

# Lunar Cubesat Program Plan – Group 3

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# A Lunar Cubesat Program

- Lunar ice mapping/characterization is a noble science goal
- Cubesat technology is uniquely poised to enable significant advances in lunar ice mapping and characterization science in the not-to-distant future
- Cubesat technology can also enable a sorely needed “great transition” in NASA’s planetary program to a more sustainable mode that involves more frequent smaller missions that accomplish exciting science at lower cost than is presently possible
- For the moon (and probably for small bodies) cubesat programs can soon compete successfully with single larger missions (i.e. LRO, Discovery, New Frontiers). ~20 cubesats can probably do more science than 1 Discovery-class mission.
- Cubesats also have potential applications for Mars, Mercury and beyond.
- Because of the shorter development times, and shorter cruise times, a lunar cubesat program could quickly take advantages of scientific and technical lessons learned from earlier missions in the series – this is not currently possible for most of NASA’s other programs (e.g. Human, Mars etc...)
- While hitch-hiking on other missions is a possible mode of existence for a lunar cubesat program, it will be much more efficient to buy our own rockets to reduce programmatic and technical uncertainties

**How can we get the lunar cubesat program off the ground?**

# First Mission – A low-cost, low-risk “Tech-Demo” mission to establish the Lunar Cubesat Program

- Tech-Demo Mission Goals -
  - A ~\$30M cubesat mission that can be launched to the moon in ~2 years
  - Demonstrate key enabling lunar cubesat capabilities
    - Reach the moon
    - Orbit the moon
    - Operate science instrument(s) at the moon
    - Return science data from the moon
    - Accurately target an impact site
  - Conduct lunar volatiles science (more suggestions welcome....)
    - Payload: Low-Light, high dynamic range camera + UV or IR low light camera
    - Science Goals:
      - Obtain low-light images of coldest/darkest permanently shadowed areas
      - Attempt to obtain some kind of spectral signature of water ice in permanently shadowed regions (UV seems the most promising)
      - Image lunar night side for impact flashes to better constrain volatile delivery and lunar chronology
      - Anything else that can be done with a low-light camera
      - Impact a permanently shadowed region that can be observed from Earth to detect volatiles
  - Single vehicle, possibly a hitch-hiker

# The Next Wave

- \$250M-class mission that provides world-class science
- Overall goal – Characterize distribution of surface and subsurface ice on the moon
- \$50-75M dedicated launch vehicle
- Multiple (~6) cubesat orbiters and impactors/penetrators
- Includes archived datasets and science teams etc...
- Beyond The Next Wave is too distant to plan right now, but could include a Second Wave, or micro-landers and rovers etc....