



CUSTOMER:
Kistler Aerospace Corporation

INDUSTRY:
Aerospace

PROJECT NAME:
Loads Modeling of the K-1 Launch Vehicle

CUSTOMER LOCATION:
Kirkland, Washington

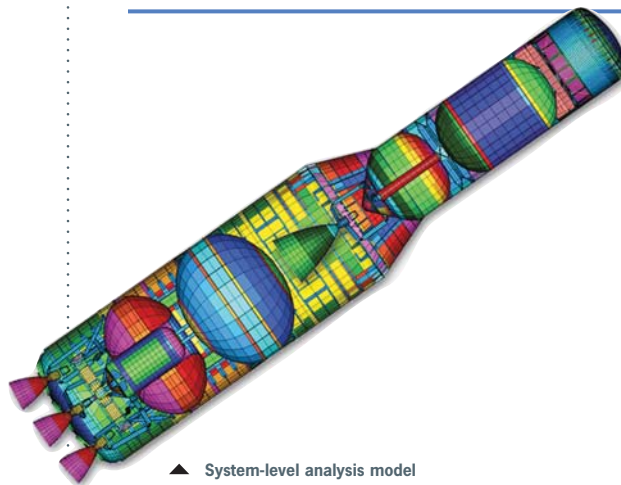
OVERVIEW

Kistler Aerospace was a private company whose mission was to develop a completely new reusable launch vehicle designed to dramatically reduce the cost of launching low-earth-orbit communications satellites.

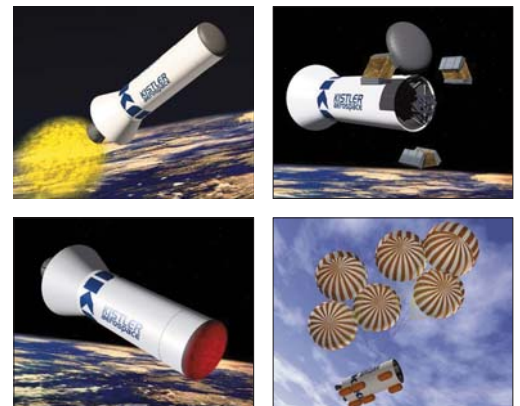
Kistler was responsible for system integration, with a large number of subcontractors supplying the various components of the vehicle. ATA Engineering, Inc. was a key subcontractor and was responsible for all system-level loads and thermal analysis of the K-1 vehicle for all phases of flight.

ATA SUPPORT INCLUDED:

- ▷ Developed finite element (FEM) of the vehicle for multiple phases of flight. This model was based on a wide variety of different data from various subcontractors.
- ▷ Developed forcing functions to represent all critical flight events.
- ▷ Created methodology to calculate buffeting loads and response based on generic wind-tunnel data.
- ▷ Structural-dynamic simulation of all critical flight events
- ▷ Pogo analysis to confirm dynamic stability of the coupled propulsion/structural system.
- ▷ Definition of acoustic and random-vibration environments for internal components.
- ▷ Creation of a system-level thermal model based on contract design information and then application of necessary heating to the vehicle.
- ▷ Application of heat loads including electronic power dissipation, aeroheating due to ascent and re-entry, base heating of the launch vehicle due to rocket exhaust, radiant heating from the rocket plume, solar and Earth IR flux, and convective heat prior to liftoff and after landing.
- ▷ Simplified representations of the decompression/recompression of the launch vehicle and the temperature of the ullage gas in the RP and LOX tanks.
- ▷ Verification of the Thermal Protection System (TPS) design by comparing the system-level results to the one-dimensional calculations performed by the TPS provider.



▲ System-level analysis model



▲ Analyses considered all phases of flight and return