**Mission Motivation**

The ice giants represent a distinct class of planet and are considered the most common class of planet outside our solar system. Uranus in particular, with its extreme obliquity, exotic magnetic field, surprisingly hot stratosphere, anomalously low heat flux, and mysterious interior is one of the strangest planets in our solar system. Exploring this unique world would bring us closer to understanding the processes that result in the formation and evolution of the vast diversity of planets in our universe.

**Proposed Mission Goals**

Our mission would directly address two of the highest priority objectives as described for an Ice Giant flagship class mission in the Decadal Survey:

1. Understanding dynamos that drive magnetospheres in the solar system and beyond
2. Determining the relationship between the ionospheric environment, thermal environment, and deeper thermal-compositional structure of the interior, in contrast with the other giant planets

**Science Objectives**

I. Resolve between dynamo models for generation of the magnetic field
II. Establish whether surficial winds and banded structure of Uranus’ upper atmosphere are related to deeper internal dynamics
III. Determine the explanation for Uranus’ low thermal emission compared with Neptune and the other giant planets
IV. Verify the prediction that Uranus’ magnetic field opens and reconnects daily, and determine if this results in heating of the stratosphere

**Baseline Spacecraft Configuration**

- PRESTO (Plasma Wave Detector)
- MIRROR (Magnetometer)
- WAND (RGB - CH4, Camera)
- MAGIC (Magnetometer)
- RadiAnt (Plasma Detector)
- OPTICS (Optical Telescope)
- Avionics (Avionics)
- Post-upgrade Design

**Instruments**

**RadiAnt**
- Stratosphere and gravity measurements

**MAGIC**
- Magnetic field magnitude and direction

**PRESTO**
- Help resolve between dynamo models
- Thermal plasma, dust, lightening

**MIRROR**
- Global circulation patterns
- Cloud spatial structure
- Coupling of deep atmosphere to dynamo

**WAND**
- Bond albedo
- Stratospheric methane abundance
- Short-term atmospheric change

**Mission Concept Design**

- Launch: 03 May 2032
- 1.3-year cruise
- EEJU gravity assist path
- Earth flyby alt 1000 km
- Jupiter flyby alt 1.76 km
- Orbit insertion: 100-day capture orbit
- Science Orbit: 9 30-day polar orbits
- Perihelion altitude: 1.1 Ru
- End of mission: Disposal into Uranus

**Notional Schedule**

**Projected Cost**

- Cost Summary (FY2018 $M)
- Team X Estimate
- Launch Ride + NEPA Costs: 856.7 M
- Development Cost: 757.0 M
- Phase A: 4.2 M
- Phase B: 75.7 M
- Phase C/D: 677.1 M
- Phase E-F: 227.2 M

**Margin and Potential Future Trades**

- Power: 30% Margin
- Mass: 50% Margin
- Cost: 43.3 M below cap

- Fits in Atlas 431
- Mass available for 3d eMMRTG
- Instrument additions

**Conclusions**

- Low cost option for high priority ice giant mission
- Margins allow for flexible trade spaces
- A launch within this timeframe is critical to allow for Jupiter gravity assist significantly reducing costs

*The cost information contained in this document is a study and planning nature and is intended for informational purposes only.*