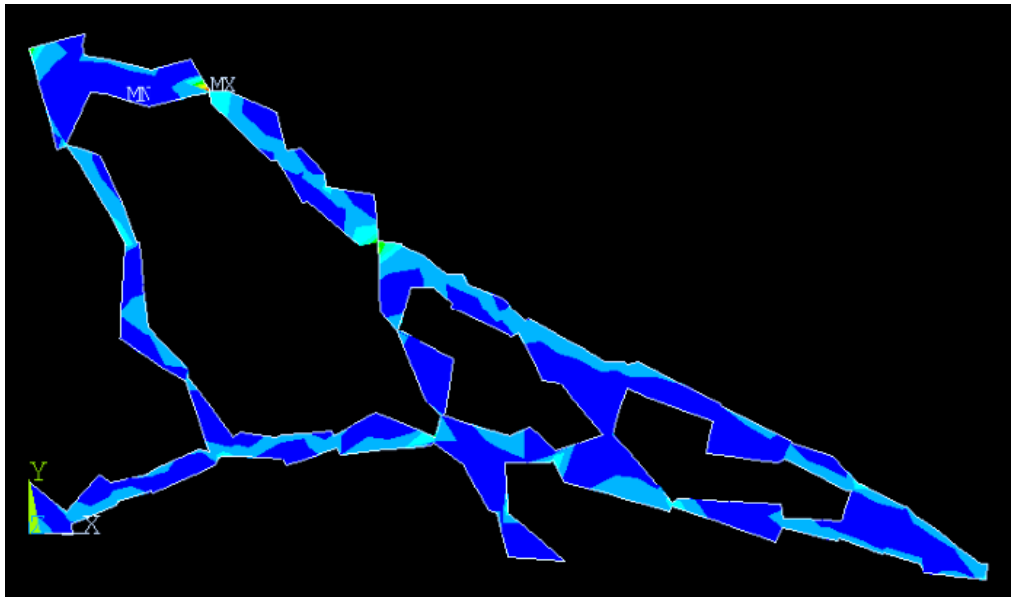
Design, Optimization, and Mentoring

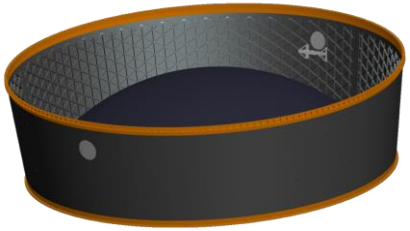


Patrick V. Hull

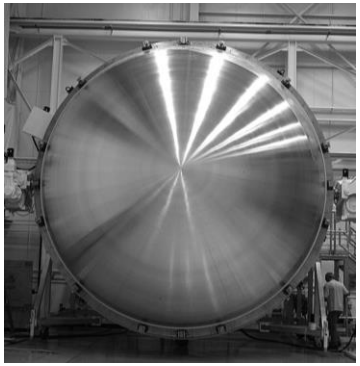
Structural and Mechanical Design
NASA/ Marshall Space Flight Center

