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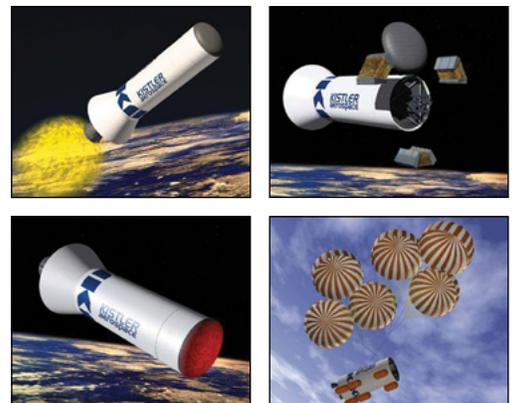
Kistler was responsible for system integration, with a large number of subcontractors supplying the various components of the vehicle. ATA Engineering, Inc., was a key subcontractor and was responsible for all system-level loads and thermal analysis of the K-1 vehicle for all phases of flight.

ATA SUPPORT INCLUDED:

▷ Development of finite element model (FEM) of the vehicle for multiple phases of flight. This model was based on a wide variety of different data from various subcontractors.

▷ Development of forcing functions to represent all critical flight events.

▷ Creation of 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 reentry, 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**

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