

Experimental validation of composite ogival structures of aerospace vehicles

Gopikrishna R^a, Ramalingam T^b, Nagendranath A^b, Seetharaman S^b, Varadanam M^a

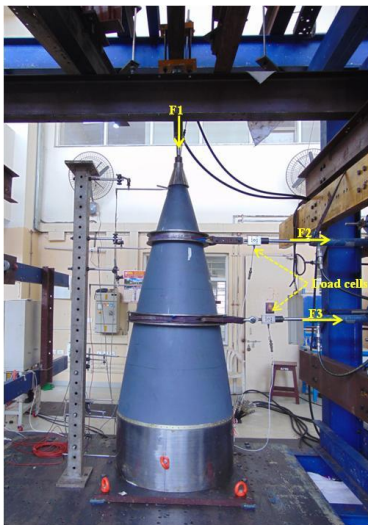
^aDefence Research Development Laboratory, Kanchanbagh, Hyderabad – 500058

^bAdvanced Systems Laboratory, Kanchanbagh, Hyderabad - 500058

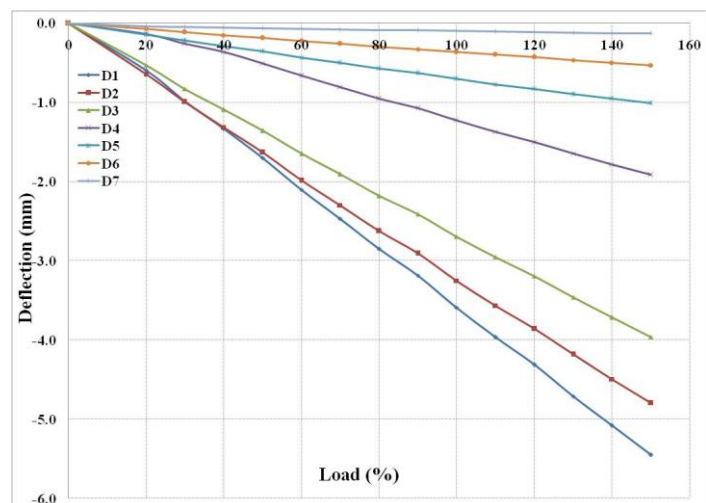
1. INTRODUCTION & OBJECTIVE

Composite sections are used in various aerospace applications for its high specific strength and tailor make capabilities. Additionally, it is necessary for the composite material to be transparent to electromagnetic waves emitted by the on-board electronics. An ogival composite shell is manufactured using quartz reinforcement and cyanate ester resin for a particular aerospace application. This structure experiences combined axial load and bending moment during its service. The bending moment experienced by the section is simulated using two lateral loads located at 100 mm apart on the section. An axial compressive load of the order of 9 kN is applied using a loading format matching to the geometric profile of the section. Load cells are used to control the input load, while strain sensors and displacement sensors are used for measuring the output response of the structure. Necessary ground fixtures and rig for execution of the experiment are realized with sufficient factors of safety. The loads were manually synchronized and applied in steps of 10% during the test. Test methodology for simulation of axial force and bending moment on ogival sections are successfully established and executed.

2. RESULTS & OBSERVATIONS



Photograph of Test set-up



Variation of deflection with applied loads

- i. Eccentricity in the axial load application axis is avoided successfully using a format, which is attached to the axial loading actuator.
- ii. Rings with provision for belt attachment have successfully helped in avoiding slippage of the lateral loads during the test.
- iii. Variation of deflection with applied load is linear throughout
- iv. Composite ogival shell withstood the applied loads up to a maximum of 150% of the design values during the test. This is carried out to evaluate the minimum necessary design factors.