



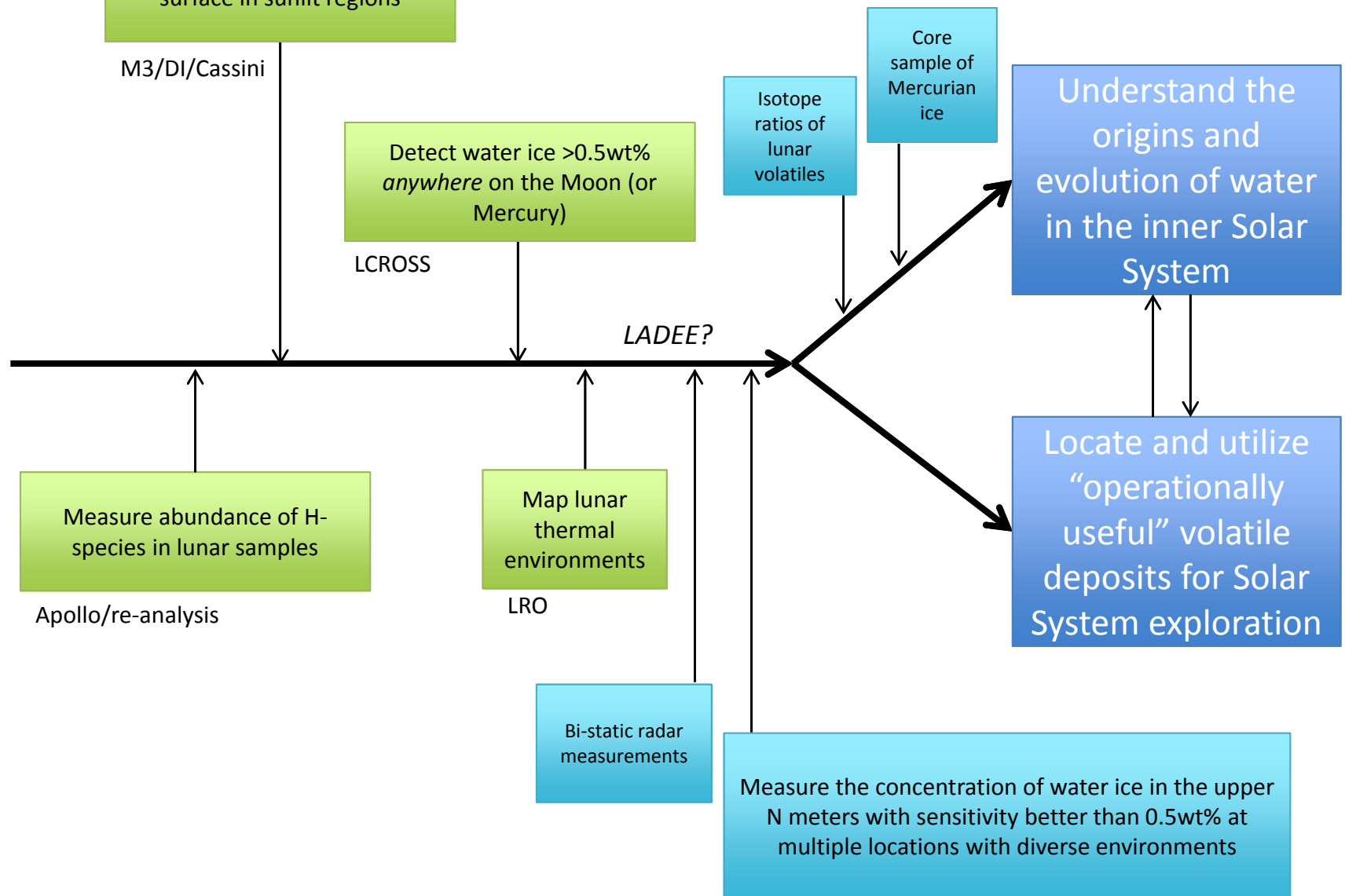
**YOUNG
GUNS**

*A Versatile,
Highly Capable
Architecture for
Low-Cost Lunar
(and Planetary)
Exploration*

Justification

- Evidence for water frost at the surface and in the subsurface at the polar regions of the Moon, yet question of location, abundance, and origins/history remain unanswered
- Microsatellite technology mature enough to begin accommodating high-quality science payloads
- Simultaneous delivery of multiple microsatellites to lunar orbit enabled by secondary payloads on larger spacecraft launch vehicles (e.g. ESPA-ring, “Brendan’s pancake”)