26 April 2017

This presentation focuses on structural design at MSFC and who mentored me



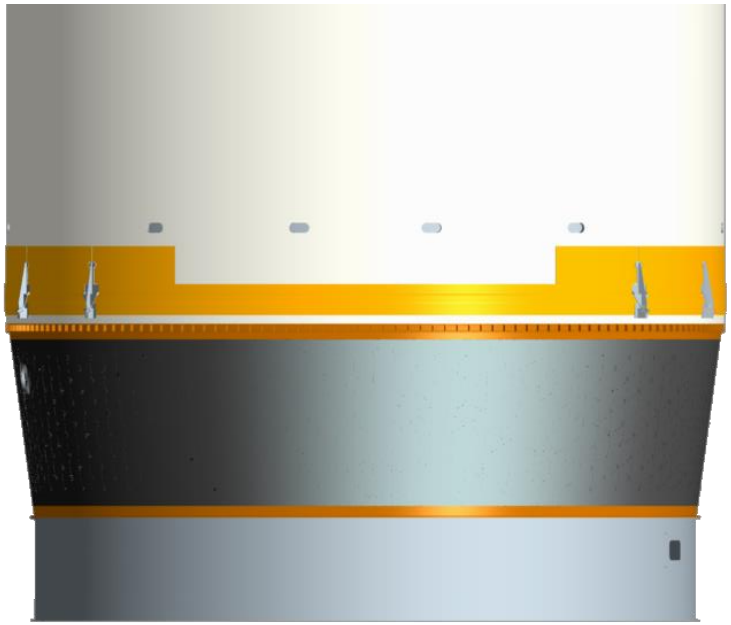
Space Launch System MSA



Ares I

Lessons from Greybeards

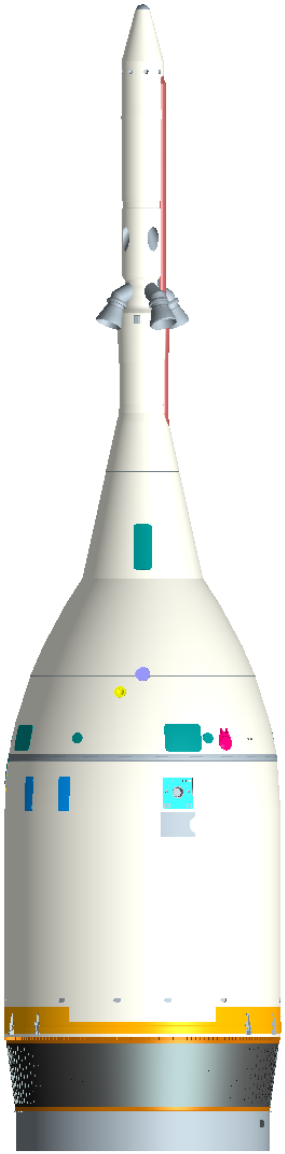
SLS MSA Design Overview



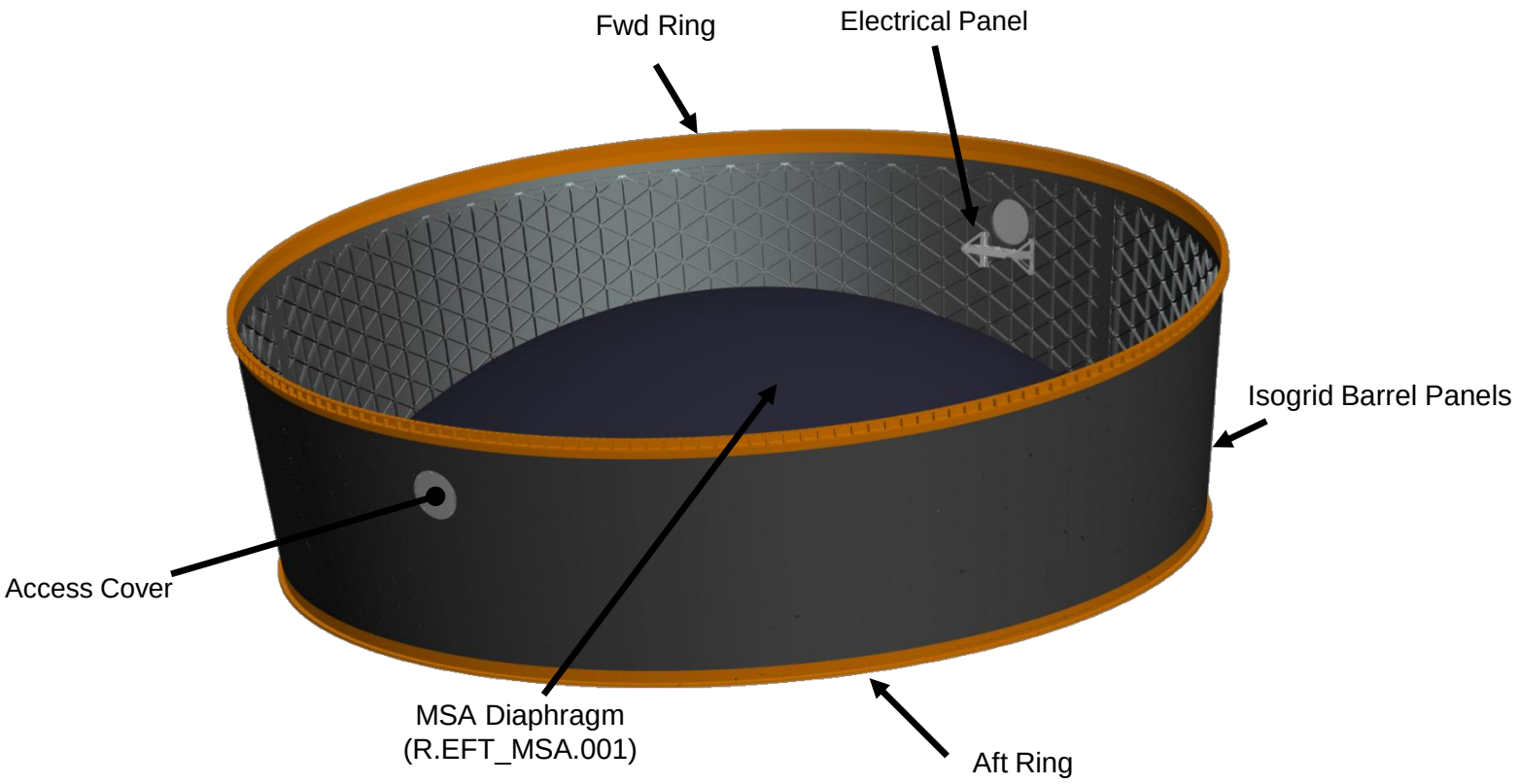
MPCV/Orion

(MSA)
MPCV Stage
Adapter
MSFC

