Step 5: Sun-Solar System Connection Roadmap
Targeted Outcome to Capabilities to Implementation

Targeted Outcome: Phase 2005-2015, Understand our Home in Space

Describe How Space Plasmas and Planetary Atmospheres Interact

Required Understanding

- Energy flow between plasma and neutrals
- Effects of planetary magnetic field geometry on energy and momentum transfer
- Morphology of ionospheric current systems
- Roles of varying atmospheric chemistry on heat, momentum, and energy transfer between atmospheric regions.
- Tidal, planetary, and gravity wave generation,modulation, and coupling.
- Variability of energetic particle precipitation patterns.
- Plasma & neutral dynamics, structure, circulation, & instabilities

Enabling Capabilities & Measurements

- Simultaneous 3D plasma and neutral drift measurements
- Measurements of 3D particle distribution functions from thermal to tens of MeV
- Constellations of satellites in complementary orbits to resolve space-time ambiguities and enable predictive models
- Tomographic and occultation studies to quantify large-scale motions of plasmas and neutrals
- Empirical and first-principles models for cause and effect based prediction

Implementation Phase 1: 2005-2015

- TIMED and IMAGE
- Rocket Campaigns
  To provide high resolution, coordinated sampling of key mesospheric and thermospheric regions
- GEC
  To understand the energy exchange processes in the current layer at the top of the atmosphere
- I-TSP
  To understand sources of ionospheric structure, and thermospheric and ionospheric responses to geomagnetic storms
- Theory Program
  To include cross-scale coupling processes, and effects at the upper and lower boundaries of the atmosphere
- Model Development
  To include assimilation for nowcasting and forecasting