STEREO Potential Control

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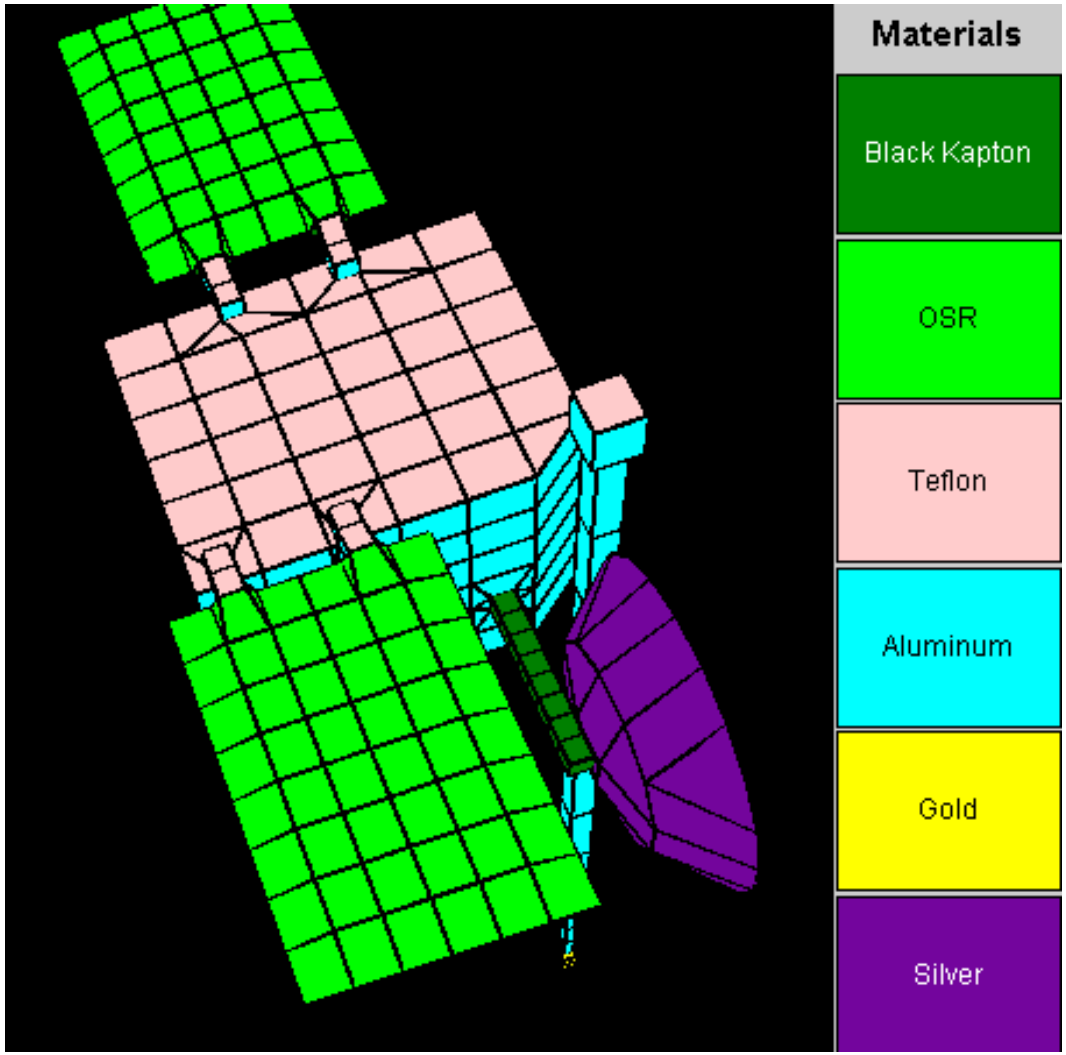
STEREO Potential Control

- Requirement
  - Spacecraft potential to remain positive.
- Baseline Design
  - Conductive Spacecraft
    - Grounded ITO coating over thermal blankets.
    - Photoemission maintains positive potential.
- Proposed Change
  - Omit ITO from some or all of front surface to avoid possible contamination of optical instruments.

Nascap-2K Model



- HGA antenna and boom are the only sunlit conductive surfaces.
- Photoemission from HGA antenna and boom must balance plasma current to all dark conductive surfaces.

Results

	A	B	C	D	E
Plasma Density [m^-3]	1.00E+06	1.00E+06	1.00E+07	1.00E+07	1.00E+07
Plasma Temperature [eV]	15	15	15	15	15
Front Surface	Conductive	Insulating	Conductive	Insulating	Insulating
HGA Raw PhotoYield [Am^-2]	1.00E-05	1.00E-05	1.00E-05	1.00E-05	4.00E-05
Ground Potential [V]	+7	+3	+2.2	-3	+0.25

- Cases C, D, E are probably typical.
- HGA alone cannot be relied on to provide adequate photo-emission to maintain positive potential.
- Required photocurrent is about 1.2×10^{-5} amperes (with adequate margin).
  - Depends on plasma density and temperature.
- 1 square meter of additional conductive sunlit area should be adequate to assure positive potentials.

Recommendations

- 1 m^2 of non-coated area on front surface is permissible.
  - Leaves about 1.2 m^2 of conductive, sunlit area.
- Make sure HGA back surface is conductive and grounded, and NOT of low-emission (carbon-rich) material.
- Experimenters should be aware that the uncoated material may present more problems (charging, sputtering, contamination) than the coated material.