Camera Layout Design for the Upper Stage Thrust Cone

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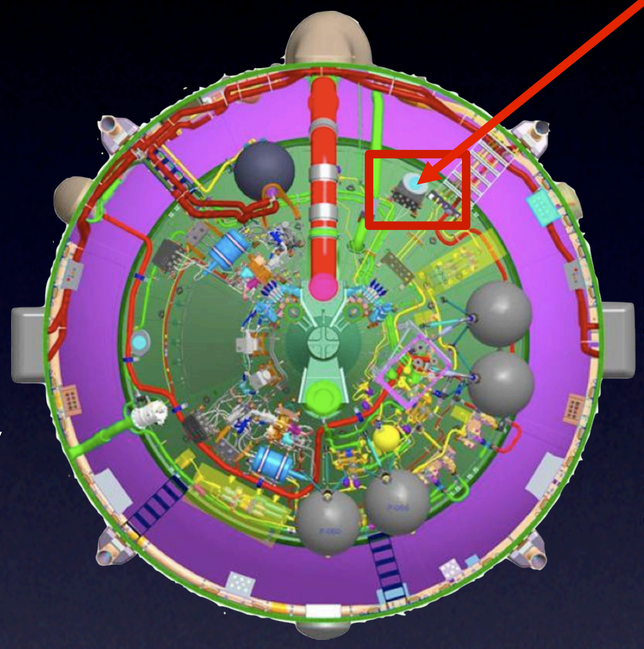
ABSTRACT

Engineers in the Integrated Design and Analysis Division (EV30) use a variety of different tools to aid in the design and analysis of the Ares I vehicle. One primary tool in use is Pro-Engineer. Pro-Engineer is a computer aided design (CAD) software that allows designers to create computer generated structural models of vehicle structures. For the Upper Stage thrust cone, Pro-Engineer was used to assist in the design of a layout for two camera housings. These cameras observe the separation between the first and second stage of the Ares I vehicle. For the Ares I-X, one standard speed camera was used. The Ares I design calls for two separate housings, three cameras, and a lighting system. With previous design concepts and verification strategies in mind, a new layout for the two camera design concept was developed with members of the EV32 team. With the new design, Pro-Engineer was used to draw the layout to observe how the two camera housings fit with the thrust cone assembly. Future analysis of the camera housing design will verify the stability and clearance of the camera with other hardware present on the thrust cone.



Thrust Cone View

DATA & FACTS

- Separation events will be filmed with two high speed cameras (HSC) and one standard speed camera (SSC) at two separate locations approximately one-hundred eighty degrees apart.
- Layout design for cameras must avoid interference with other thrust cone components and hardware (e.g. thermal blanket, power sources, etc.).
- Each camera mount houses two camera power connections and a lighting source.
- Lighting sources for cameras require placement in optimal locations to enhance image resolution and clarity.

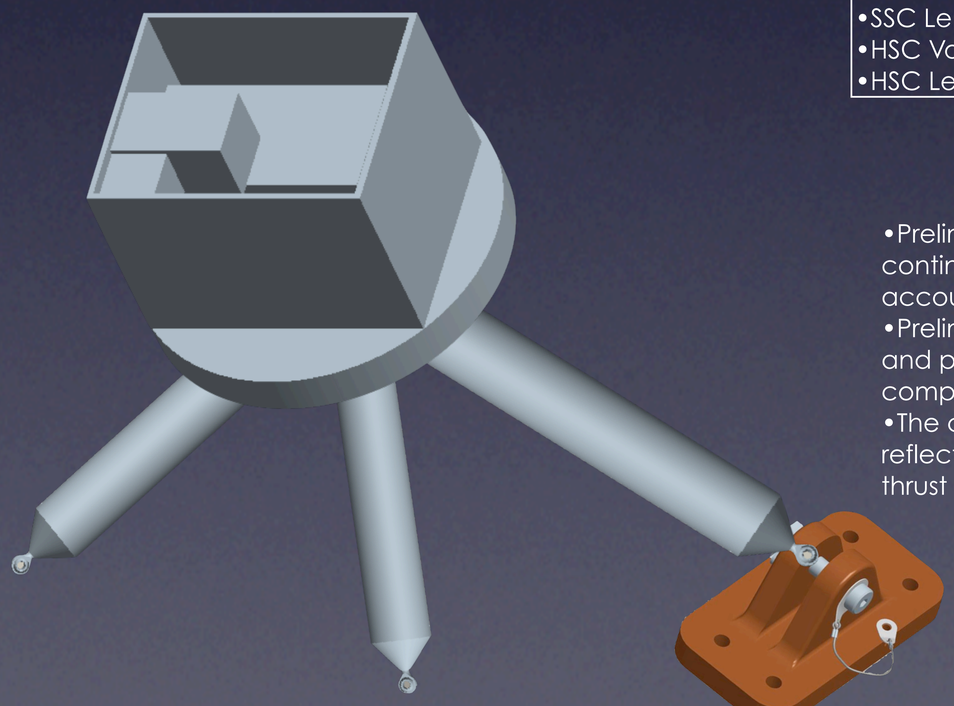
Volume Constraints-
- SSC Volume: 2.5” width X 2.5” height X 4” length
- SSC Lens: 2” width X 2” height X 2” length
- HSC Volume: 4.3” width X 6” height X 8” length
- HSC Lens: 2.5” width X 2.5” height X 3” length

BACKGROUND

- Stage separation occurs at the plane between the interstage and first stage frustum.
- A secondary separation occurs when the interstage separates from the upperstage.
- Confirmation of a clean stage separation (no contact) is important for flight monitoring and possible anomaly resolution.
- Thrust Cone field of view allows for best opportunity to confirm a clean separation event without contact of the nozzle.
- This task advances the preliminary design of the camera system as a part of the design process.

METHODOLOGY

- Trained with Pro-Engineer tool used for model design.
- Met with Upper Stage design and technical points of contact.
- Reviewed Motion Imagery specifications for design details and constraints.
- Reviewed previous Ares I-X camera implementation.
- Modeled an ideal housing for the cameras.



Camera Mounting Assembly

CONCLUSIONS

- Preliminary layout of camera mount design allows engineers to continue maturing design of the thrust cone layout by accounting for camera footprint.
- Preliminary layout includes some allowance for camera growth and protects against interference from other thrust cone components.
- The current layout of camera mount design is preliminary but reflects current specification maturity and will support future final thrust cone design and layout.

REFERENCES

Acknowledgements: Pravin Aggarwal
Brent Beabout
Jeff Dilg
Carlos Velez