Large Space Apertures : Customers & Users
The *Long View* From Astronomy

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Large Space Apertures Kick-Off Workshop
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Astronomy in the Coming Decades

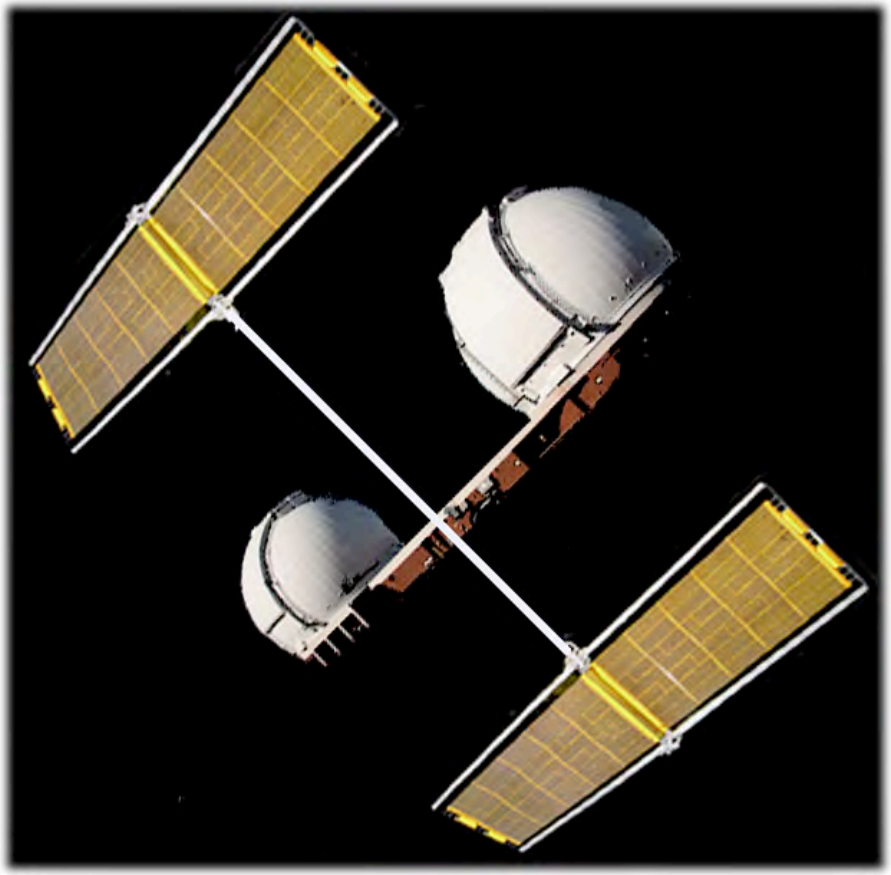
Hard to escape …

BIGGER IS BETTER

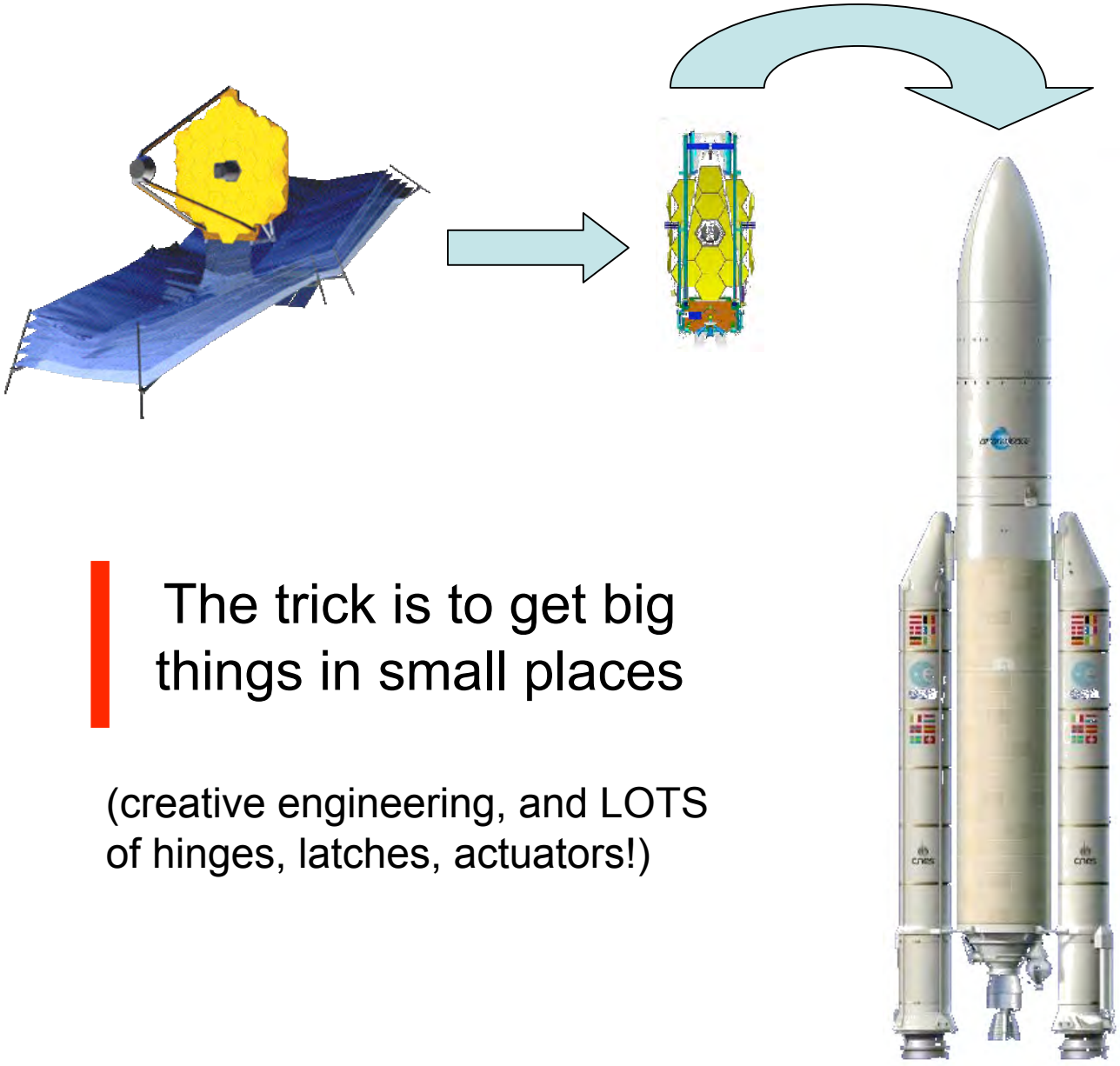
- Spatial resolution
- Light collecting power
- Background rejection

