PACOSS Program

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The objectives of the PACOSS program were to demonstrate the respective roles of passive and active control for structures that represented future Large Space Structures (LSS), to develop means to introduce passive vibration control, and to experimentally verify the damping predictions and the control algorithms. In order to meet the objectives, the program was divided into an analytical simulation phase to establish the respective roles of passive and active damping on a LSS-type structure, and a design, analysis, and test phase to validate the passive damping and the control algorithm performance for a structure.

The objective of the analytical simulation was to control the line-of-sight of the configuration shown in FIGURE 1 during slew. The desired performance was the rigid-body response. Using active modal control only if required, the goal was to determine the control energy required to achieve the desired performance for various levels of realizable passive damping. The results from the study were that a proper combination of passive and active damping delivers the desired performance, at the same time reducing the number of active control components, and the energy and power requirements. In addition, the passive/active system can lead to more robust, reliable, and less expensive systems. The conclusion was future LSS should be designed to facilitate the effective utilization of passive damping.

One of the principal objectives of the test phase of the program was to establish the capability to design and analytically predict the passive damping characteristics of LSS-type hardware by comparison with the experimental data. A dynamically representative article of the LSS was fabricated. Other requirements on the test article were that it be inexpensive, contain negligible unpredictable damping, and suitable for testing in a 1-g field. The approach taken in the analysis and test effort was to divide the system into six subsystems; each subsystem analytical model was in turn validated by modal tests. Subsystem coupling techniques were then used to couple the subsystems to obtain the system damping and eigenparameter estimates. Excellent correlation was achieved between the analytical estimates of damping, and the system test damping values. The test data indicated that the higher modes of precision structures do not necessarily have significant inherent damping.

In conclusion, predictable amounts of damping can be designed into a LSS structure, the best control strategy uses a combination of passive damping and active controls, and a more optimum system can be achieved by an early interaction between the structural designer, controls engineer, and the damping designer.

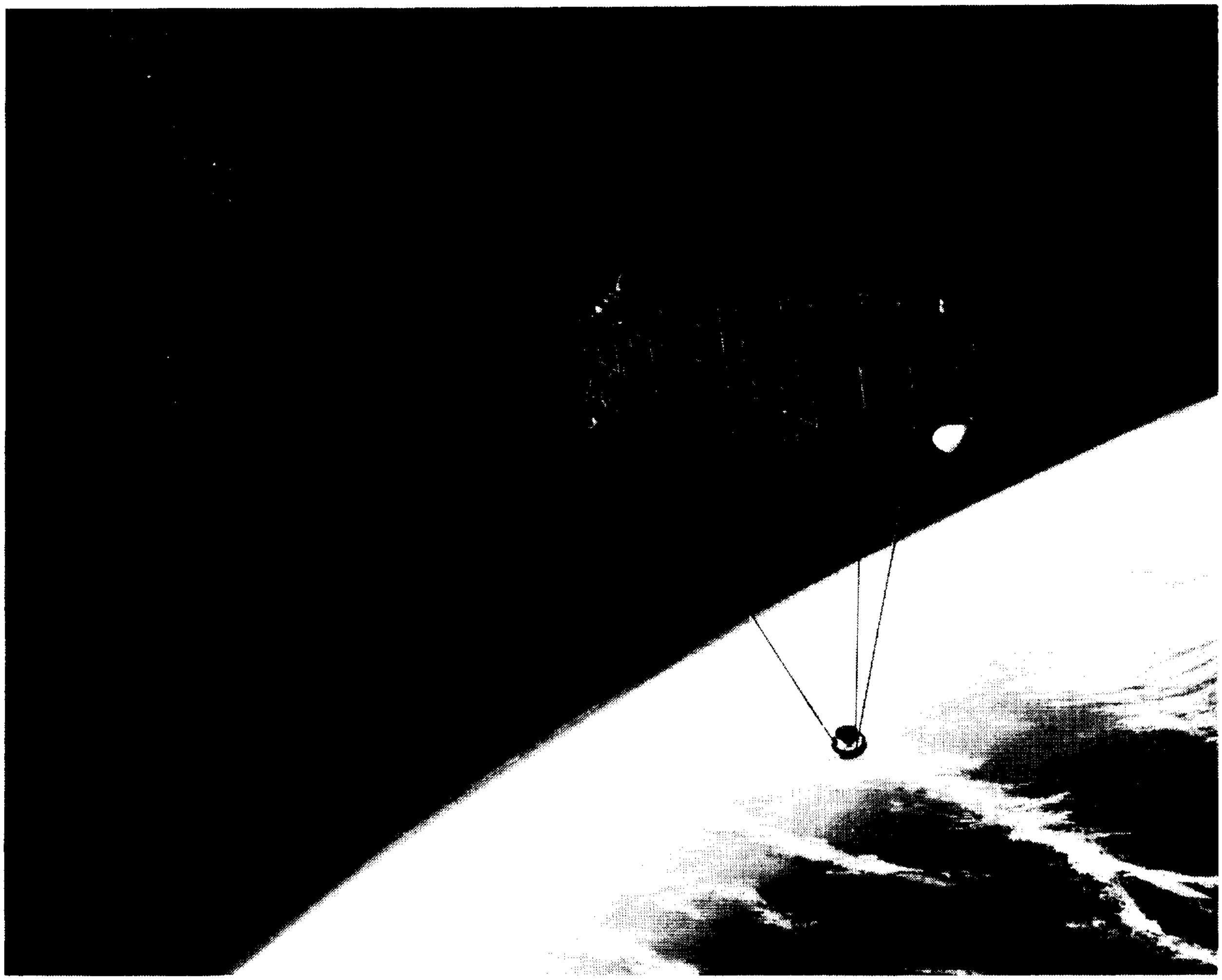

FIGURE 1. The PACOSS Large Space Structure

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