Hierarchy of Past Missions and Workshop Goals

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KISS Workshop on New Approaches to Lunar Ice Detection and Mapping Part II
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Moon/Mercury Ice Timeline

	1960-1965	1965-1970	1970-1979	1970-1990	1990-1995	1995-2000
Theory	1961 - Watson, Murray and Brown heory of cold-trapped volatiles at the lunar poles		1979 - James Arnold reassesses cold-trapped ice theory in the post apollo context.			
Telescopic					1992 - Earth-based rader images of Mercury reveal bright depostits at both poles, suggesting the presence of deep, pure water ice	1997 - Earth-Based radar shows no evidence for lunar polar ice 1999 - Earth-Based Radar topography of lunar poles
Orbiter					1995 - Clementine Bistatic Radar suggests the presence of ice in Shackleton Crater 1995- Clementine images map lunar poles	1999 - Lunar Prospector neutron spectrometer measurements reveal enhancednear-surface hydrogen at lunar poles
Lander		1969 - Apollo 11 landing reinforces "dry moon" paradigm				
Impactor						

	2000-2005	2005-2010	2010-2012	2013
Theory		2007 - Diffusive mobitliy of lunar ice better defined	2011 - No consistent theory for lunar ice emerges in the wake of LRO/LCROSS findings	
Telescopic				
Orbiter		1999 - Kaguya and LRO map complete topograpy of polar regions 1999 - LRO maps lunar polar temperatures and predicts ice stability zones 1999 - LRO detects dust, hydrogen and mercury in LCROSS impact plume	2010 - Near IR spectrometers on Chandryaan-1 detect lunar soil OH/H2O features 2010 - LRO detects localized polar near-surface hydrogen enhancements not in permanent shadow 2010 - LRO detects decreased UV albedo in regions of permanent shadow, plus spectrascopc evidence for surface water ice	2013 - MESSENGER detects bright surface deposits and enhanced polar hydrogen on Mercury 2013 - LRO detects enhanced near-ir laser reflectivity in many permanently shadowed regions
Lander		2008 - Water detected in Apollo volcanic glass samples		
Impactor		1999 - LCROSS impacts Cabeus crater and detects evidence for abundant water and other volatile species		

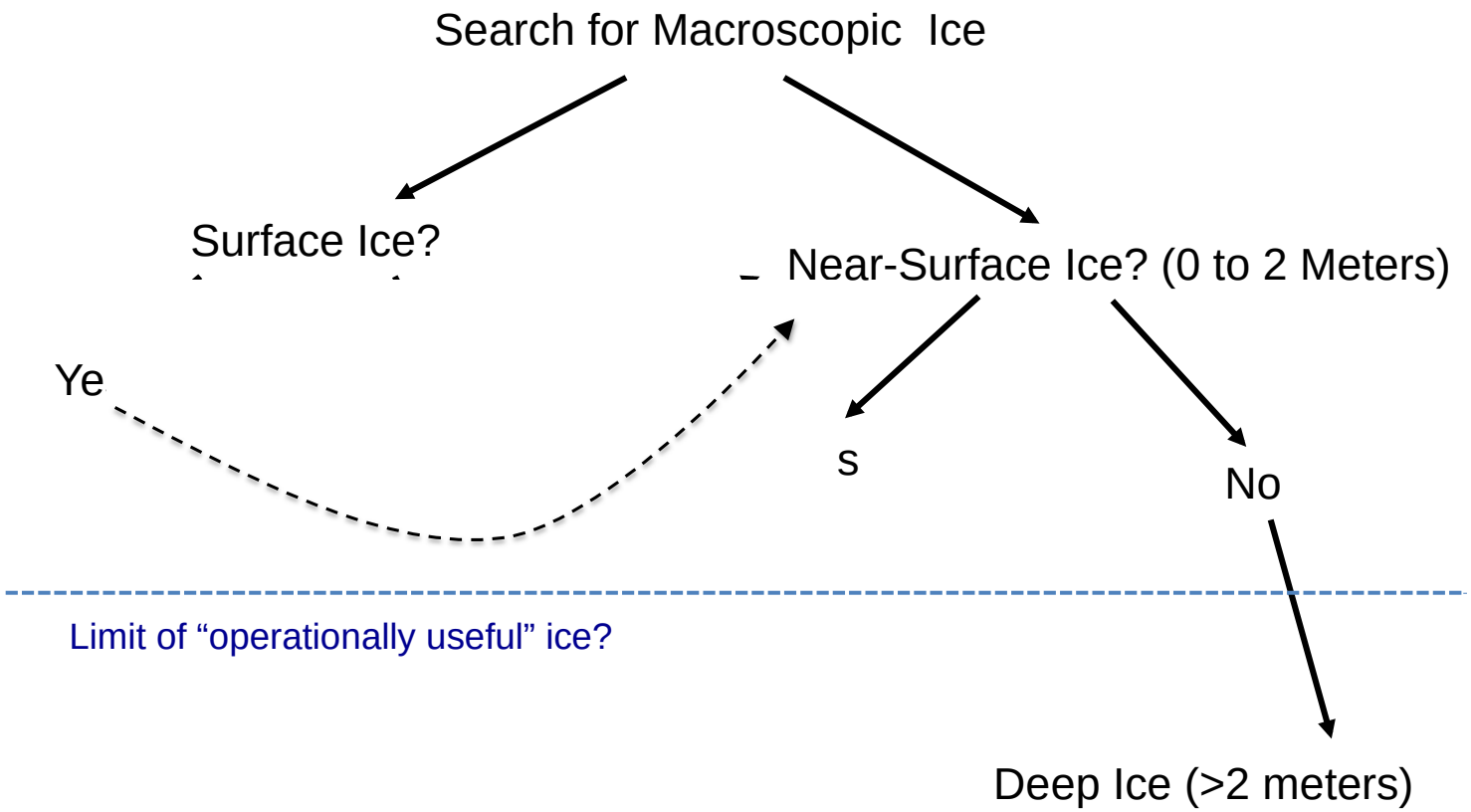
Future

The Far Future

- Lunar ice deposits fully mapped
- Lunar ice deposits extensively sampled and analyzed
- Origin, evolution and history of lunar volatiles understood
- Lunar ice resources are utilized by humans

Key Outcomes of First Workshop: Near-Term Science Strategy

Key Unanswered Question: Is “macroscopic” lunar ice present?



Near-Term Lunar Polar Exploration Funding Scenarios

- **Low/Zero Funding** (<$10M) – Continue analysis of existing datasets + occasional ultra-low-cost lunar mission(s) by national space agencies and private companies
- **Medium Funding** ($10-$150M) – Low Funding + new low-cost orbiter/lander/impactor mission(s)
- **High Funding** – (>$150M) Medium Funding + significant new mission or series of missions focused on ice mapping/characterization goal

* Missions are like movies – The results don't necessarily correlate with cost…..

Key Goals For KISS Workshop

- Define overall near-term strategy for lunar ice detection and mapping
- Identify mission/instrument concepts that can accomplish strategy
- Suggest optimal near-term pathways(s) for the next step(s) in lunar ice detection and mapping that is robust to uncertainties in funding and results