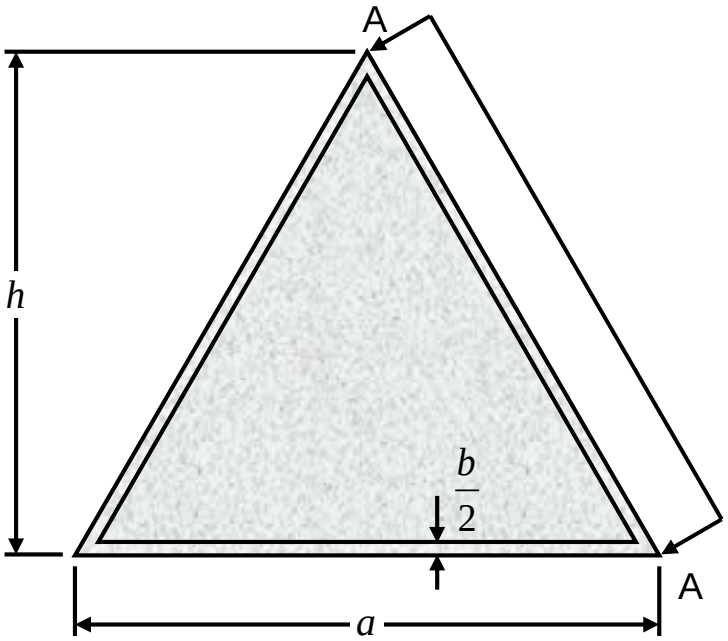
Delta IV DCSS

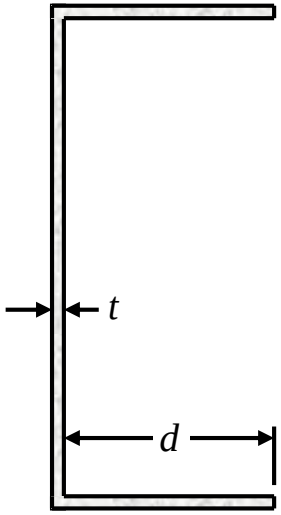


MSA Design Overview

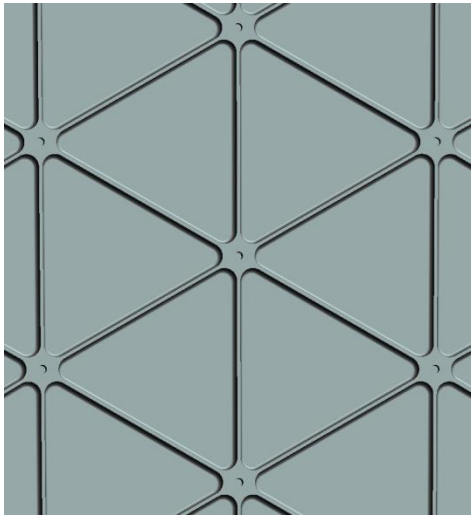


Grid Stiffened Design Space





View A-A



Design Space

Pocket Height:	*3.00 in ≤ h ≤ 9.00 in*
Rib Height:	*0.90 in ≤ d ≤ 1.50 in*
Rib Thickness:	*0.06 in ≤ b ≤ 0.50 in*
Skin Thickness:	*0.05 in ≤ t ≤ 0.25 in*

