



T0115-S EDL Technology Development for the Maraia Earth Return Capsule

Problem Statement

- The overarching goal is to develop an inexpensive, autonomous, ISS based vehicle to provide on-demand return of small scientific & engineering payloads, or function as an ISS-deployed entry technology test bed.
- This flight opportunity explores the super thru sub-sonic stability, control & aero of a candidate Maraia vehicle shape, advancing understanding of its performance farther into the EDL flight regime.
- Potential users include (1) ISS small, on-demand return payloads; (2) Entry technology flight testing (aero shapes, propulsion, GNC, TPS, etc.); and could evolve to support (3) planetary sample return.

Development Team

- PI: Al Strahan/JSC-EG4 (alan.l.strahan@nasa.gov)
- STMD & Flight Opportunities Office are funding this effort
- JSC and KSC are collaborating on this tech; Wallops has supported; Ames could be a future partner

Proposed Flight Experiment

Experiment Readiness:

- Maraia payload will be ready to support a flight test scheduled for Aug, 2015.

Test Vehicles:

- Flight test shall utilize a Flight Opportunities' sRLV platform, specifically a high altitude sounding rocket, the SpaceLoft XL by UP Aerospace.

Test Environment:

- Previous Maraia flight testing explored sub-sonic performance from Mach 0.5 to 0.8 without active control, & demonstrated a pneumatic chute deploy.
- This flight test shall target a speed regime from Mach 3.0+, down to Mach 0.4, exploring aerodynamic stability and control augmentation utilizing a cold gas system, and will again demonstrate a pneumatically deployed parachute.

Test Apparatus Description:

- Capsule is 6.5 inch x 10 inch dia., being 1/3 scale for envisioned ISS vehicle. Shape is a truncated Soyuz derivative, intended to maximize volume while being stable (stability requires investigation). Subsystems include GPS/INS, propulsion, flight processor, cameras, tracking and data recording.



Technology Maturation

- Flight test & demonstration of the candidate Maraia capsule shape, with active control, from 200,000+ ft and Mach 3+, constitutes that of a prototype demonstration in a relevant environment (NASA TRL 6) for this EDL flight regime, where capsules can be unstable and hard to model. To date this tech, involving aero modeling and simulation, maps to a TRL 3 - 4, (analytic validation in a lab).
- Future testing could take this prototype shape to orbit flight conditions or entry from orbit speeds.

Objective of Proposed Experiment

- Investigate aero & stability for capsule shape (Mach 3 to 0.5)
- Explore / demonstrate active control augmentation
- Capture & record data for trajectory and aero reconstruction
- Demo pneumatic chute deploy
- Data will include attitude & rates, correlated with altitude and speed, to support aero, stability & performance model extraction

Applicable Technology Areas: TA09 (EDL Systems); A mature orbit return test-bed could support: TA04 (auto sys), TA07 (human exploration – EDL precursor), More EDL systems, etc.

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