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STS PAYLOAD RETENTION SYSTEM CONCEPT

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16. ABSTRACT

This memorandum presents a look at an advanced payload retention concept that may be utilized on future Space Shuttle missions. This concept appears to embody all the desirable features for the very demanding requirements for space flight. The attractive features are as follows: light weight, low cost, high reliability, excellent load distribution, critical alignment is virtually eliminated, and is extremely versatile.

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INTRODUCTION

Throughout the space program, the objectives have been to complete the missions successfully while keeping costs within reason, yet maintaining high levels of reliability and safety.

Past experience has shown payload retention systems to be very troublesome, expensive, and complex. They have, because of their complexity and weight, taken away valuable payload capabilities.

An effort was undertaken to define a significantly improved payload retention system to alleviate existing problems. This effort has resulted in a conceptual design that has desirable characteristics and potential improvements in weight, simplicity, reliability, sensitivity to alignment, and cost.

STS PAYLOAD RETENTION SYSTEM

The STS payload retention system design is described as follows. It consists of two hemispherical halves; one payload mounted and the other carrier mounted through a yoke/pivot as shown in Figure 1.

The two hemispherical surfaces of the mating halves carry the load of the object being supported. A motor-driven pin is provided to lock the yoke/pivot at the desired position.

The load is distributed over the two mating hemispherical surfaces. The design can tolerate misalignment of the two halves being mated and therefore critical alignments are not necessary. Alternate configurations of the design are possible for applications requiring special mounting. Two of these are shown in Figures 2 and 3.

As can be seen, the design is very simple and does not require any sophisticated manufacturing techniques and therefore is low cost. Also, the simplicity of the design should result in a high reliability of operation.

Models of the design have been constructed and the conceptual operation verified.

A brief description of the operation of the STS payload retention system is as follows.

In the stowed position, shown in Figure 1, the payload is retained by four locked retention mechanisms. To initiate the deployment, the motor-driven pins are released to unlock the mechanisms. As the payload is raised, the mating halves of the retention mechanisms begin to disengage as shown in Figure 4. When the payload is deployed fully, the retention mechanisms are left in the position shown in Figure 5.

As the payload is lowered for stowing, the retention mechanism halves on the payload engage and halves on the vehicle. When the stowed position is reached, the motor-driven pins are inserted to lock the system. Based upon the work accomplished, the feasibility of the design concept has been established. The detailed design to determine the dynamic and structural characteristics of the system has not been accomplished as yet; however, we do not anticipate anything which would distract significantly from the projected benefits of this system as compared with current technology.

CONCLUSION

The payload retention system design is flexible and can accommodate a large variety of payloads. We believe that the inherent design features of this system, i.e., simplicity, insensitivity to alignment, and low cost represent a significant advancement of the technology.

