



CLV Update

*Dale Thomas
June 15, 2006*



NASA's Exploration Launch Vehicles





◆ **Lead responsibilities for Upper Stage**

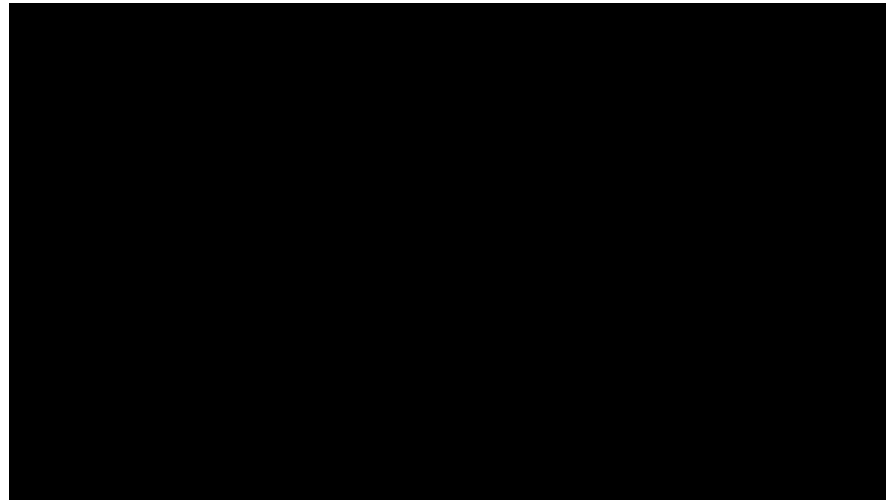
- Thrust Vector Control subsystem design and development
- Electrical Power and Power Distribution system design and development
- Developmental Flight Instrumentation Package
- Leak Detection Sensors Development
- Purge System
- Hazardous Gas Detection system

◆ **Upper Stage module development for Ascent Development Flight Test-0 (ADFT-0)**

◆ **Upper Stage SE&I support**

◆ **J-2X thermal/vacuum testing at Plum Brook**

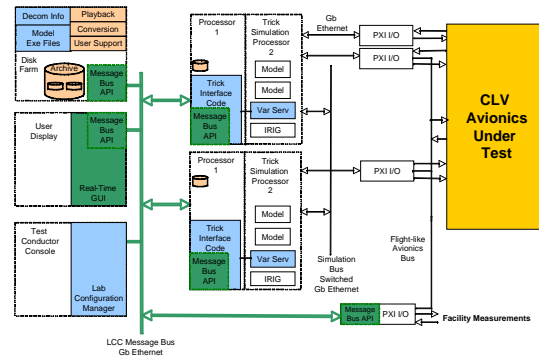
◆ **Vehicle Integrated Design Analysis support**



◆ Ground operations support to the CLV:

- Ground Support Equipment development and support facility modification activities
- Ground operations requirements during the design, development and test of all elements

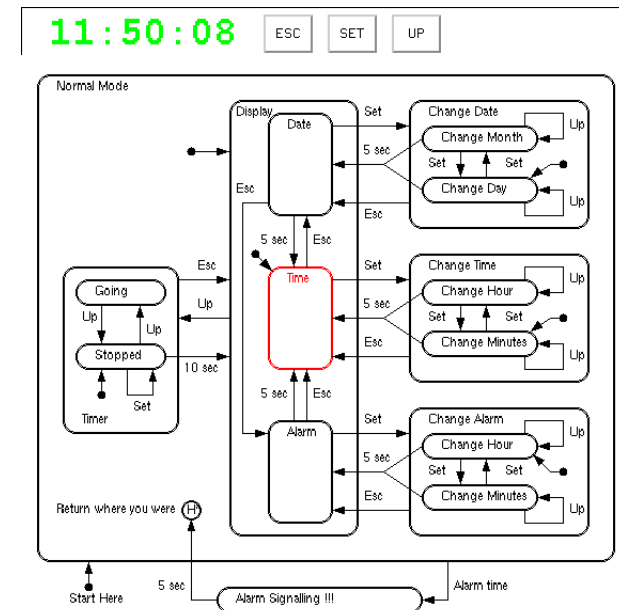
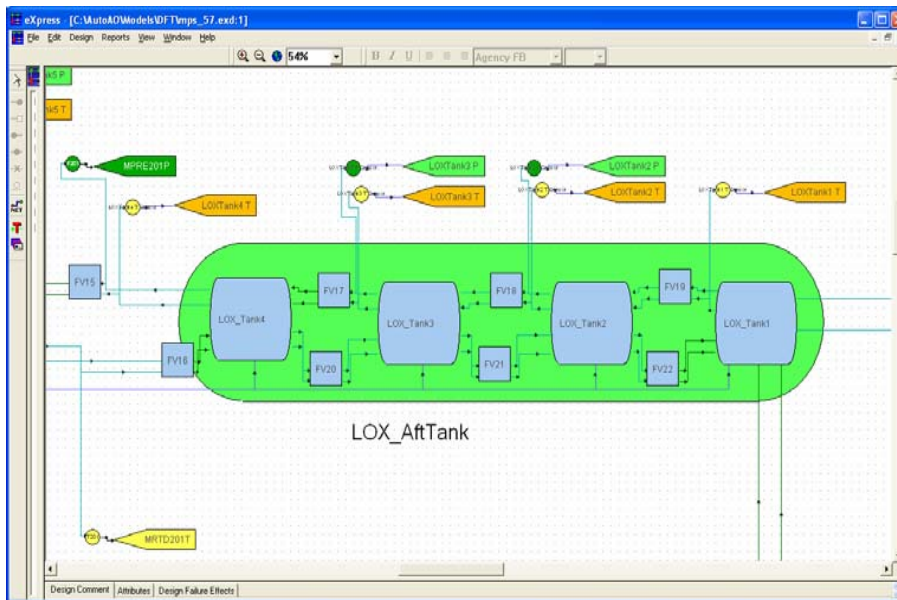
◆ Avionics Simulations Support