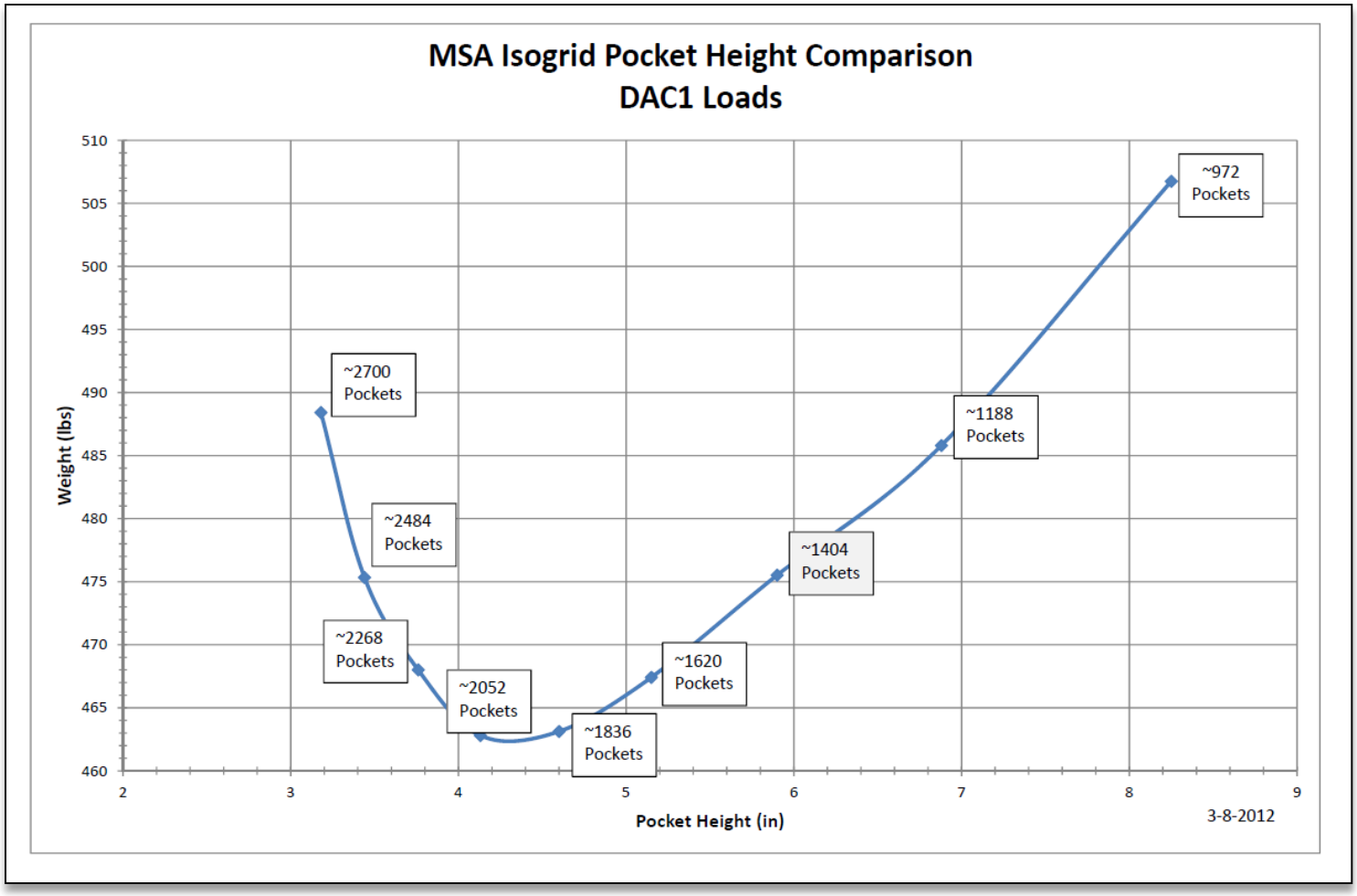
Rib Aspect Radio: 10:1 Max

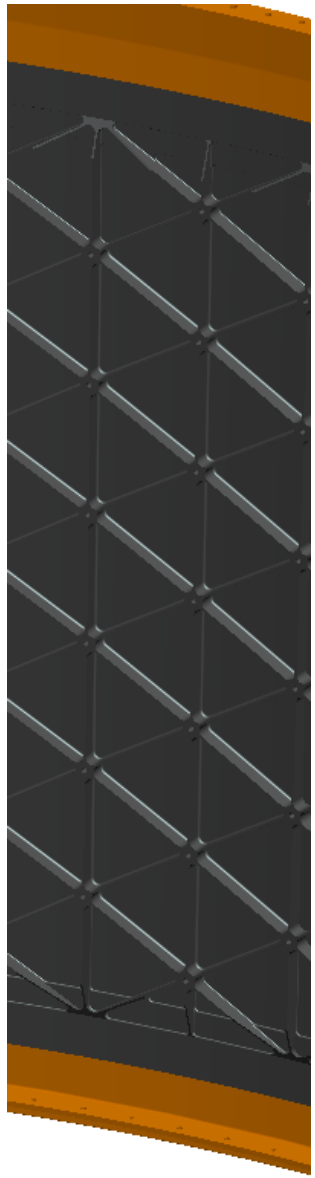
Results

Pocket Height:	***5.90 in***
Rib Height:	***0.90 in***
Rib Thickness:	***0.090 in***
Skin Thickness:	***0.083 in***

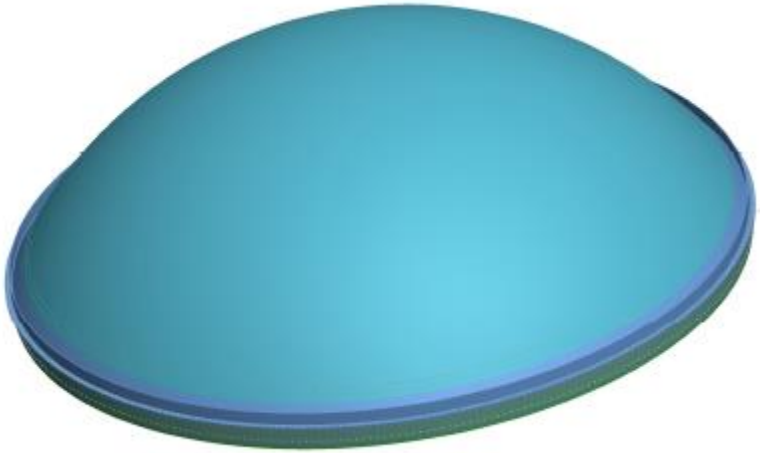
Rib Aspect Radio: 10:1 Max