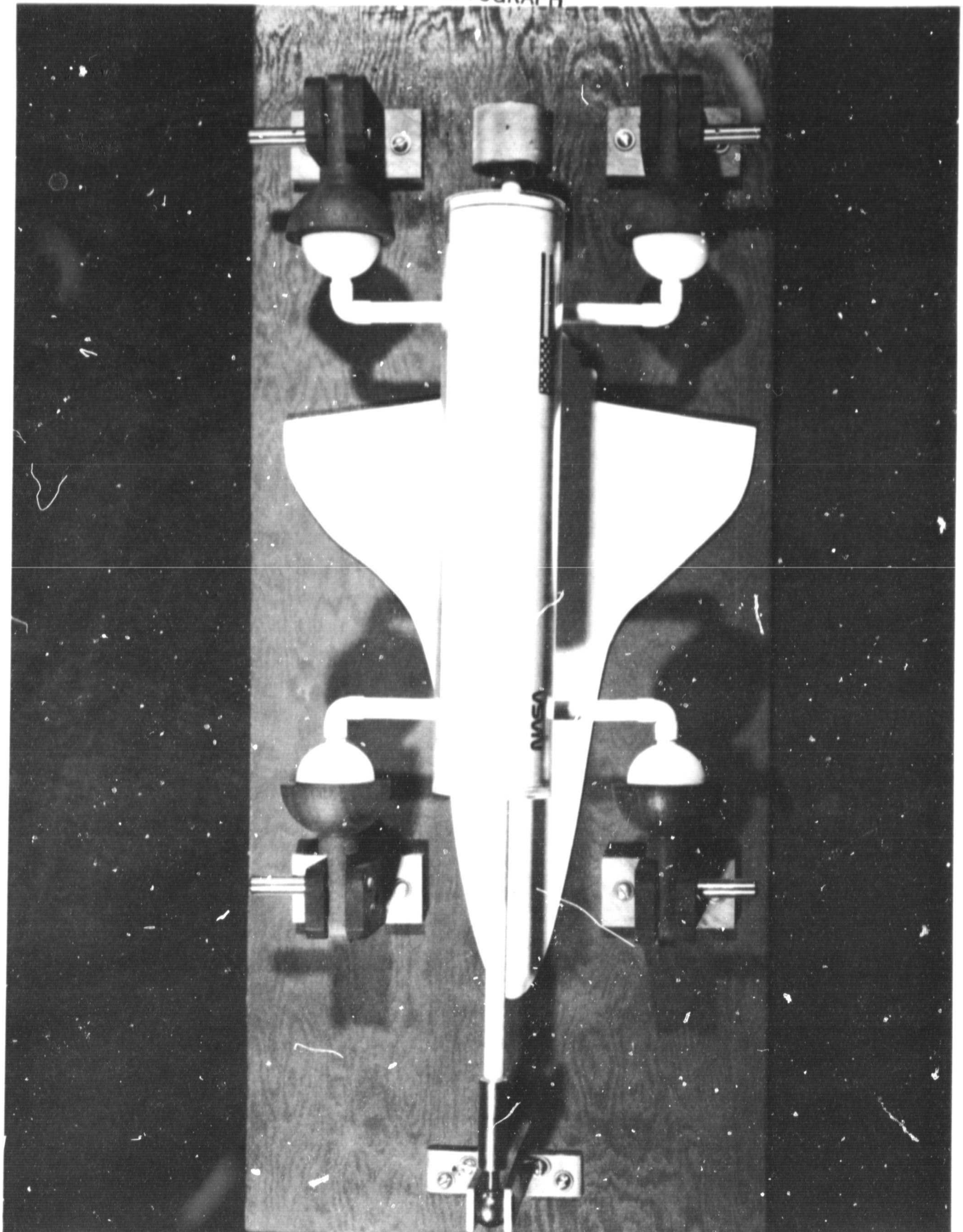

Figure 1. Ball joint representing a high-accuracy pointing control system.

