

C.2 IMPACT Boom Suite

The IMPACT boom instrument suite has relatively little in common other than 1) they are not part of SEP, 2) they are not part of the IDPU, and 3) they all have reasons to want to be on a boom, away from the spacecraft. The suite consists of the Magnetometer sensor, the SWEA and STE electron instruments, and the boom itself. The possibility of accommodating the proposed SWAVES coil on the boom has been considered, and we see no significant difficulties.

The MAG sensor needs to be on a boom that keeps it at least 3 meters from the nearest part of the spacecraft in order to avoid contamination of the measurement by spacecraft-generated fields (See Appendix H for a description of practices that help maintain magnetic cleanliness pertinent to all STEREO instruments and the spacecraft.) For the same reason the MAG sensor must also be at least 1 meter from the other sensors and metallic materials, and the sensors must be especially magnetically clean. UCB has built electron instruments that have met these MAG requirements before, most recently on Lunar Prospector. The MAG sensor dissipates almost no power. It either needs to be mounted in the sun, or else needs operational heaters to keep it warm. We have designed the magnetometer sensor mount to the boom such that it should be in the Sun to avoid the operational heater requirement.

The STE detectors work best when they are cold; we hope to get the sensors cooled down to -50°C passively. This requires that STE be in the shade, and far from radiated heat sources on the spacecraft. STE also has a fairly large field of view (two oppositely-directed 80° by 80° fans) that must be glint-free, which would be hard to accommodate on the spacecraft. The STE is accommodated on the boom 1 meter outboard from the MAG sensor, just far enough inboard from the SWEA sensor to clear its FOV. STE shall be placed in the MAG sensor's shadow to keep it out of the sun.

SWEA needs to be far from the spacecraft in order to clear its large field of view (360° by 130°). Its aperture should also be in the shade to minimize the effect of photoelectrons and UV scattered into the detector. SWEA measures very low energy electrons (down to about 1eV) which can be easily perturbed by even low levels of spacecraft charging. Positioning SWEA on the end of the IMPACT boom provides it a clear FOV and keeps the trajectories of electrons traveling to SWEA as far as possible from the spacecraft. (Because no electrostatic cleanliness counterpart to Appendix H for magnetic cleanliness currently exists, we will generate a similar description of "good practices" for electrostatic cleanliness during Phase B.) We are currently working with Maxwell Technology consultants to determine whether the NASCAP code, developed for NASA and DoD for designing spacecraft immune to charging effects, can be used to benefit SWEA and STEREO design.

The IMPACT boom must maintain the instruments in the desired locations post-launch, while fitting within the available volume prior to launch and caging the instrument as required to survive launch. The boom must also not impact the spacecraft ACS stability, must meet the Electrostatic Cleanliness (ESC), ElectroMagnetic Cleanliness (EMC), Magnetic Cleanliness, and Contamination Control requirements. It must also deploy reliably. Since many of the boom requirements are imposed by the instrument, it was decided by Project in Phase A that the IMPACT team should be responsible for providing this boom.