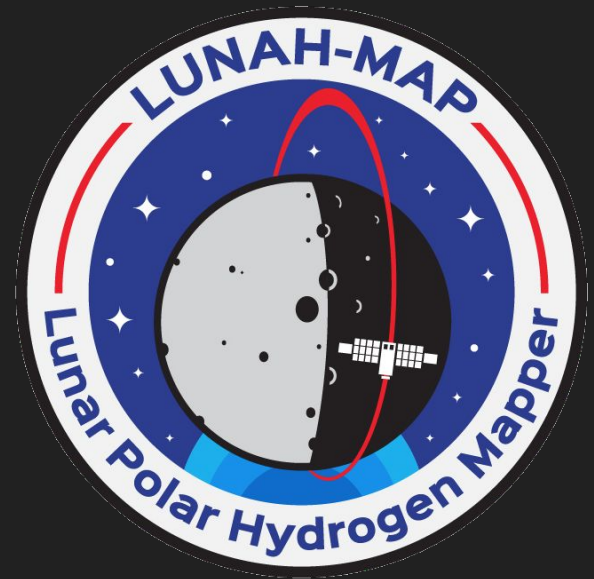


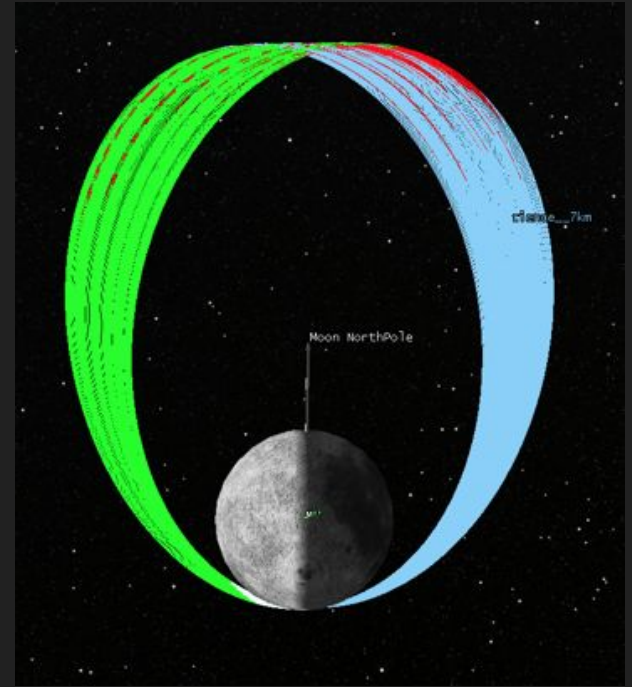
The Lunar polar Hydrogen Mapper (LunaH-Map) CubeSat Mission

Hannah Kerner
Flight Software Lead



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

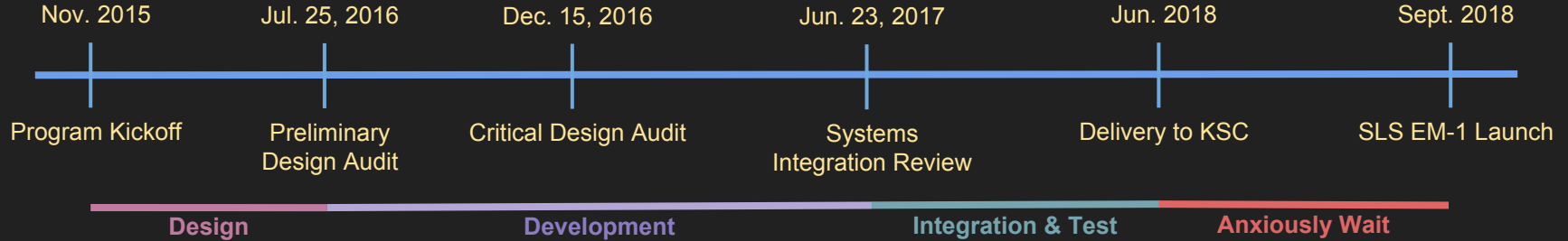


Lunar polar Hydrogen Mapper (LunaH-Map)

