Structural Design Practices

- Payload interfaces to launch vehicles
- Examples of structural design approaches from past space vehicle structural designs
Shuttle Payload Restraint Configurations

3-POINT ATTACH

KEEL FITTING; REACTS SIDE AND LONGITUDINAL LOADS ($F_y$ & $F_x$)

5-POINT ATTACH

PRIMARY FITTINGS; REACT LONGITUDINAL AND VERTICAL LOADS ($F_x$ & $F_z$)

KEEL FITTING; REACTS SIDE LOAD ($F_y$)

STABILIZING FITTINGS; REACT VERTICAL LOAD ($F_z$)
Orbiter Active Latches

Diagram showing the components and alignment guides for the orbiter active latches.
Orbiter Passive Latches
Atlas V Payload Fairing Configuration
Delta IV Bolted Payload Attach Fitting
Delta IV Pyro Payload Attach Fitting
Delta IV Marmon Band PAF
Saturn V First Stage (S-IC) Cutaway
Saturn V S-IC Intertank Fairing
Saturn V S-II LOX Tank Cutaway

LIQUID OXYGEN TANK

36 INCH DOLLAR CLOSEOUT
GAS DISTRIBUTOR
LOX TANK VENT LINE
EQUATORIAL WELD
LOX RECIRCULATION RETURN LINES
LOX VENT VALVES
ACCESS PANEL
CRUCIFORM BAFFLES
ENGINE SUPPLY LINE CONNECTION
ENGINE CUTOFF SENSORS
LOX RECIRCULATION RETURN LINES

CAPACITANCE PROBE
LH2/LOX COMMON BULKHEAD
PROPELLANT LEVEL MONITORING STILLWELL AND ULLAGE SENSE LINE
SLOSH BAFFLES
LOX FILL AND DRAIN LINE
AFT LOX BULKHEAD
9 FOOT DOLLAR SECTION
SUMP
ANTI-VORTEX BAFFLES
Saturn V S-II Thrust Structure Detail
Saturn V S-IVB/J-2 Thrust Structure
Lunar Module Overall Configuration
Lunar Module Ascent Stage Structure
Lunar Module Ascent Stage Structure

- Antenna Supports
- Midsection
- Aft Equipment Bay
- Equipment Rack
- Thermal and Micrometeoroid Shield
- Crew Compartment
- TCA Cluster Supports
Lunar Module Descent Stage Structure
Lunar Module Descent Stage Structures
Gemini Spacecraft Equipment Arrangement

GEMINI EQUIPMENT ARRANGEMENT

- Communications Equipment
- Propellant Tanks
- Orbit Attitude Control Thrusters (Typical)
- Coolant Radiators
- Coolant Pumps
- Cryogenic Oxygen Tank
- Electrical Power System
- Instrumentation Equipment
- Drinking Water
- Maneuver Thrusters (Typical)
- Inertial Guidance System
- Electrical Equipment
- Horizon Sensors
- Rendezvous Radar
- Retrograde Rockets
- Entry Seats
- Parachute Landing System
- Entry Attitude Control System

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Structural Practices
Principles of Space Systems Design