Preliminary SIL Architecture

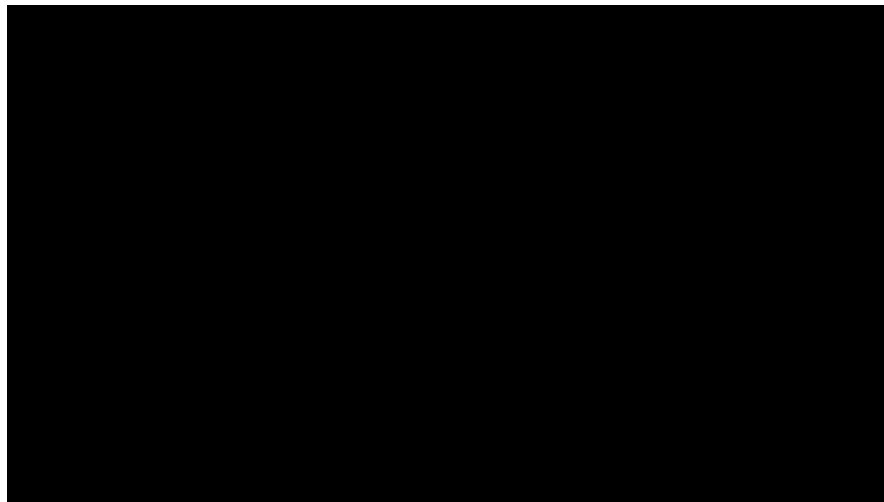


- ◆ **Integrated Systems Health Monitoring (ISHM) including design and development health monitoring requirements analysis, CLV element fault detection algorithms development, and DDT&E and V&V tools development**
- ◆ **Reliability assessment**
- ◆ **Ascent Abort CFD Blast Analysis**

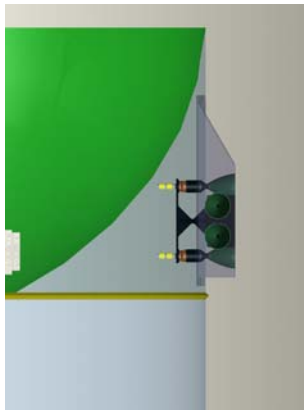




- ◆ **Lead Aerodynamic characterization of integrated launch vehicle stack, aerodynamic database development, and aeroelasticity test and analysis**
- ◆ **Lead for vehicle integration activities and CEV module development for Ascent Development Flight Test-0 (ADFT-0)**
- ◆ **Structural design and analysis, Guidance, Navigation, and Control (GN&C) development, Flight Mechanics and trajectory analyses**
- ◆ **Systems Engineering support to Upper Stage DDT&E**

