STRUCTURAL ANALYSIS

SCOPE

Preliminary stress analysis to assess the honeycomb core thickness necessary to satisfy the structural load requirements. This study is to determine if the 0.375 inch thick honeycomb core can be thinner and still withstand the design specification loads. A conservative analysis is based upon the following conditions:

- Finite element model of complete radome structure with bolted connections between RF and STRUCTURAL sections. Analytical model accounts for structural coupling between both halves and has a weight of 15.8 lbs.

- Both sections assumed with A-sandwich of 2 ply 7701/7781 face skins and 0.250 HRH 10/OX – 3/16 – 3.0 pcf core. Effects of Access window on STRUCUTURAL half are not included in this preliminary study.

- Worst case load appears to be combination of 95 fps wind, 0.25 psi. differential pressure and 30 MPH vehicle speed. Analyses were performed with combinations of the 60 RPM rotation, 4 G max. Acceleration, and 20 G shock, and the stress analysis results show very low stress levels. By inspection, the random vibration levels are insignificant; hence this dynamic analysis was not performed.
  Note:
  30 MPH vehicle speed subjects radome to 0.016 psi aerodynamic pressure
  95 fps wind subjects radome to 0.0746 psi. aerodynamic pressure
  20 psf snow load equivalent to 0.139 psi.
  3 inch thick ice equivalent to 0.097 psi.
  60 RPM rotation equivalent to radial acceleration of 1.94 g

RESULTS

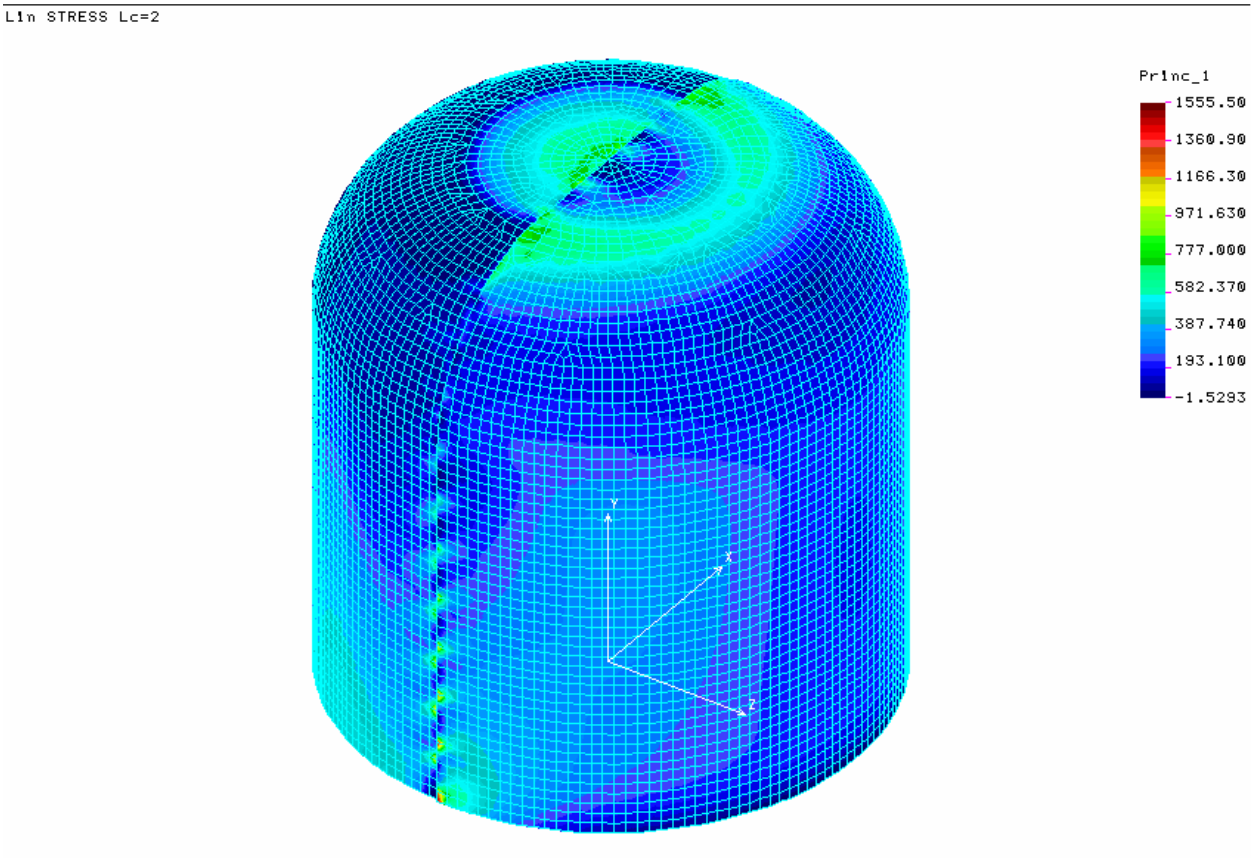
Maximum response with combinations of wind, vehicle speed and differential pressure:

