Initial Test Results for the Mini-Mast

L. Horta and G. Horner
Langley Research Center
Hampton, VA 23665-5225
Presented and Summarized by Ben K. Wada

The objectives of the 20-meter Mini-Mast were (1) to learn how to efficiently test this type of large truss structure, (2) to relate component testing to the overall behavior of the structure, and (3) to update the associated analytical model based upon the experimental data. The Mini-Mast represents structural characteristics similar to the COFS beam which is planned to be flown on Shuttle to perform on-orbit structures and controls experiments. The information is of interest to LDR because it represents analysis and test information on a truss-type structure which may be similar to the LDR backup structure. The structure has a total of 111 titanium joints; the joint in the center of the truss element is the near-center latch joint presented in the paper by M. Rhodes.

The successful identification of the first three modes (< 10 Hz) indicated excellent agreement of the two bending modes with analysis, whereas the torsion test mode was about 20 % higher than predicted. The modal damping data were approximately 0.5 % indicating "tight" linear joints in the joint dominated structure. Comparison of the static test results to the analytical predictions shows excellent correlation up to a static deflection at the tip of the beam of about 0.22 inches.

As noted in FIGURE 1, the near-center latch joint represented a significant mass in the center of the beam. At higher resonant frequencies, the many local modes represented by all members with the near-center latch joint were excited; difficulty existed in extracting all the local modes. The frequencies of the local modes were slightly different; the difference could be partially attributed to the different compressive loads in the truss members. The compressive loads were higher in the lower members due to the gravitational loads of the structure above the members.

The results of this research indicate that linear deployable-type structures can be built, but difficulties do exist in extracting modes with identical frequencies; gravitational loading does affect the ground test results; and prediction of truss-type-structure dynamic characteristics is not trivial.

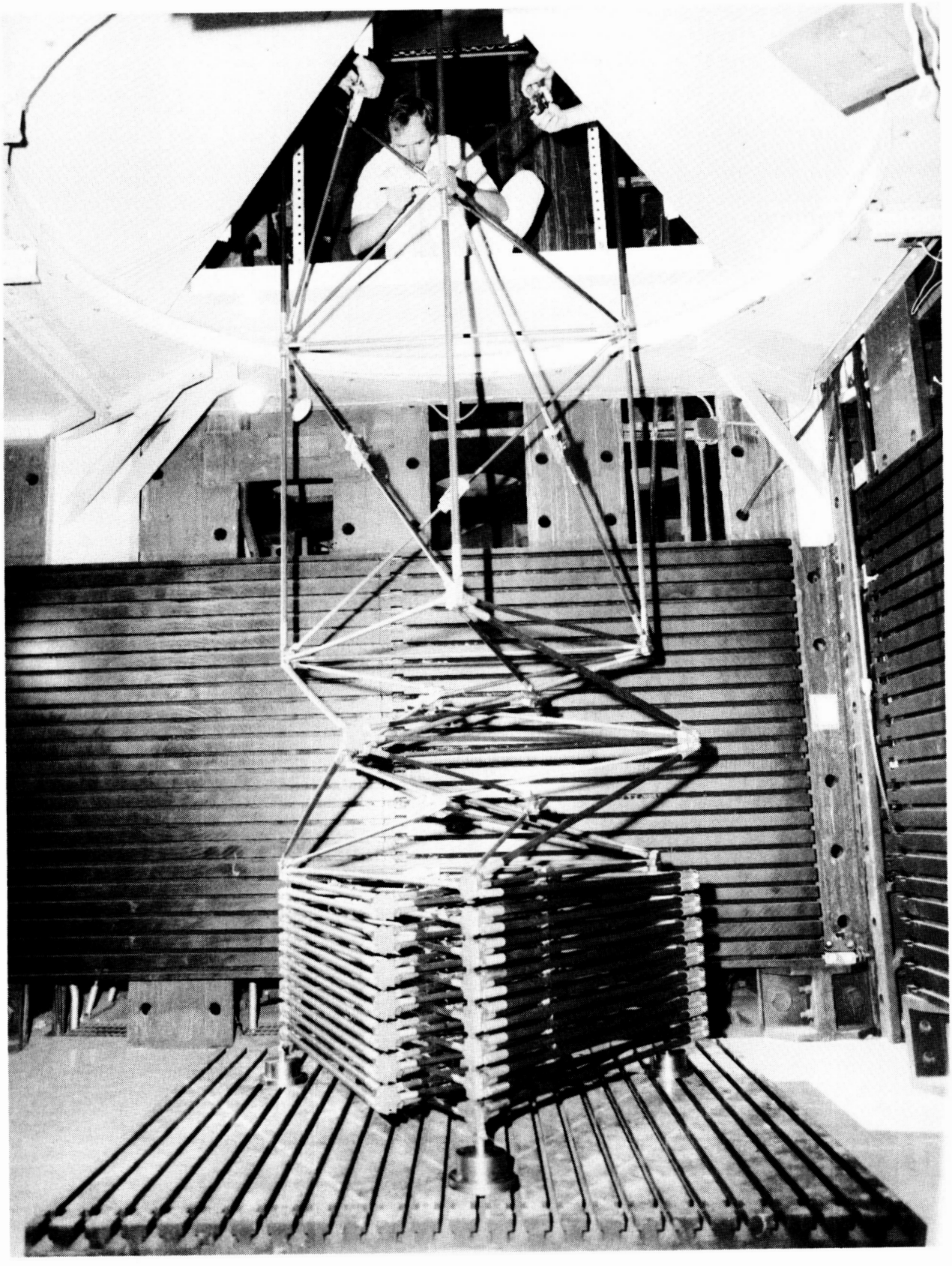

FIGURE 1. The Mini-Mast