

25 April 2006

At the STEREO Mission Design and Navigation Review held on 12 October 2005, the following Action Item was generated:

- **Area of Concern:** Separation Modeling
- **Originator/Organization:** Roby Wilson / JPL
- **Action:** Revisit the models for the A/B separation. Specifically look at the cg/cm offset. Confirm that this is properly modeled in the Monte Carlo simulations.
- **Rationale:** My concern is that unmodeled torques may be introduced in the s/c's. This will offset the correlation factor between the de-tumble ΔV 's. If large enough, the ΔV 's could drive the s/c towards each other instead of apart. This could be especially evident in the case where the yo-yo despins the stack to mean 0 but with non-zero tip off rates.

Response:

In the "MD Monte Carlo" section of the Mission Design and Navigation Review, reference was made to detailed analysis performed by P.J. Sharer, that was documented in the supporting paper: "Separation Analysis for the STEREO Mission," Paper AAS 03-553. That analysis used supporting detumble analysis that is documented in reference 2 of the paper: Kantsiper, B. L., STEREO Separation Analysis, SRM-03-011 (APL Internal Memo), January 24, 2003.

While the spacecraft stack is nominally spin-balanced to put the *stack* cm on the launch axis, the A/B separation detumble analysis did in fact include individual mass properties for each spacecraft with off-axis components of the respective center of mass locations based on the estimates of the cm locations at the time of the analysis. The cm offsets of the respective spacecraft were not explicitly mentioned in the Sharer paper but were included in the Kantsiper analysis and, by extension, the Sharer paper. (Note: There has been very little change in the estimated position of the respective spacecraft cm's since the original analysis.) The detumble analysis included variation of the initial stack angular rates from zero to 5 rpm that covers the variations as expected from the launch vehicle. Furthermore, each of the A/B separation springs were modeled with variations that we believe are larger than the expected cm uncertainties (and which would, therefore produce a torque even with no cm offset). As both papers indicated, at low (de)spin rates and separation ΔV 's the initial attitudes of the two spacecraft relative to one another at the time of the propulsive detumble are random. While we have almost certainly not modeled the A/B separation and resulting detumble events perfectly, we have modeled spacecraft cm offsets and spring force variations to produce torques at A/B separation that should be representative of what we will see in flight and consistent with the Area of Concern expressed in this question.