- Max. tensile/compressive stress for 7701/7781 face skins = 1,560 psi.
  Occurs adjacent to the RF/STRUCTURAL half bolting flange
  Allowable tensile/compressive strength = 32,000 psi. at max. temp.
- Max. shear stress for HRH 10/OX – 3/16 – 3.0 pcf core = 7.5 psi.
  Allowable shear strength = 85 psi.
- Max. resultant displacement = 0.105 inch
- Minimum resonant frequency of vibration = 132 Hz

Note: See attached contour plots for maximum stress and maximum displacement.

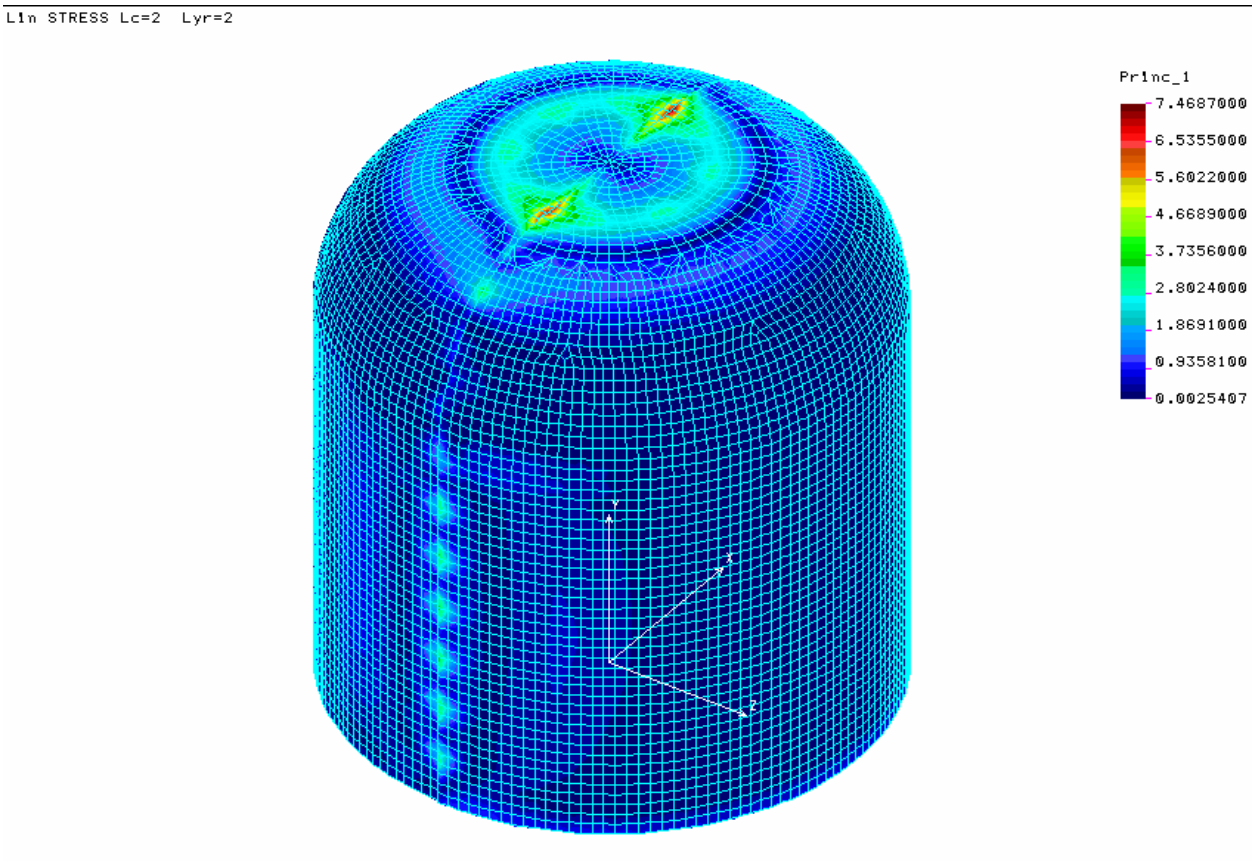
CONCLUSION

The preliminary analysis concludes an A-sandwich design with honeycomb core thickness between 0.250 inch and 0.375 inch will provide a large structural safety margin. Also, the design needs to consider if the 0.105 inch maximum deflection during the worst load conditions is electrically acceptable.