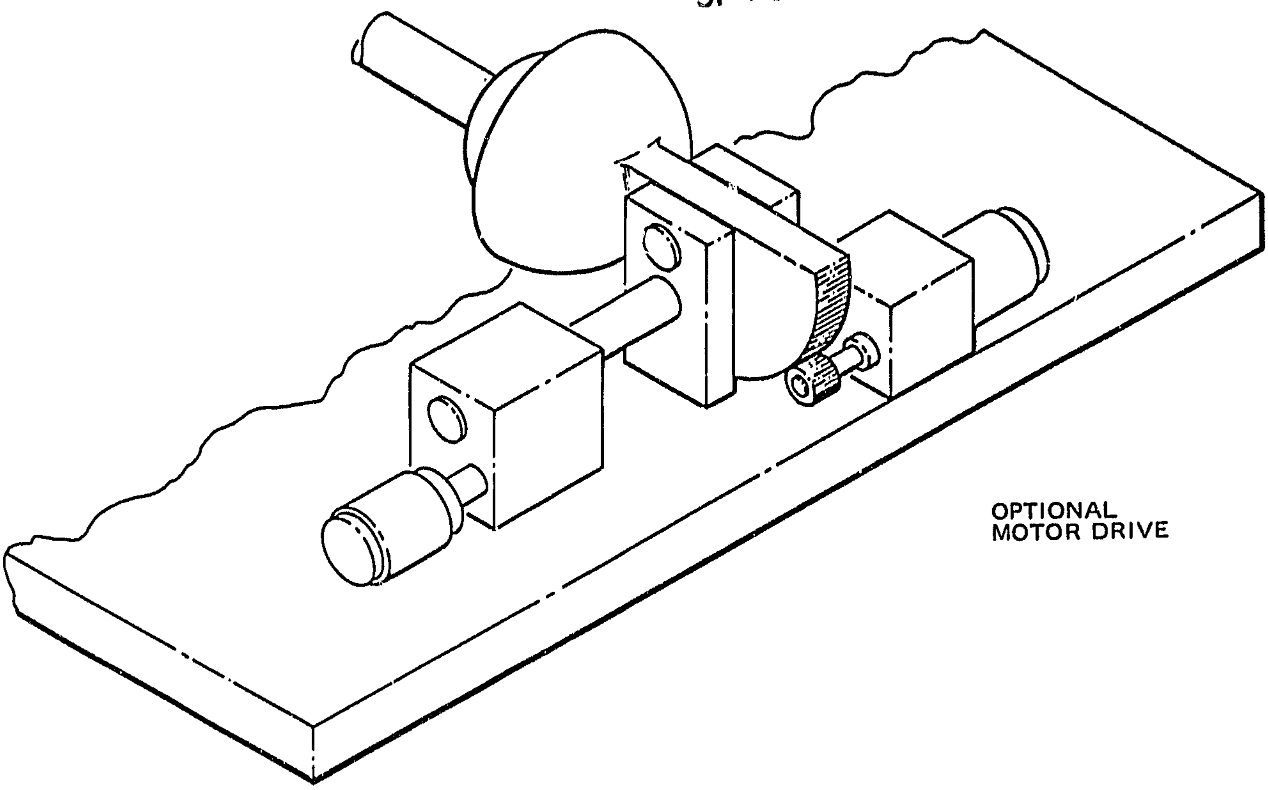

Figure 2. Simplified drawing of basic latching mechanism.

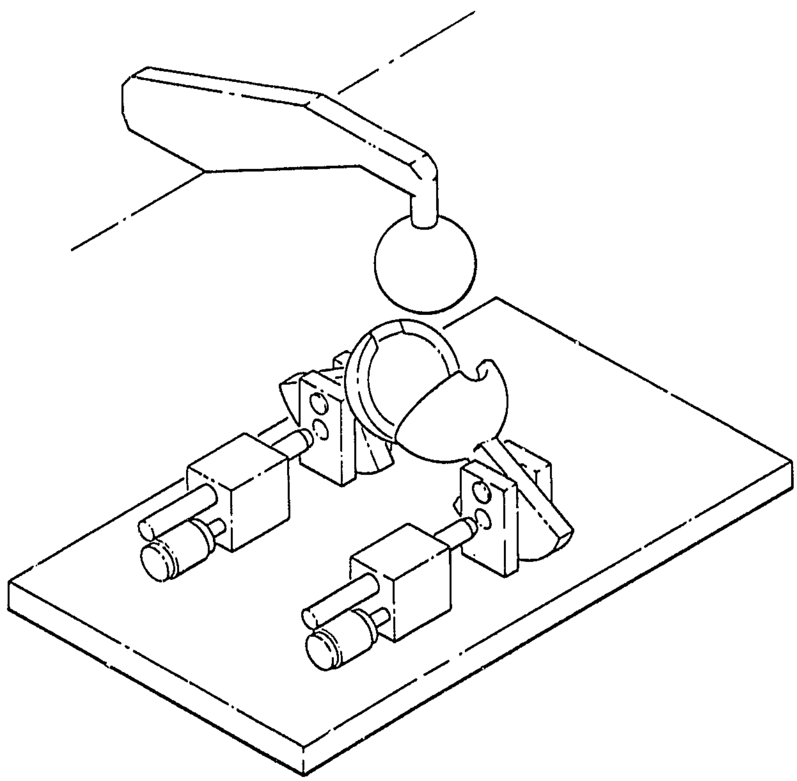

Figure 3. Alternate embodiment of the retention mechanism.

