The Lunar polar Hydrogen Mapper (LunaH-Map) CubeSat Mission

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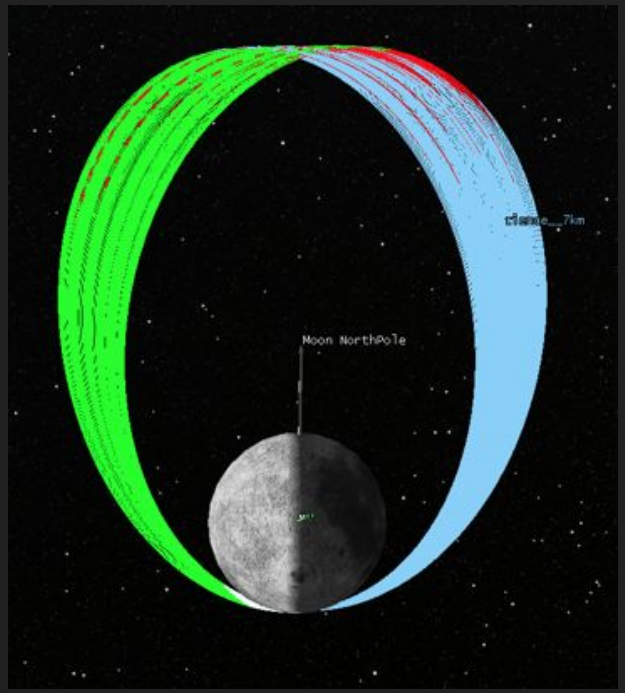
Mission overview

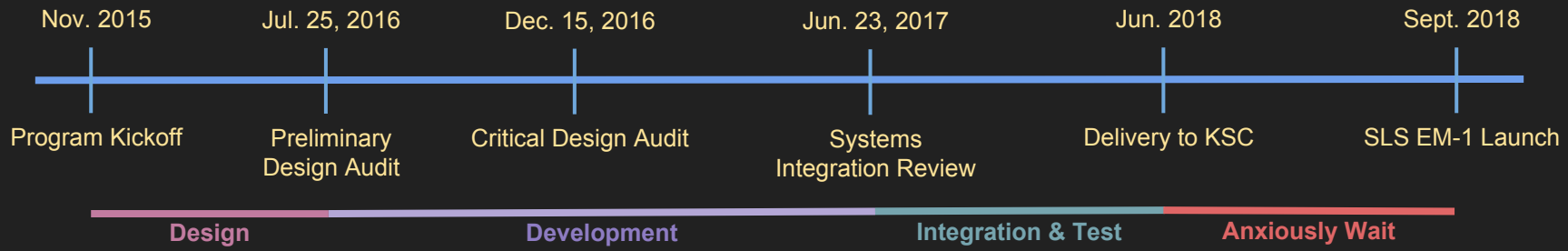
- Selected by NASA for SIMPLEx program in November 2015 to fly a 6U cubesat carrying a planetary science payload on SLS EM-1 in 2018
- Led by ASU in collaboration with NASA centers, JPL, and commercial companies
- Will complete low perilune (10 km) passes over lunar south pole to map hydrogen abundance and distribution in PSRs