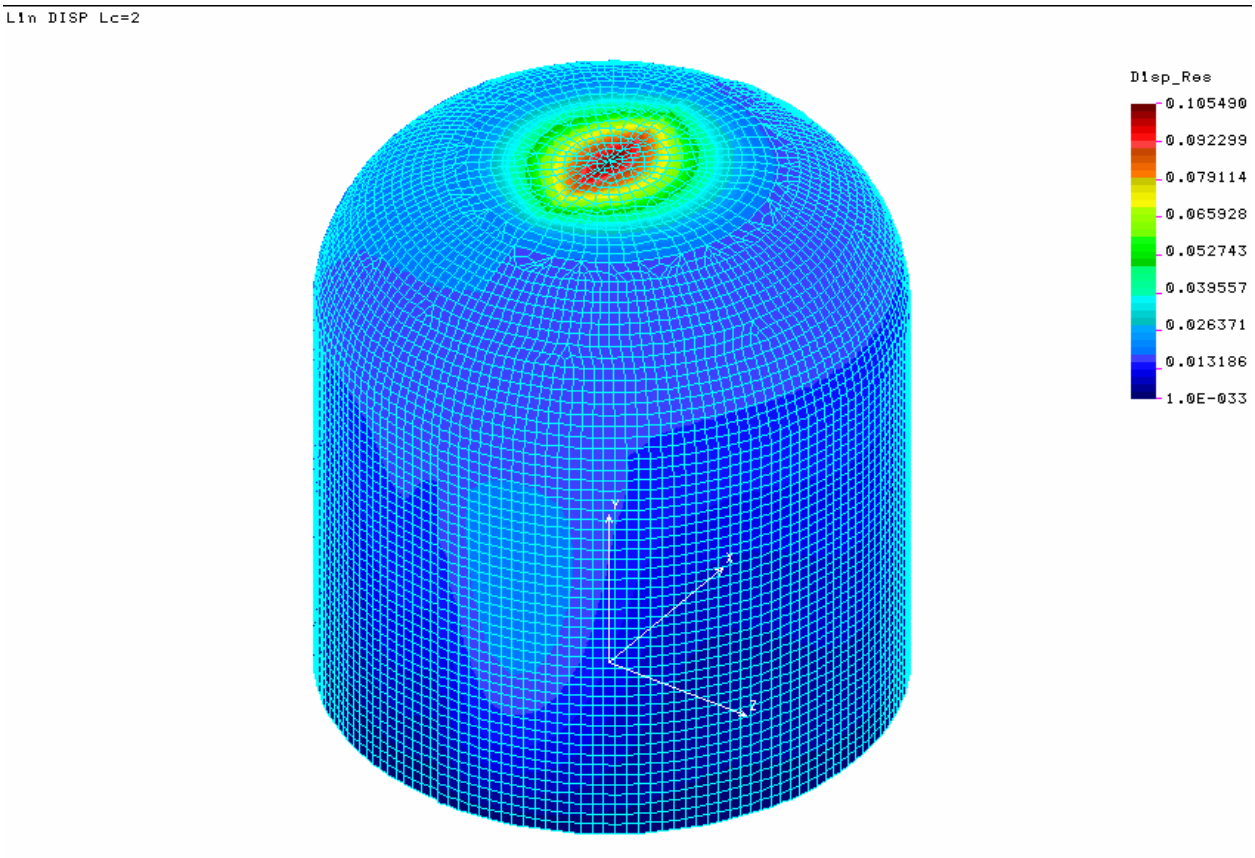
Contour Plot for Maximum Tensile/Compressive Stresses on 7701/7781 Face Skins During Max. Wind and Vehicle Speed

Note: Max. Face skin stress = 1,560 psi.



Contour Plot for Maximum Shear Stress on HRH 10/OX – 3/16 – 3.0 pcf Honeycomb Core During Max. Wind and Vehicle Speed

Note: Max. Core shear stress = 7.5 psi.



Contour Plot for Maximum Resultant Displacement of GBFR Radome During Max. Wind and Vehicle Speed

Note: Max. Displacement = 0.105 inch