

Outer Planet Spacecraft Temperature Testing and Analysis
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Unmanned spacecraft flown on missions to the outer planets of the solar system have included flybys, planetary orbiters, and atmospheric probes during the last three decades. The thermal design, test, and analysis approach applied to these spacecraft evolved from the passive thermal designs applied to the earlier lunar and interplanetary spacecraft. The inflight temperature data from representative sets of engineering subsystems and science instruments from a subset of these spacecraft are compared to those obtained during the ground test programs and from the prelaunch predictions. The ground testing programs applied to all of these missions are characterized by: a) thermal development test activity for areas where there were significant thermal uncertainties, b) rigorous "black box level" environmental temperature testing program for the electronics and mechanisms which included a long dwell time at a hot temperature in vacuum, and c) comprehensive solar thermal vacuum test program on the flight spacecraft. Several lessons are presented with specific recommendations for considerations for new projects to aid in the planning of cost effective temperature design, test, and analysis programs.