No Hydraulic/Pneumatic Support Systems

Space Propulsion Technology
Assessment Workshop

April 2001

Current Baseline
No Hydraulic/Pneumatic Support Systems

- Use of hydraulic and pneumatic actuation on the vehicle results in
  - Distributed hydraulic and distributed pneumatic systems on the vehicle
    - Must be both heated and cooled at different times in the flight and space environment
    - Many potential leaks
    - If maintenance required, system must be broken
      - Leak checks and process verifications
    - Historically requires significant maintenance
  - Hydraulic and pneumatic connections through umbilicals
    - System integrity broken every turnaround
  - Significant amounts of Ground Support Equipment
    - >150 pieces of GSE
    - Ground support equipment itself has distributed hydraulic and pneumatic systems
    - So much GSE itself requires significant support

- Overall effect is large amount
  - Hands-on labor
  - Unplanned maintenance
  - Turnaround times that can not be shortened to Gen 2 or Gen 3 goals

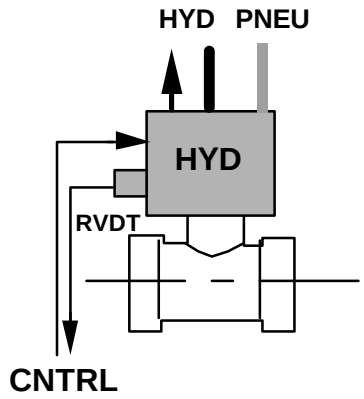
Goal/Solutions
No Hydraulic/Pneumatic Support Systems

- Eliminate distributed hydraulic and pneumatic systems on the vehicle and engine
  - Valves
  - TVC actuators
  - Control surface actuators

- Eliminate hydraulic and pneumatic connections through umbilicals
  - Eliminates some fluid lines
    - Eliminates leak checks and process verifications
  - Replaced by electrical power and signal lines

- Greatly decrease amount of GSE and eliminate distributed hydraulic and pneumatic systems on the GSE that remains

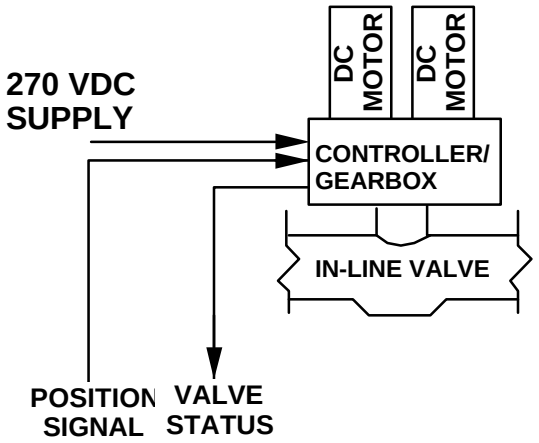
Current SSME



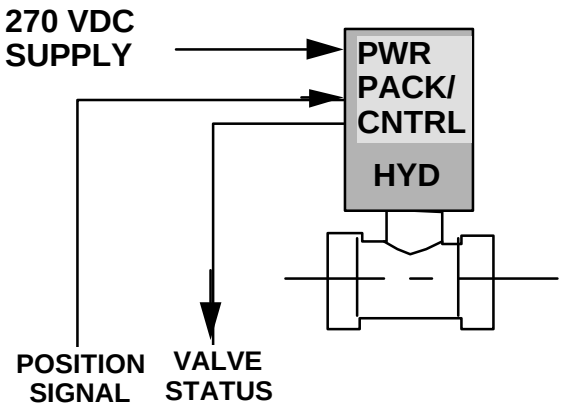
Technologies to Implement Solutions (TRLs)
No Hydraulic/Pneumatic Support Systems

- EMAs for valve actuation (4/5)
    - Also requires low torque valves (e.g., ball sector valves)
- Electro hydrostatic actuators (EHAs) for high torque applications, e.g., TVC actuators (4/5)
    - Self-contained, not distributed, hydraulics
- Power supply (4/5)
- Power management and distribution system (4/5)
- Now only power across interface
    - Could be only one umbilical if supplying to main internal power system