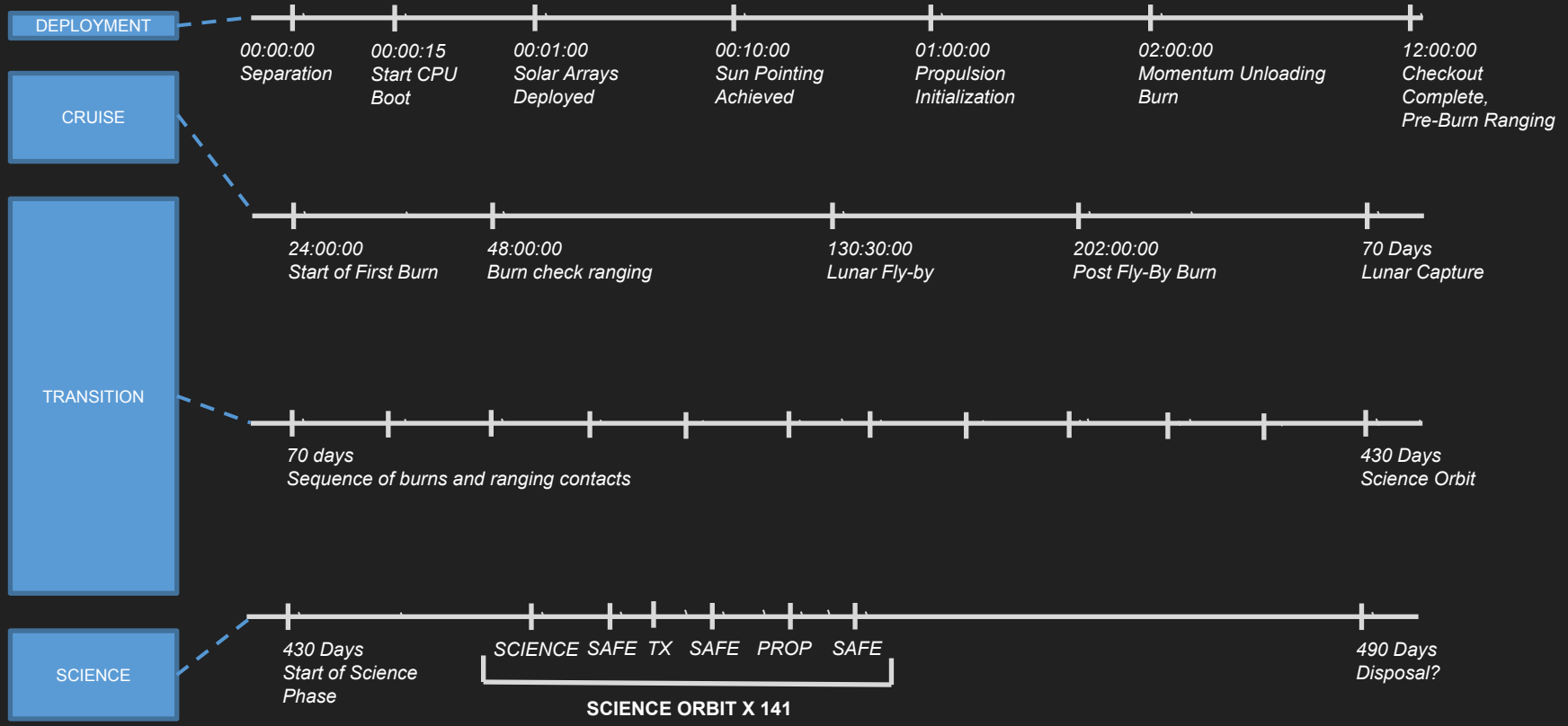
Mission objectives

- Technology demonstration
  - Design, build, fly and acquire in-flight data with a CubeSat-sized neutron spectrometer
  - Demonstrate a modified eHaWK+ solar array design in-flight
  - Maneuver using a low-thrust ion propulsion system (for ~8 months) to enter a lunar polar orbit
  - Demonstrate scheduled communications, tracking, and spacecraft operations with an interplanetary CubeSat
- Science: evaluate uniformity of hydrogen across the lunar south pole
  - Map hydrogen abundances of no less than 0.6% WEH (600 ppm) +/- 120 ppm
  - Map hydrogen abundances at spatial scales of less than or equal to 15 km^2 in the top 1-m of lunar regolith

