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Growth of small satellite interplanetary missions necessitates development of novel lightweight deployable materials and systems. Among these high quality reflective thin films are of great interest for thermal control (radiators), deployable antennas, inflatable and deployable telescope components, and radiation pressure attitude control systems. In this work we study ultrathin ( $\sim 1\mu\text{m}$ ) carbon nanotube (CNT) freestanding thin films with optically smooth reflective coatings. Thin film CNTs exhibit unique properties including high thermal conductivity, heat resistivity, plasma resilience, while being a lightweight material ( $\sim 1\text{g}/\text{m}^2$ ). Typically fabricated carbon nanotube films are not optically smooth and lead to excessive light scattering, which limits their functionality. Here we demonstrate an approach with the use of a smooth sacrificial layer. Our fabricated free-standing films are optically smooth and  $<1$  micron thick, enabling ultralight  $<1\text{g}/\text{m}^2$  secularly reflective films. Several different metal coatings, including Al, Pt and TiN are explored. Thermal stability tests show that films can survive  $>400$  C. As an example use of our films we consider a solar sail material that is capable of reaching close to the sun. Such solar sails can enable fast transit small satellite interplanetary missions.