Roadmap of (Lunar) Volatiles Investigation



- Architecture:
 - 6 x 6U CubeSats as secondary payload on adapter ring, which goes to lunar orbit (relay + payload)
 - Each 6U CubeSat can have different purpose, or all operate together
 - Mission progression selected based on science quality (*Where on the roadmap does this move us?*) and cost
- Missions:
 - Orbiters (up to 6 per mission)
 - Impactors (nominally 4 per mission)
 - Penetrators (number depends on accommodation constraints)

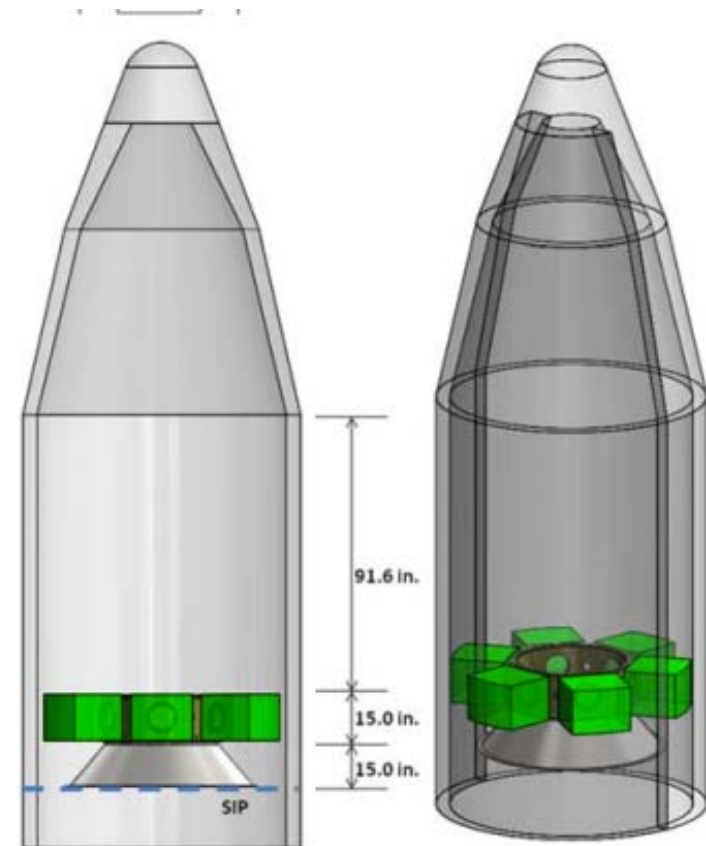


Figure 5. SL-ESPA-15 payload volumes in Minotaur IV Standard Fairing



ESPA ring s/c

Passive microwave
w/ impactors can
detect H₂O vapor
+ isotopes?

YES

Go!

2 Orbiters
4 Impactors

NO

Penetrators
compatible w/
ESPA ring?

YES

Penetrators
tech. ready?

YES

Go!

2 Orbiters
4 Penetrators

NO

NO

Different
platform

Cost/risk
Assessment

Orbiters:
Go!

6 Orbiters

Near-IR or UV w/
impactors can
detect H₂O?

