### **19-5. Multi-User Spaceport Umbilical Low Force Disconnect**

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This project designed and fabricated a prototype model of an Umbilical Low Force Disconnect (LFD). Traditional quick disconnects (QD) have a high separation force (SF) when pressurized due to the axial flow path through the QD. For standard QDs, the SF is equal to the fluid pressure times the flow area and can be 1000s of pounds for some QDs. To keep these QDs connected, massive structures such as heavy umbilical plates and latching mechanisms are required. The LFD eliminates the high SF by changing the fluid flow path from axial to radial at the QD interface. Thus, the SF is reacted by the QD internal structure and not transferred to the external mounting fixtures and supports. This allows other umbilical components to be much lighter, such as carrier plates, vehicle structure, mating mechanisms, and locking devices. The current concept combines three features, making it unique. One is a compliant mount, allowing self-alignment. Another is passive self-sealing mechanisms, which may evolve into self-cleaning design. The zero (or low) SF seal arrangement and radial flow path is the third major feature. This feature eliminates the axial SF and will greatly reduce the weight of mounting components and reliance on high strength locking devices. Analysis was performed to verify the LFD design can meet the pressure requirements without exceeding the material allowable stress. Some hand calculations were also done to check the area of complex geometry near the probe holes. The QD was modeled in the mated hydrotest configuration. All part stresses were < 20 ksi range which are less than the allowable stress 53.3 ksi so all parts pass the stress criteria. Stress concentration due to coarse meshing geometry near the holes creates local hot spots in the Finite Element Analysis (FEA) model, but hand calculations above show an adequate margin in this area. After all of the parts we designed using Creo, a full set of shop drawings were created and logged in the KSC database for future official record and release of production LFD design. Fabrication of the parts were done by commercial vendors. The LFD design, analysis, fabrication, and assembly were successfully completed during the FY20 phase of the project.