Mission objectives

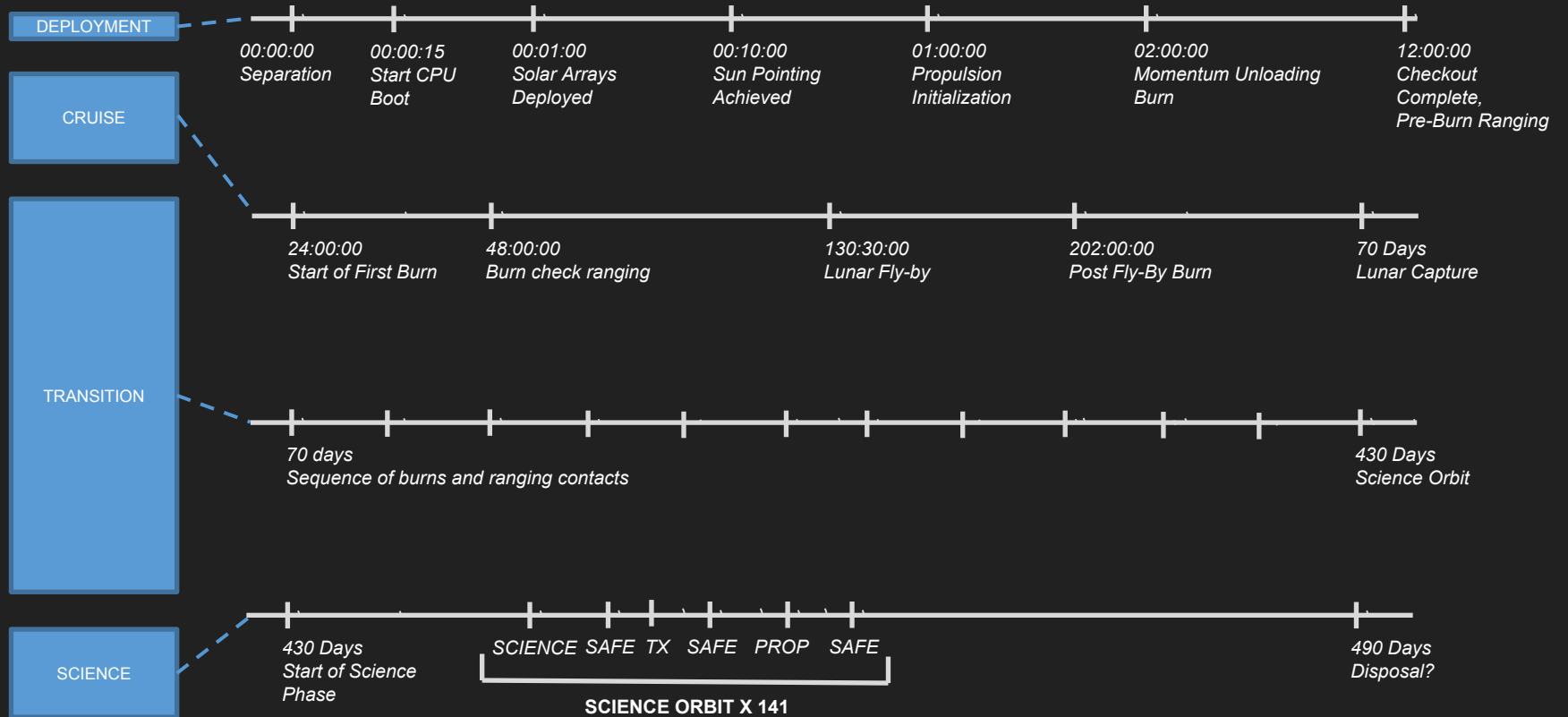
- Technology demonstration
 - Design, build, fly and acquire in-flight data with a CubeSat-sized neutron spectrometer
 - Demonstrate a modified eHaWK+ solar array design in-flight
 - Maneuver using a low-thrust ion propulsion system (for ~8 months) to enter a lunar polar orbit
 - Demonstrate scheduled 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 km² in the top 1-m of lunar regolith

Development timeline



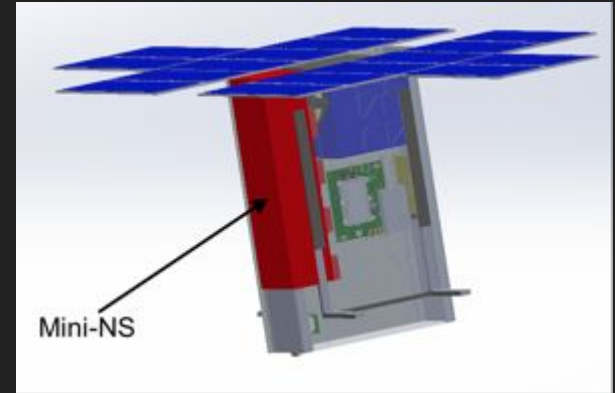
Lunar polar Hydrogen Mapper (LunaH-Map)