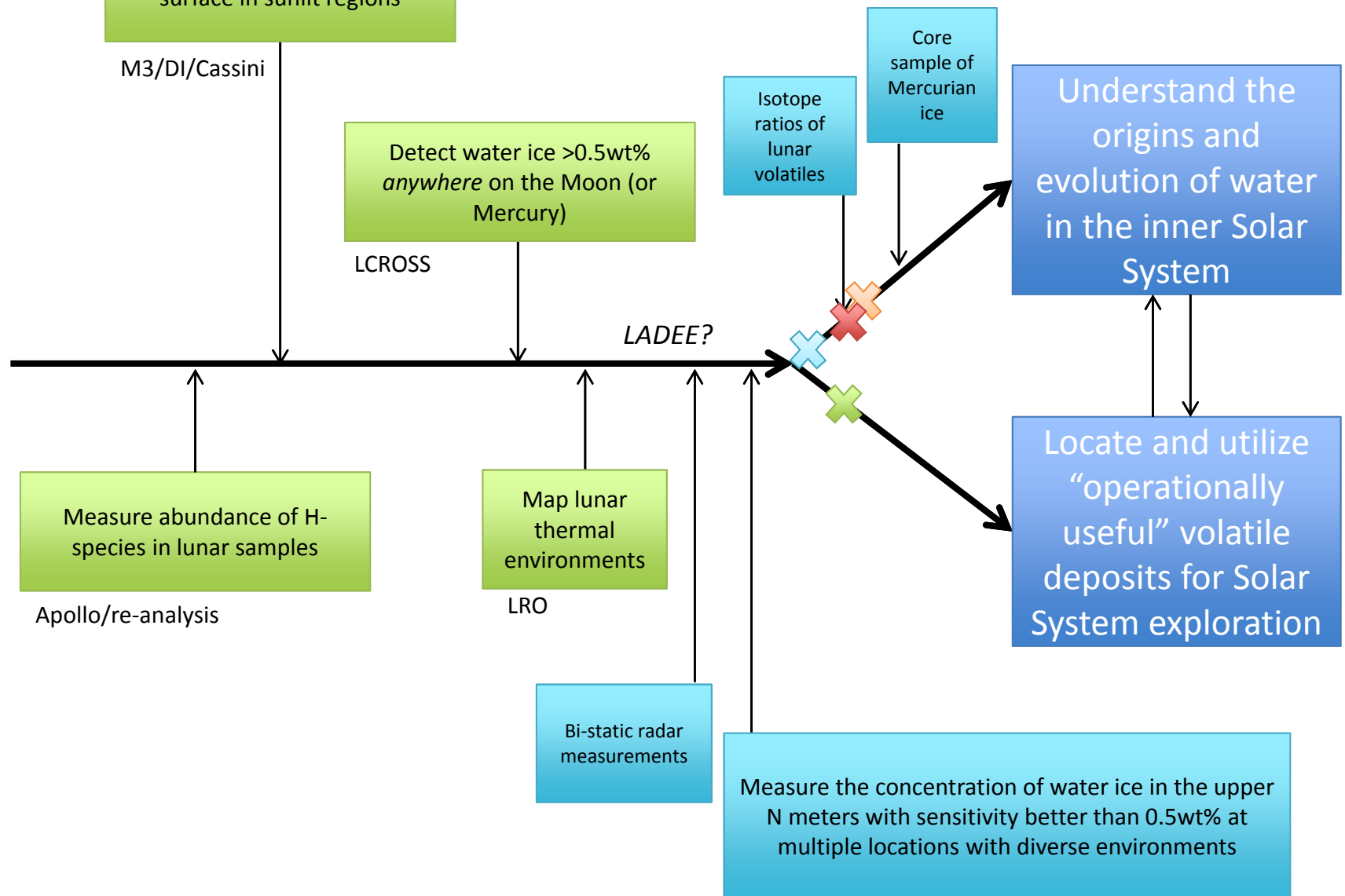
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Program of Lunar Ice
Detection and Small
Spacecraft
Development

Roadmap of (Lunar) Volatiles Investigation





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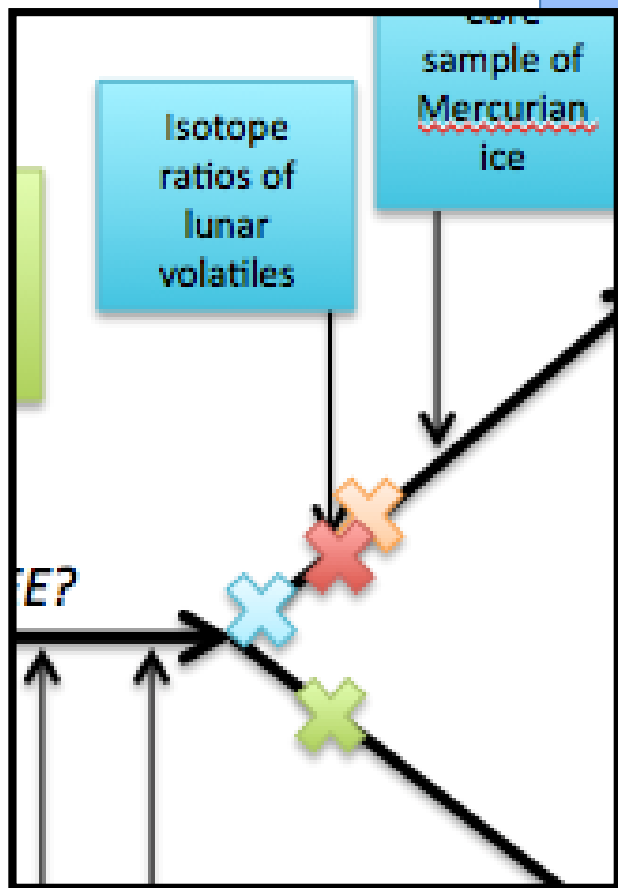
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Outstanding Questions

- Cost
- Getting ice into sunlight for near-IR detection
- Getting enough ice vaporized for microwave detection of vapor
- Accommodation of instruments on 6U CubeSats
- Accommodation of non-6U-cubesat s/c
- All the issues with putting a microsat in lunar orbit and surviving long enough to do science