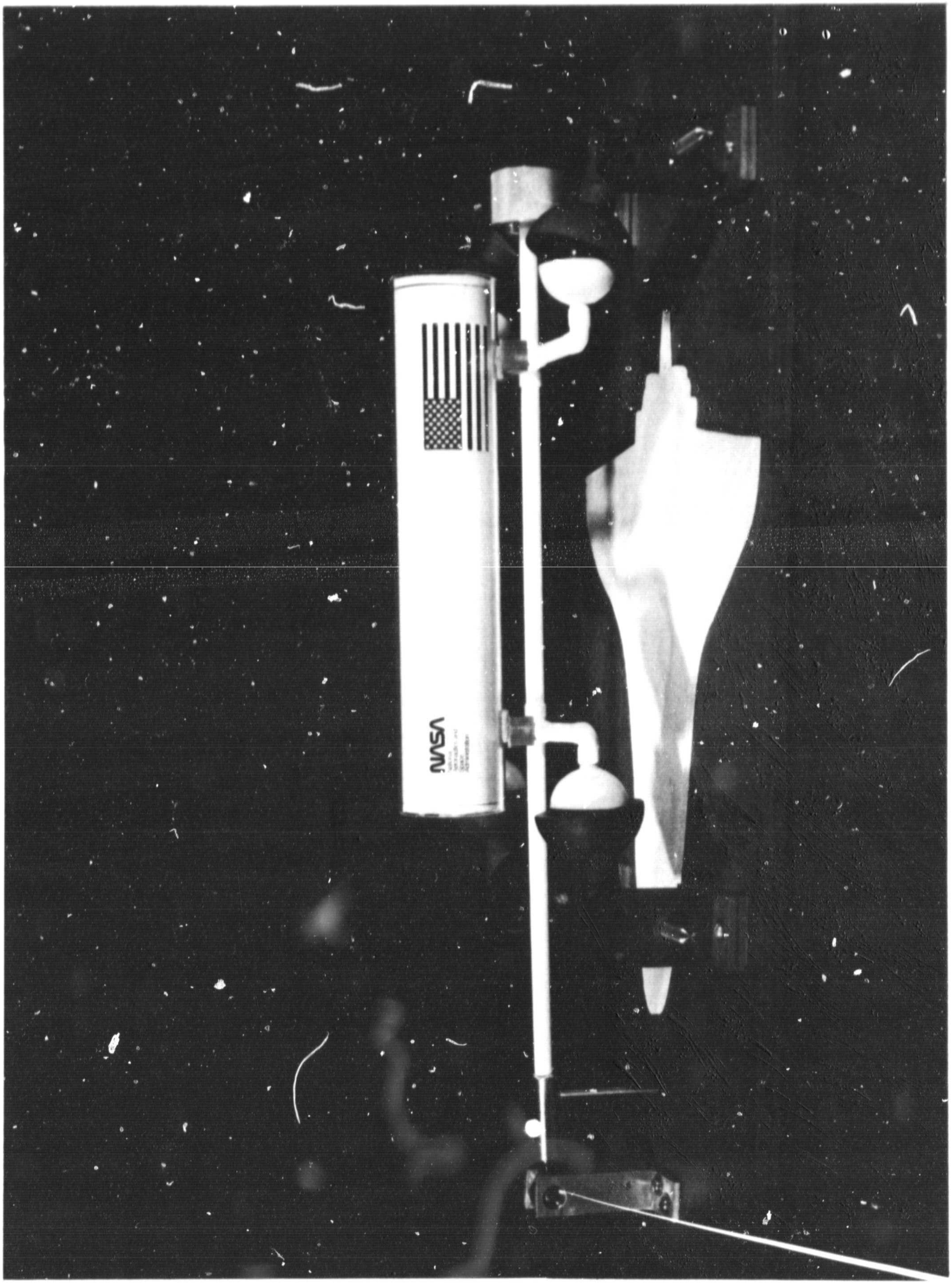

Figure 4. Single-axis mechanisms.