"Large Space Apertures"
translates to

- Large optics
- Large structures
- Large instruments

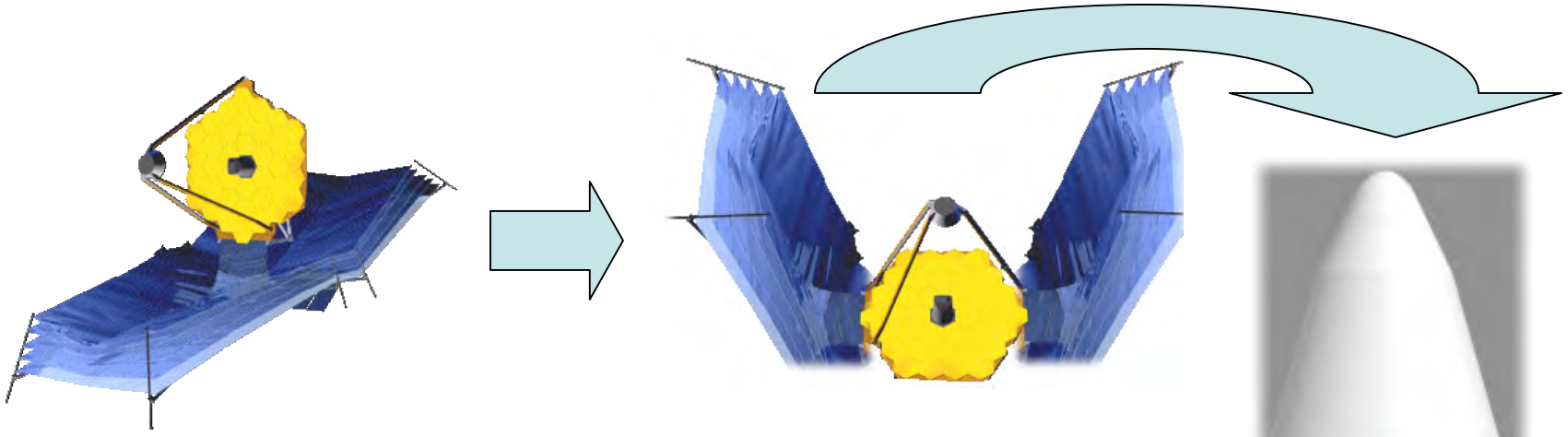


If our strategies for space telescope sizes aren't extensible,
we hit a scientific dead end.



The trick is to get big things in small places

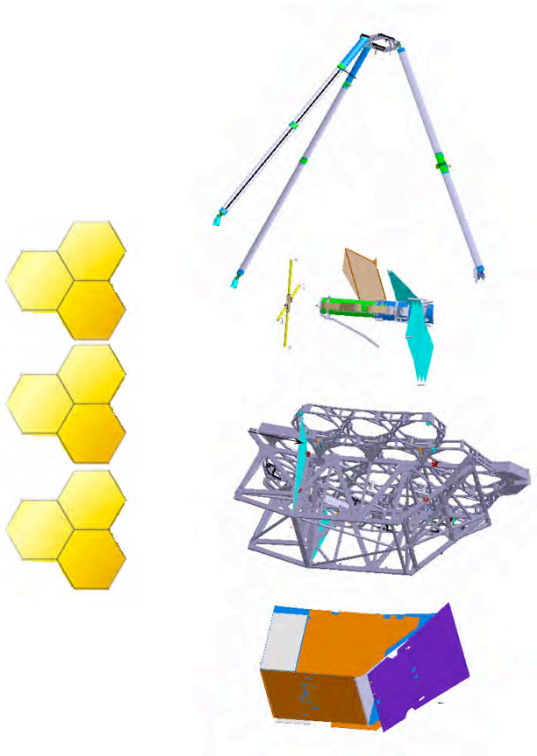
(creative engineering, and LOTS of hinges, latches, actuators!)

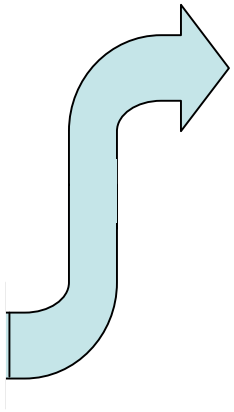


Or maybe to get bigger places to put things

(big dumb launchers help … for a while)

Ares V





Or maybe to do it in pieces

(true extensibility!)

To avoid scientific dead ends, must consider

- new heavy lift launchers
- in-space deployment/maintenance/servicing

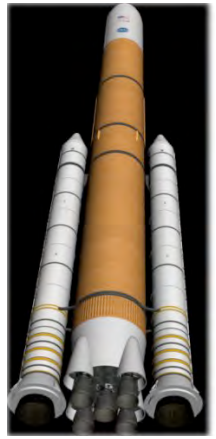
  (humans?, robots?)
- precision formation flying

Think outside the ~~box~~ EELV launch shroud

Look at the "big picture"

The Exploration Initiative Offers

- Human access beyond LEO → (maintenance, servicing)

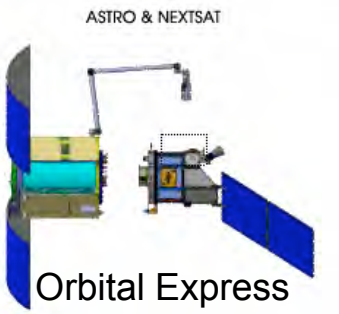


- Huge launch vehicles (e.g. Ares V) → (large mass and volume lift capability)

… and we have witnessed

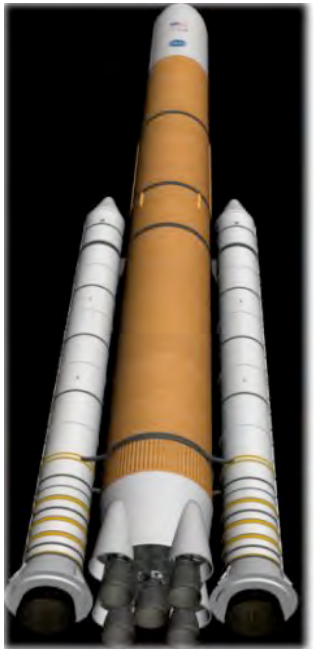
autonomous!