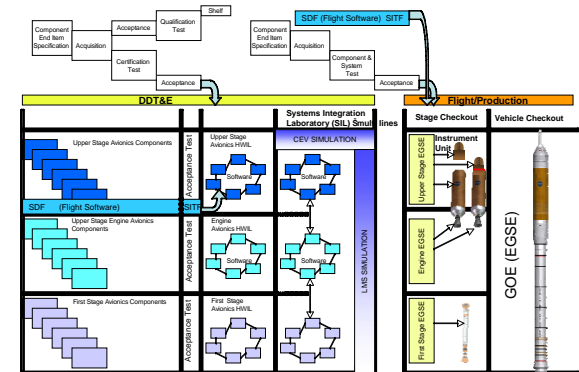
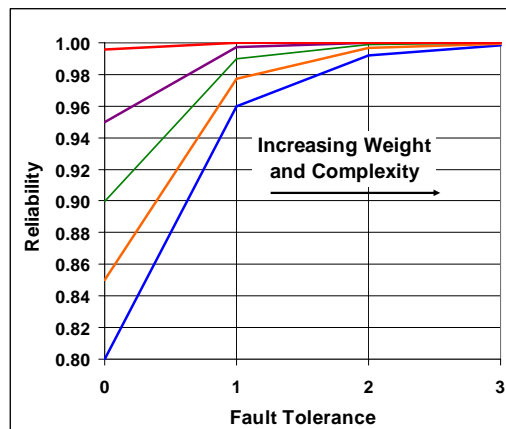


- ◆ **Flight operations support to CLV including:**
 - First Stage Recovery System modification activities
 - WSTF support to Upper Stage Reaction Control System test planning and activities
 - Abort Certification for all phases of CLV flight
- ◆ **Support Separation Certification for all phases of CLV flight:**
 - CLV reliability and safety assessments including launch site function
 - CLV Mission Operations Planning to the Operations Integration organization
 - Avionics Simulation development



Upper Stage Roll Control

Effect of Redundancy on Reliability

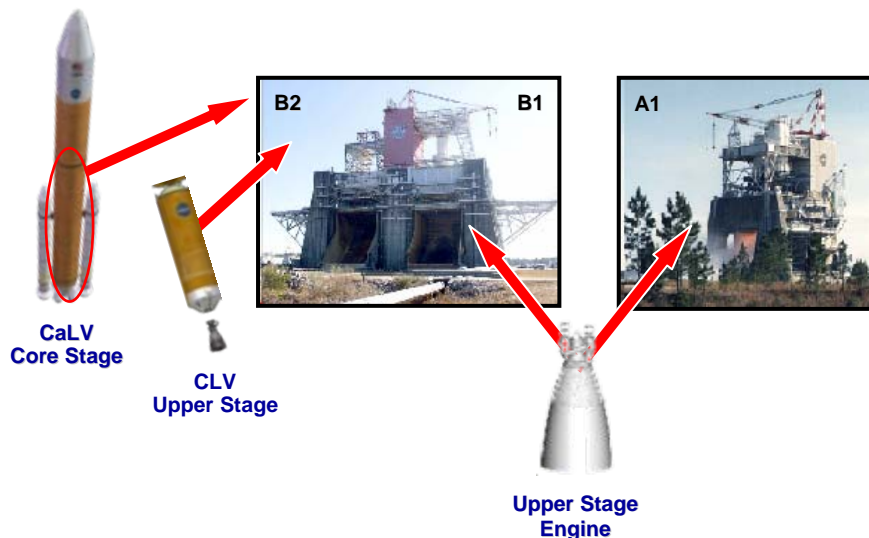


System Integration Lab

Stennis Space Center



- ◆ Program management and integration role for Constellation Systems rocket propulsion testing
- ◆ Lead Sea Level Development, Certification & Acceptance Testing for Upper Stage Engine including facility modifications and test operations
- ◆ Altitude Development & Certification Testing for Upper Stage Engine support
- ◆ Lead Sea Level Development Testing for Upper Stage Main Propulsion Test Article including facility modifications and test operations
- ◆ Lead Sea Level Acceptance Testing for Flight Upper Stage Assembly including facility modifications and test operations
- ◆ CaLV Core Stage/RS68 engine testing



Marshall Space Flight Center



- ◆ **Responsible for achieving all CLV and CaLV objectives for the Agency and overall Projects Management**
- ◆ **NASA-led launch vehicle stack integration and S&MA**
- ◆ **NASA-led Upper Stage DDT&E with later industry production partner**
 - First Stage and Upper Stage Engine design & development management (with ATK and Pratt & Whitney Rocketdyne) and CLV demonstration testing (ADFT-0 and other flight demonstrations)
 - Propulsion component & small scale wind tunnel testing
 - Large scale structures & dynamics testing