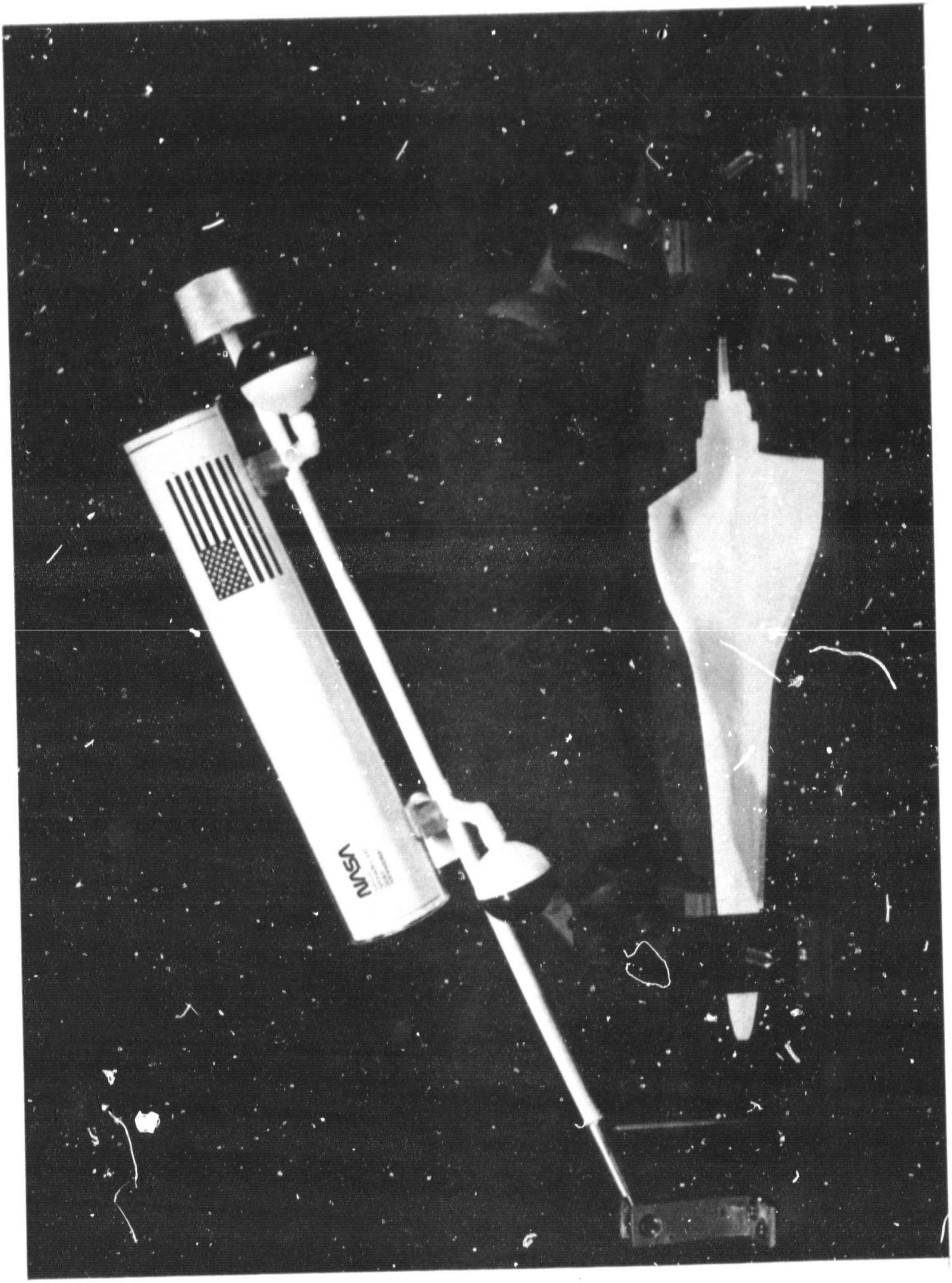

Figure 5. Retention system.

APPROVAL

STS PAYLOAD RETENTION SYSTEM CONCEPT

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The information in this report has been reviewed for technical content. Review of any information concerning Department of Defense or nuclear energy activities or programs has been made by the MSFC Security Classification Officer. This report, in its entirety, has been determined to be unclassified.

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