- Successful first steps at robotic servicing →



- Dramatic advances in in-space construction →

Re Exploration – TWO Thrusts



(1) Use the Moon as a platform to enable astronomy

(2) Use the new lunar transportation architecture to enable astronomy

Exploration and Astronomy? Lots of Thinking

"Workshop On Astronomy Enabled By Ares V"
April 26-27, 2008 NASA Ames
Final conference report NASA/CP–2008-214588 August 20, 2008

NRC "**Science Opportunities Enabled by NASA's Constellation System"**
Space Studies Board (ongoing) RFI – March 2008, Interim Report – June 2008

Workshop on "**Astrophysics Enabled by the Return to the Moon"**
April 26-27, 2007 Space Telescope Science Center
Conference report to NASA HQ, and to Lunar Science Conf July 23, 2008

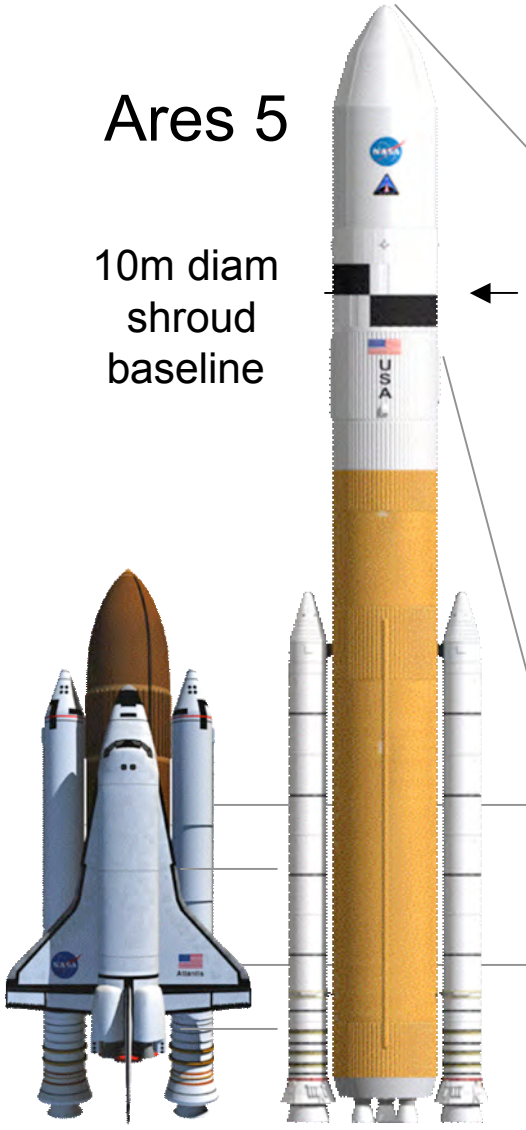
NRC **"The Scientific Context for Exploration of the Moon"** study
Space Studies Board, Final Report issued 2007

NAC **"Science Associated with the Lunar Exploration Architecture"**
workshop; February 27- March 2, 2007 Tempe AZ
White papers and presentations.
Summary report by John Mather March 2, 2007 from NAC APS
(followup to NAC ongoing through LEAG)

Ares V Options - A New Paradigm?

Ares 5

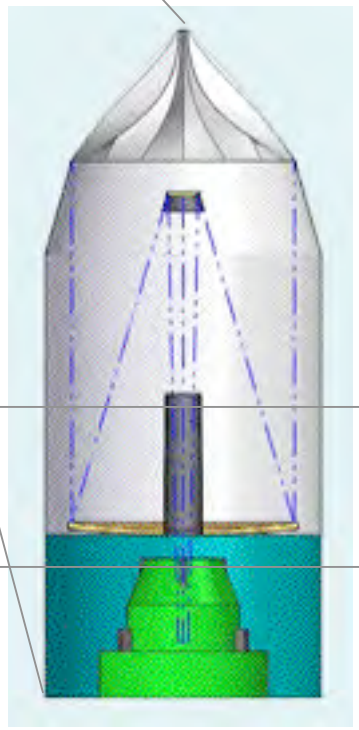
10m diam shroud baseline



25mt to LEO

125mt to LEO

Heavy-lift, large payload volume options
For lofting BIG, DEPLOYED (~8m) or UNDEPLOYED (>20m?) telescopes.