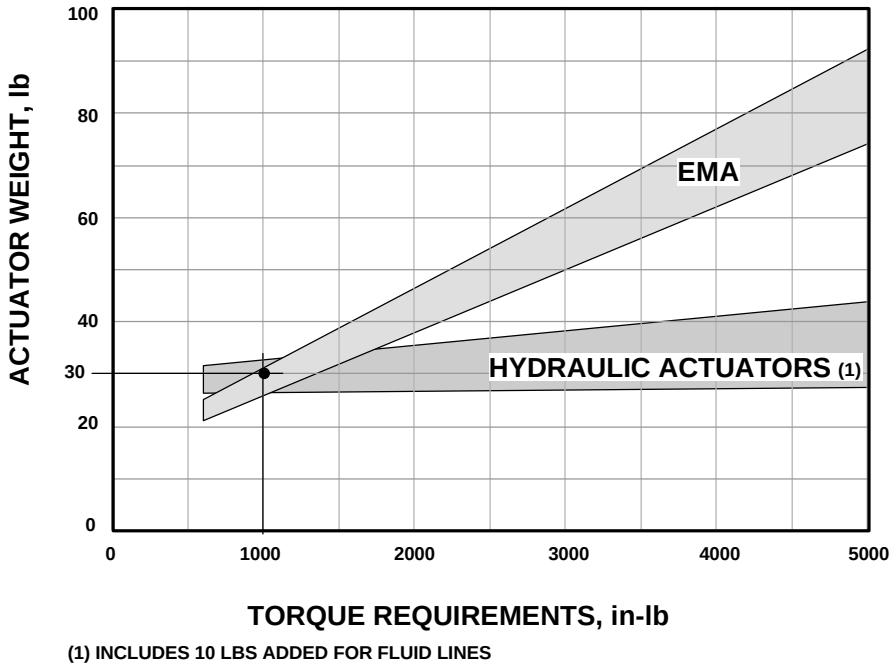
EMA



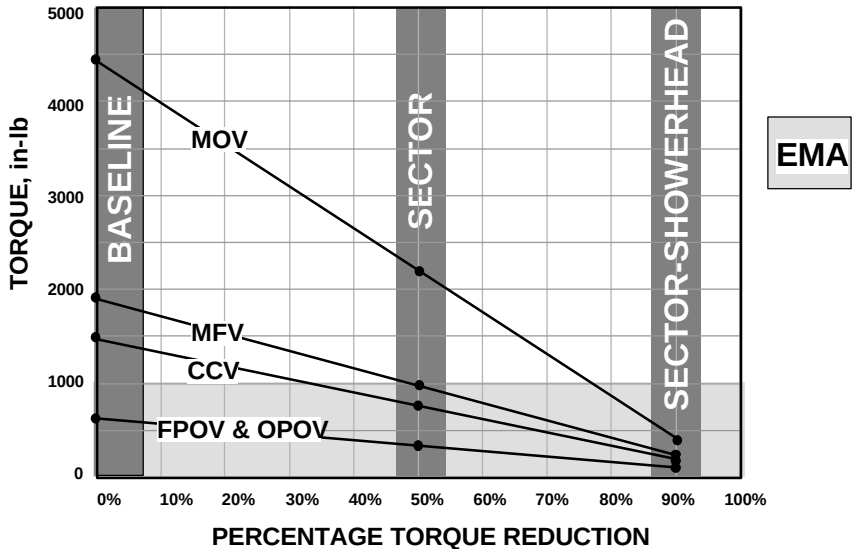
Electro-Hydraulic



Technologies to Implement Solutions (TRLs)
No Hydraulic/Pneumatic Support Systems



(1) INCLUDES 10 LBS ADDED FOR FLUID LINES



Cost to Mature Technology
No Hydraulic/Pneumatic Support Systems