Public Abstract First Name:Shelly Middle Name: Last Name:Su Adviser's First Name:Craig Adviser's Last Name:Kluever Co-Adviser's First Name: Co-Adviser's Last Name: Graduation Term:SS 2008 Department:Mechanical & Aerospace Engineering Degree:MS Title:ADVANCED GUIDANCE ALGORITHMS FOR THE ARES V CARGO LAUNCH VEHICLE

In following with the United Statesâ€[™] Vision for Space Exploration, the next generation of launch vehicles is aimed at providing crew and cargo access to the International Space Station, the Moon, Mars, and beyond. Therefore, it is necessary to develop advanced guidance algorithms which improve fuel performance over the current Shuttle-based guidance methods and are capable of anticipating/compensating for discrete events, such as escape tower jettison and heat-rate constraints. Launch ascent guidance is an area that routinely involves applications of optimization tools and optimal control theory. The vacuum ascent trajectory problem has been formulated as a two-point boundary-value problem with an interior-point state constraint and is solved with a method of direct parameter optimization. The direct method simplifies the more complicated full costate problem and an off-line trajectory optimization routine for the Ares V Cargo Launch Vehicle (CaLV) shows optimal performance as compared to trajectory simulations performed in the industry standard software, Optimal Trajectories by Implicit Simulation (OTIS).

The guidance solution may also be determined through an analytic method, developed by assuming polynomial approximations for the steering profiles and flight-path angle profiles. This approach is valuable as guidance routines typically operate under indirect methods, and it is practical to derive a solution which can be used for on-board, real-time guidance. The analytic solutions prove to be useful when applied to the Shuttle-based Powered Explicit Guidance (PEG) routine, where the results have been shown to converge to a near optimal trajectory.