Mission timeline

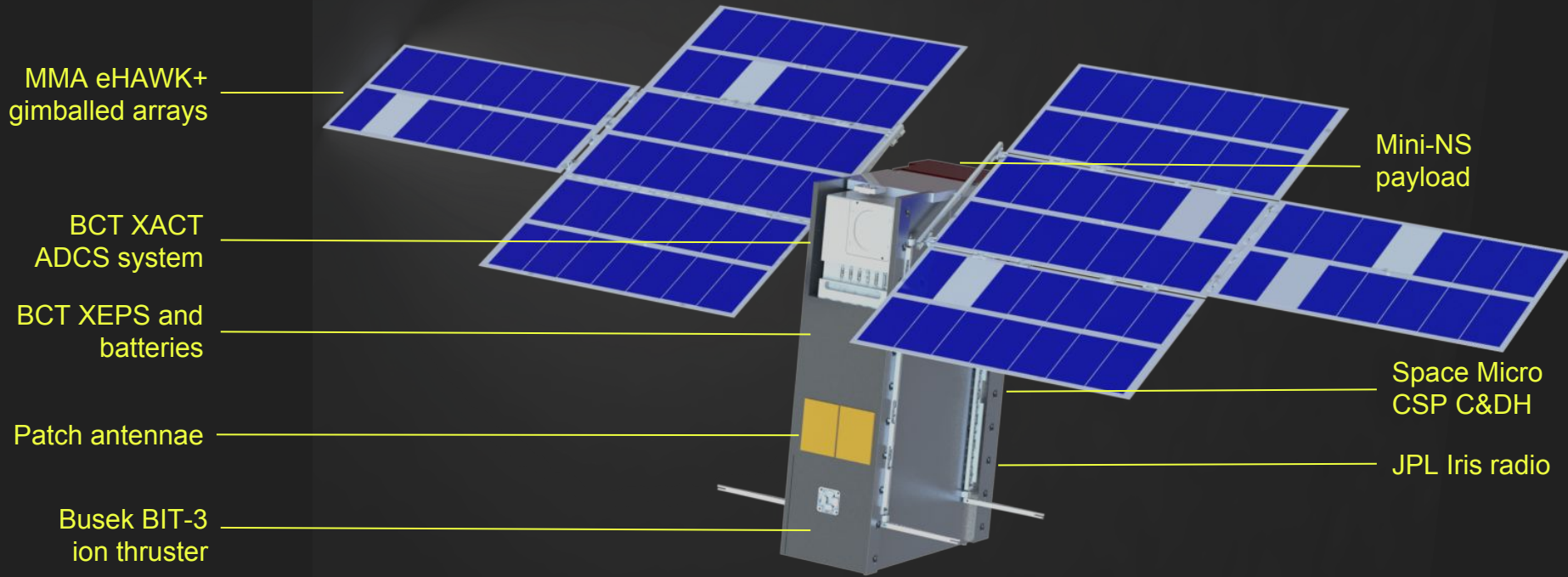


Mini-NS Payload

- < 2.5U detector using $\text{Cs}_2\text{YLiCl}_6:\text{Ce}$ (“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



Lunar polar Hydrogen Mapper (LunaH-Map)

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



ARIZONA STATE UNIVERSITY

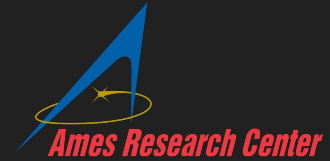
Dr. Craig Hardgrove (PI)
Dr. Jim Bell (Deputy PI)
Robert Amzler (Mechanical/Structures)*
Nathan Barba (Harnessing)*
Zach Burnham (Ground Ops)*
Tess Calvert (Project Manager)
Jim Crowell (Thermal)**
Austin Godber (Science Ops)
Savannah Puckett (Software)*
Dr. Mark Robinson (Science Co-I)
Dr. Paul Scowen (Co-I, Instrument Integration)

AZ Space Technologies

Igor Lazbin (Chief Engineer)
Gates West (FPGA, EE)
Dawn Gregory (Safety)
Valentin Ivanitski (Mechanical/Structures, Thermal)



Alessandra Babuscia (Comms)
Kar-Ming Cheung (Ground Ops)



Tony Colaprete (Science Co-I)
Anthony Genova (Trajectory)



James Christian (Instrument Dev)
Erik Johnson (Instrument Dev)



Mike Tsay (Propulsion)
Lenny Paritsky (Propulsion)



Jeremy Bauman (Navigation)
David Dunham (Navigation)
Derek Nelson (Navigation)
Bobby Williams (Navigation)

Other members

Darrell Drake (Science Co-I, Consultant)
Richard Starr (Science Co-I, Catholic Univ. of America)
Matthew Beasley (Collaborator, Planetary Resources)