Dynamic Characterization of NASA Armstrong Test Facility Mechanical Vibration Facility

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# ABSTRACT

In preparation for Sierra Nevada Corporation’s (SNC) Dream Chaser spacecraft vibration test campaign at NASA Armstrong Test Facility (ATF) in Sandusky, Ohio, a dynamic characterization of the Mechanical Vibration Facility (MVF) is currently ongoing. The Mechanical Vibration Facility is comprised of an 18 ft diameter annulus table that is driven with sixteen hydraulic vertical actuator assemblies and four hydraulic horizontal actuator assemblies. During a test campaign this allows for single axis vibration testing in the vertical axis and in each of the two orthogonal horizontal axes without the need for reconfiguring the test article. The dynamic characterization of the facility was defined to follow a building-block approach requiring three vibration test configurations: (1) MVF bare table (2) MVF table and head expander (3) MVF table, head expander, and a dummy test article. Following the completion of the facility dynamic characterization, a facility finite element model (FEM) will be test-verified allowing for more accurate pretest analysis used for determining response limits and abort levels.

To date two of the three test configurations have been completed. Test results have been used to verify the facility FEM that includes both the 18 ft diameter annulus table and the aluminum head expander that fills in the center opening of the annulus to provide a continuous flat mounting surface. Both the MVF table and the head expander models were previously correlated using test results from free-free boundary condition modal tests so model updates to the facility FEM focused on the uncorrelated vertical actuator assemblies and horizontal actuator assemblies. The accuracy of the test-verified facility FEM will be further determined based on comparison of analytical and test results from the vibration test of the dummy test article. Efforts will also be made to determine fixed base modes of the test article attached to the flexible vibration table using fixed base correction techniques. This paper will discuss test and analytical results from the MVF dynamic characterization test sequence and corresponding model updating effort.

**Keywords:** Dream Chaser, Finite Element Model, Glenn Research Center, Modal, Modal Pretest Analysis, Modal Test, Mechanical Vibration Facility (MVF), Model Correlation, NASA, Orthogonality, Sierra Nevada Corporation (SNC), Armstrong Test Facility (ATF), Vibration Test,