Accomplishments this Period:

**Contracting:** Letter contract with Ball Aerospace approved. GA Tech personnel now fully engaged in Ball ESR&T team activities.

**Coordination:** Georgia Tech personnel participated in all Ball ESR&T team telecons.

**Workforce:** In addition to Dr. Robert Braun and Dr. Stephen Ruffin, the following 7 Georgia Tech students (all US citizens) are working as part of the Ball ESR&T team as of Aug 15, 2005:
- Reuben Rohrschneider (PhD student, aeroelasticity)
- Jin Wook Lee (PhD student, aerothermodynamics), started 9/1/2005
- Scott Francis (MS student, aeroelasticity)
- Grant Wells (MS student, design concepts & integrated systems analysis tool)
- Ian Clark (MS student, design concepts & integrated systems analysis tool)
- John Theisinger (MS student, design concepts & integrated systems analysis tool)
- Kevin Flaherty (Undergraduate research scholar, integrated systems analysis tool)

**Aeroelasticity Tool:** An initial integrated tool set was completed on Aug 15, 2005 and delivered to Chris Zeller at Ball Aerospace. This integrated tool set allows fully-coupled structural and aerodynamic solutions. Structural code validation was performed with simplified models to demonstrate the capability to predict structural response for thin membrane tests documented in the literature. Wrinkling and buckling criteria were both examined. The structural analysis code results show good agreement with test data in the literature. The simplified aerodynamics model with moving boundary capability utilizes the modified Newtonian method for the continuum regime and the collisionless DSMC for the free-molecular regime. This milestone was delivered early (not planned for completion until October 14, 2005).

**Aerothermodynamics:** Moving geometry flow boundary conditions fully installed in NASCART-GT. During the performance period, interface routines to write and read data between the flow code and LS-DYNA were completed and are ready for preliminary testing of coupled aeroelastic simulations. Equilibrium air curve fit routines written for NASCART-GT. Testing and validation being performed on blunted axisymmetric geometries.
Plans for September:

**Contracting:** Complete negotiations and gain approval of fixed-price contract for Ball ESR&T Base Period.

**ISAT:** Version 0 of the Integrated Systems Analysis Tool will be delivered on September 16, 2005 (on plan). This tool has conventional entry system functionality and will be initially accessible to all members of the Ball ESR&T team via a standardized email interface. A description of the tool functionality, input/output process and plan for continued development will be posted on the Livelink server on Sept-16. Version 1.0 updates of this tool will include ballute geometry (clamped and trailing) and trajectory event functionality and web format input/output access scheme and will be delivered by Jan 20, 2006.

**Systems Design:** The Georgia Tech team will begin analysis of three alternative ballute applications: (1) ISS cargo downmass, (2) CEV ascent abort, and (3) Hybrid ballute CEV concept that allows the CEV thermal protection system to be designed and qualified for the LEO aerothermodynamic environment, but be used for lunar return. The Georgia Tech team will also support Ball Aerospace primary applications as directed.

**Aeroelasticity:** Georgia Tech is working towards integration of a thermal response model into the existing structural-aerodynamic coupled model. A 3-D steady state thermal response model will be complete by the end of September. A shadowing algorithm will be added to the simplified aerodynamic tool to allow more complex geometries. Wind tunnel test data obtained through NASA’s In-Space Propulsion program will be used to validate the static coupled solution.

**Aerothermodynamics:** Will conduct preliminary testing of coupled aeroelastic simulations with LS-DYNA and NASCART-GT. Conduct testing and validation of equilibrium air predictions on blunted axisymmetric geometries.

**Significant purchases:** Georgia Tech will obligate equipment costs totaling approximately $25k for an 8-node, 16-CPU Linux based cluster machine. Each CPU is an AMD Opteron 248 with 3 GB of RAM. Node coupling is via gigabit Ethernet. This machine will allow computation of complex ballute aeroelasticity and aerothermodynamic solutions over the remainder of the Ball ESR&T contract.