1106-VG-2700   **Justin Droba*** (`justin.c.droba@nasa.gov`), Lyndon B. Johnson Space Center, 2101 NASA Pkwy, Houston, TX 77058. *Bringing the Orion Space Vehicle Home Safe: the Mathematics of Thermal Protection Systems.*

Toward the end of *Star Trek Into Darkness*, as the *Enterprise* begins a free fall toward Earth's surface, the crew frantically attempts to restore power to the shields to prevent the ship from being incinerated upon re-entry. In order to avoid a real-life version of this scene all too common in science fiction films, spacecraft employ thermal protection systems (TPS). Unlike the energy-based deflectors of the cinema, real TPS are made from advanced materials and are based on ablation, the process by which a solid loses mass by sublimation or vaporization. Due to the exorbitant cost of testing, NASA makes extensive use of simulation and reconstruction of flight data to develop TPS that will keep astronauts and their transport safe. This talk will discuss the mathematical models used in the design of TPS for modern spacecraft such as Orion, scheduled for manned operation in 2020. We will then discuss the computational challenges present in resolving these models and give a high-level discussion of some of the techniques used to surmount the difficulties encountered. (Received September 16, 2014)