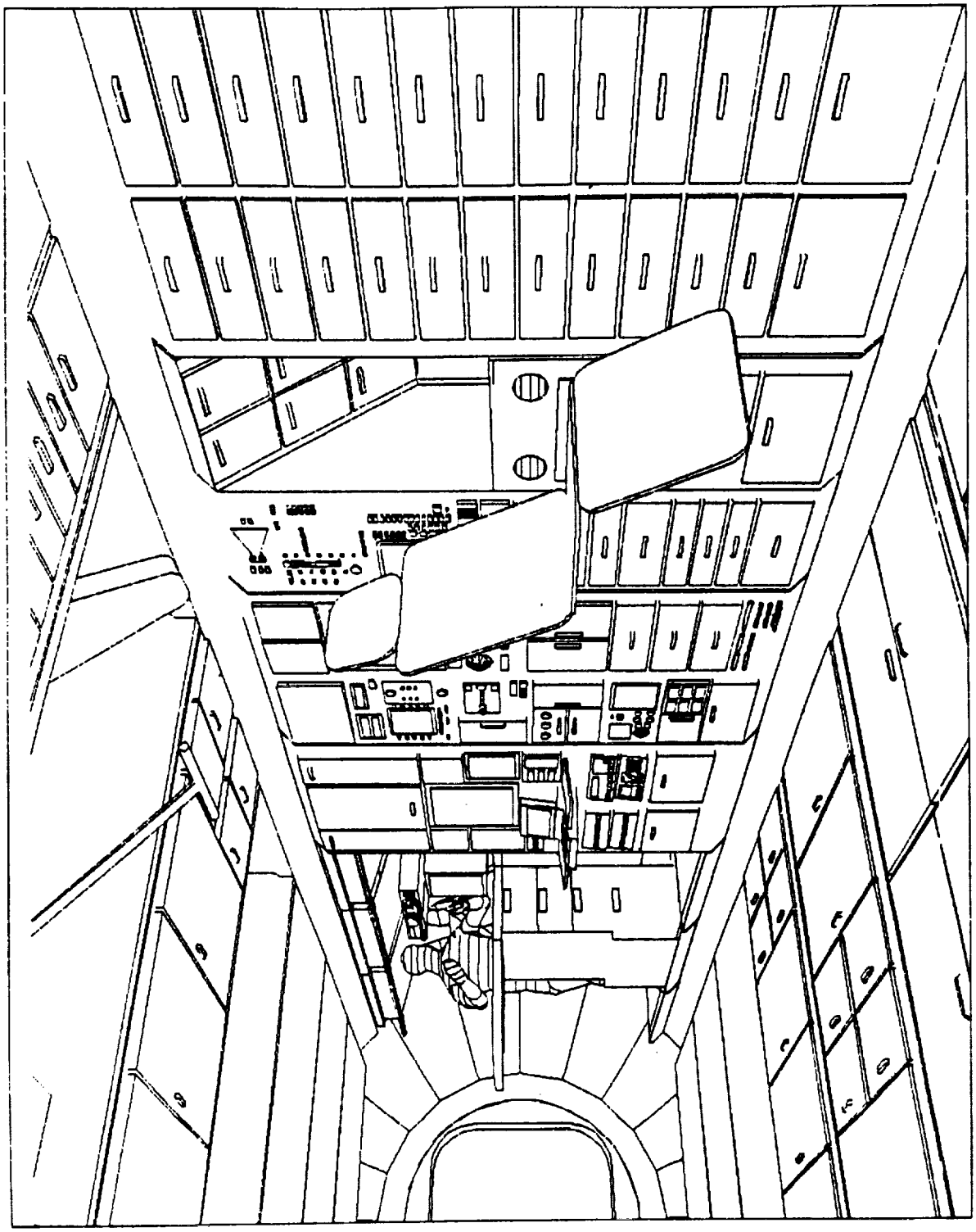

Figure 3