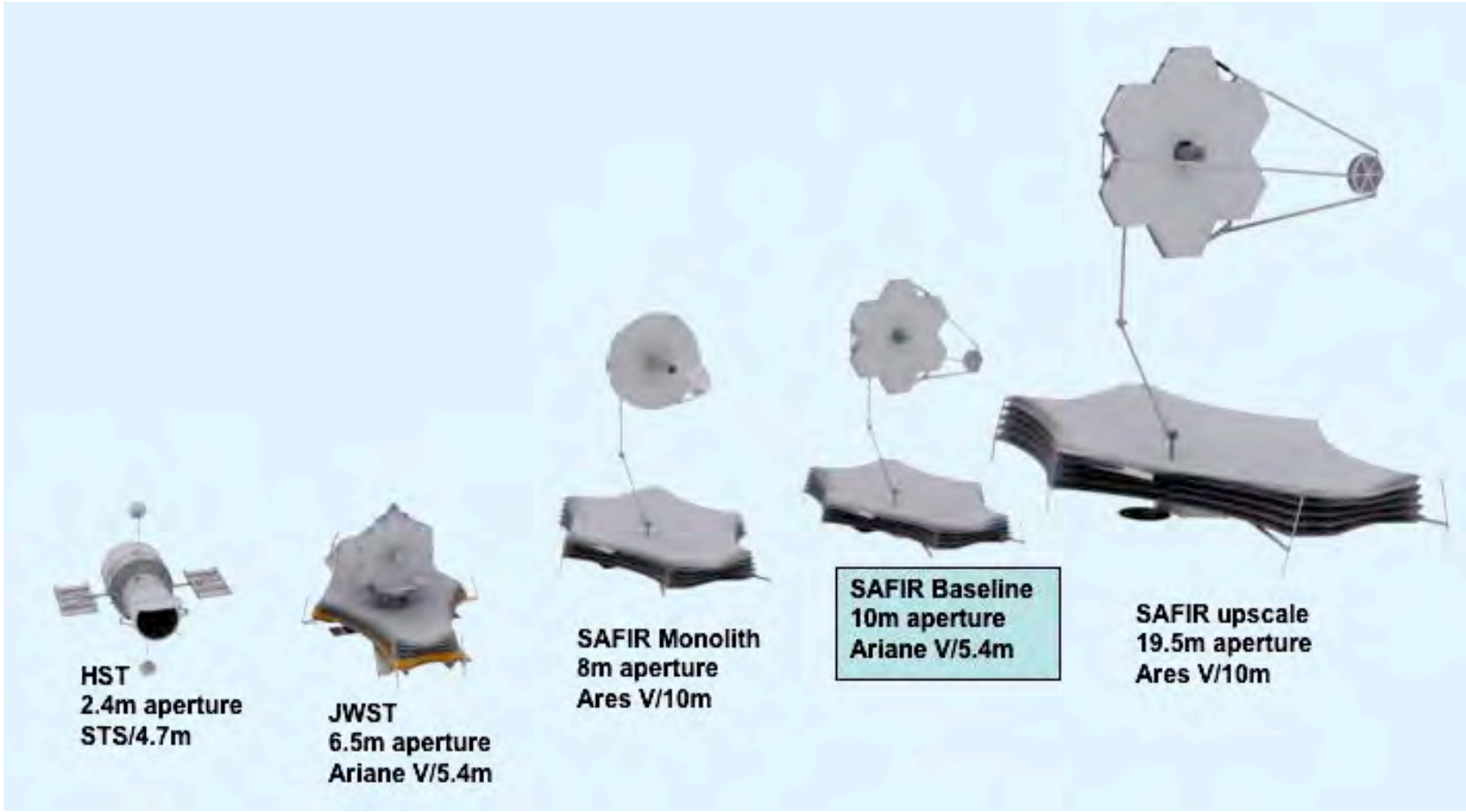


HST

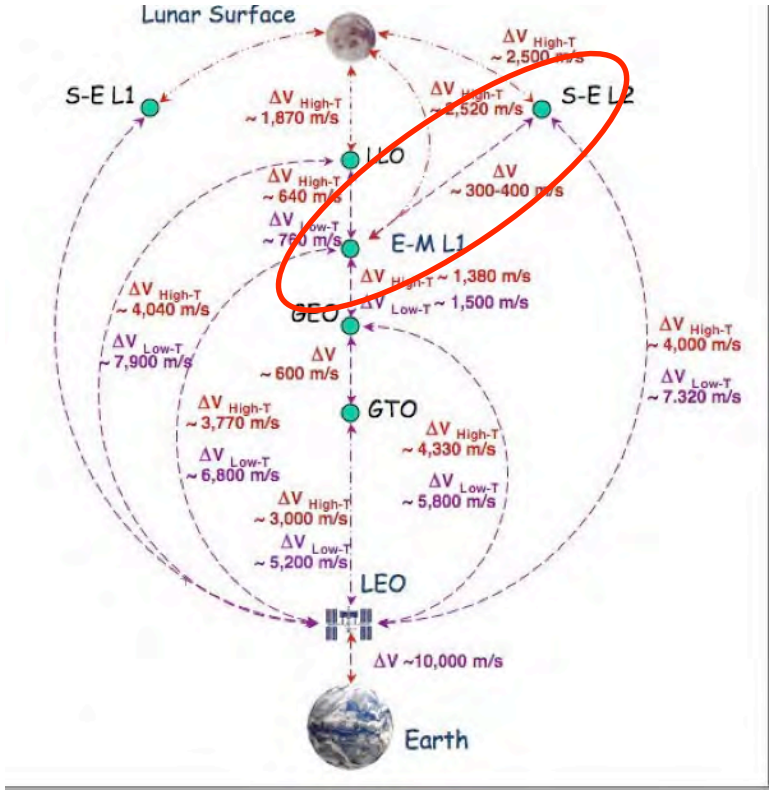
Heavy lift offers not just aperture, but aperture with “simplicity”.
Trade risk for mass.

<u>Volume lift</u> capacity more important than <u>mass lift</u> capacity!
(65 mT to SE L2)

In the case of the Single Aperture Far Infrared (SAFIR) observatory, Ares V could offer baseline large apertures with low deployment risk, or x2 scaling of baseline architectures.

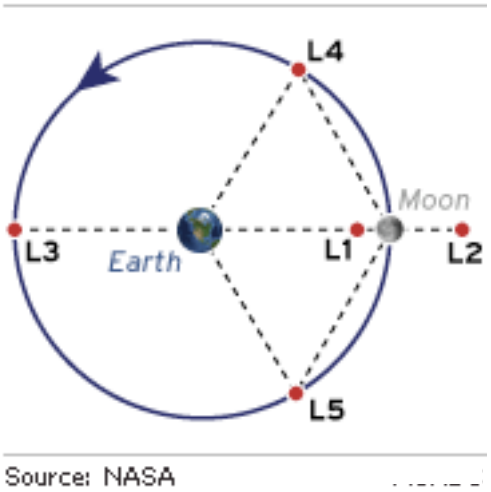


Servicing Venues -- Importance of EM L1



Adapted from Decadal Planning Team documents

While Earth-Sun L2 is optimal ops site for many telescopes, Earth-Moon L1 is a nearby jobsite to which transit back and forth is easy -- meters/sec delta V



Earth-Moon L1 is 84% of the way to the Moon, semi-stable, highly accessible to lunar-capable human space program, and offers low latency (~1 sec) to Earth for telerobotic efforts.

“Attach points” for KISS?

- large space telescopes in a mass-relaxed design environment; opportunities? new approaches?
- scaling non-linearities for large space telescopes?
- AR&D and nav technologies for in-space assembly?
- Lagrange ops/job-site planning, stationkeeping, comm?
- piecewise approach to in-space assembly of large telescopes?