

CUSTOMER:  
**Kistler Aerospace Corporation  
 and Lockheed Martin Space  
 Systems**

INDUSTRY:  
**Aerospace**

PROJECT NAME:  
**Design and Analysis of the K-1  
 LAP LOX and RP Tanks and  
 Skirts**

CUSTOMER LOCATION:  
**Kirkland, Washington & New  
 Orleans, Louisiana**

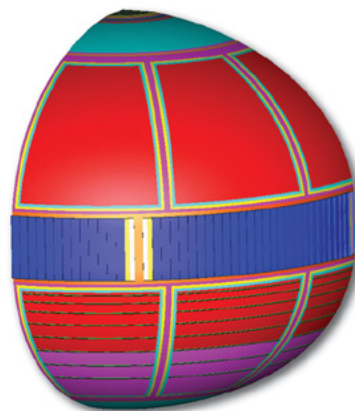
**OVERVIEW**

The Kistler K-1 is a new reusable launch vehicle consisting of two stages: a Launch Assist Platform (LAP) and an Orbital Vehicle (OV), both using LOX/RP engines. Until a tank manufacturer was brought under contract, ATA took responsibility for the design and analysis of the LAP LOX tank before it became a schedule-critical item. ATA carried out a series of trade studies to explore different design concepts to satisfy material availability and manufacturing constraints. After Lockheed Martin Space Systems (LMSS) was awarded the tank contract, ATA continued the design effort directly for them and used an analysis-driven design approach to develop a design that could meet all of the structural, producibility, and transportability requirements.

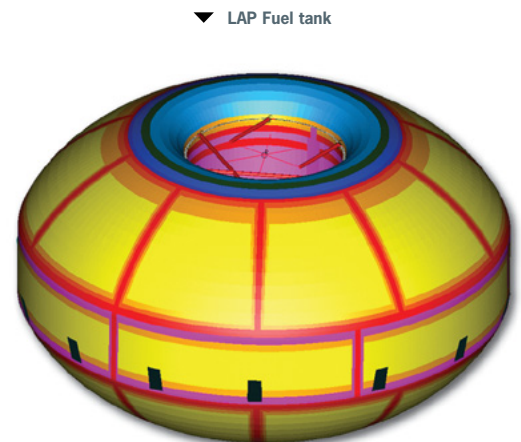
ATA also provided stress, buckling, and weight-reduction analysis support on the LAP LOX retention tank and LAP RP tank and supported the development of the all-metallic skirts used to integrate the LAP and OV LOX tanks into the K-1 structure. This support was provided through a combination of on-site support at LMSS Michoud Operations and off-site support at ATA's facilities in San Diego.

**ATA SUPPORT INCLUDED:**

- ▷ Development of early design concepts for the LOX tank barrel and domes.
- ▷ Thin shell stress analysis of the tanks subject to internal pressure and quasi-static G loads.
- ▷ Recommendation of suitable factors of safety and allowable stress values for all areas including the welds.
- ▷ Linear and/or nonlinear buckling analysis of all compression components.
- ▷ Detailed analysis of flanged connections.
- ▷ Analyzed the LOX tank manhole cover design concept used by LMSS on the Space Shuttle external tanks and checked the design for stresses and sealing requirements for use in the K-1 tank configuration.
- ▷ Analysis in support of weight reduction studies for all components.
- ▷ Detailed analysis and trade studies to identify alternate and lower-weight orthogrid configurations for the tank skirts.



▲ LAP LOX tank



▼ LAP Fuel tank

© ATA Engineering, Inc. 2010