Development timeline

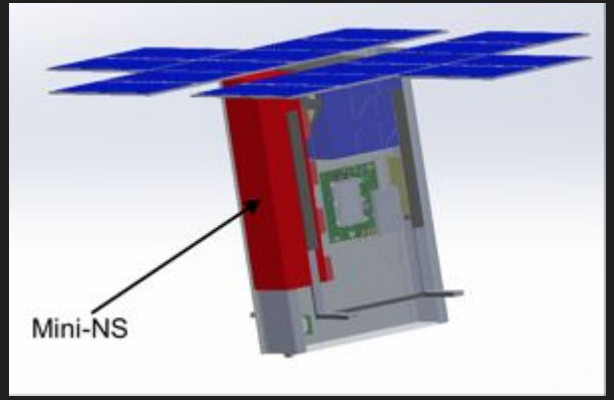


Mission timeline

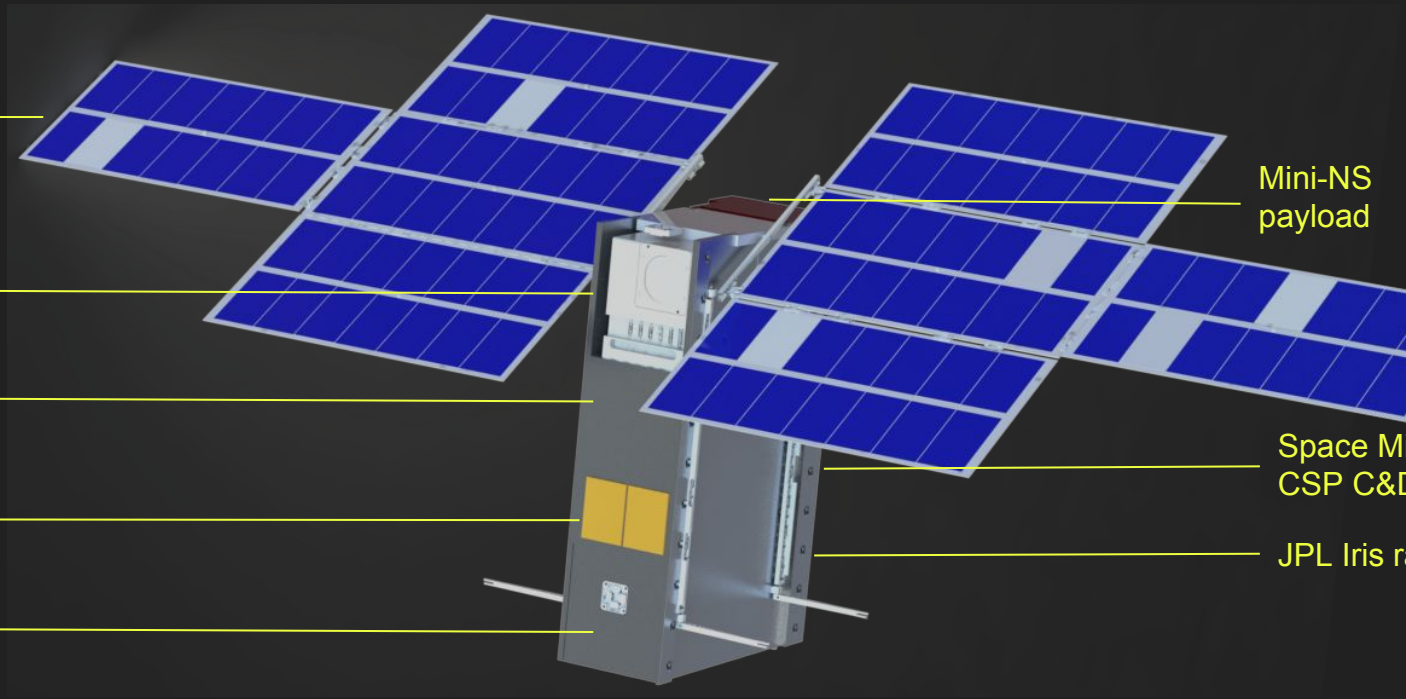


Mini-NS Payload

- < 2.5U detector using Cs_2YLiCl_6:Ce (“CLYC”) scintillator material to detect epithermal neutrons
- Neutron spectroscopy is well suited for resource constrained missions
  - Low power, low mass, and low data volume
  - Challenge is to maximize surface area of detector for achieving statistically significant count rates compared to previous missions (e.g. LEND, LPNS)
- Need precise attitude determination, but not necessarily pointing control



Spacecraft overview



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Challenges

1. Developing subsystems as spacecraft is being developed — must have a flexible schedule, design, and team
2. Small budget → small team… like a startup!
3. Many low TRL components flying for the first time on EM-1 or post-integration
4. More autonomy necessary when handling faults during cruise due to relatively infrequent contacts with ground

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