Grid Stiffened Design Space

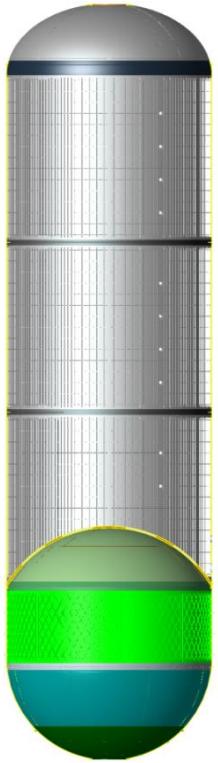




Ares I Common Bulkhead



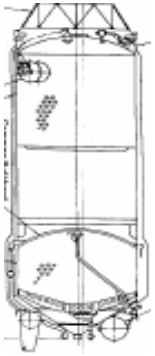
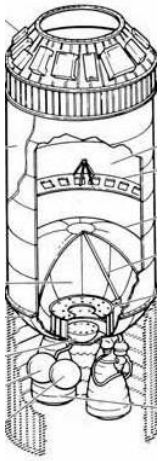
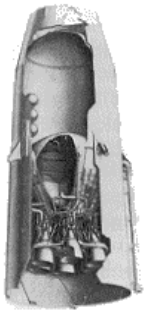
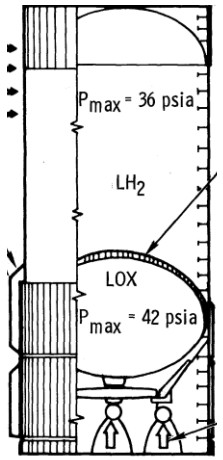
Ares I Upper Stage
Common Bulkhead

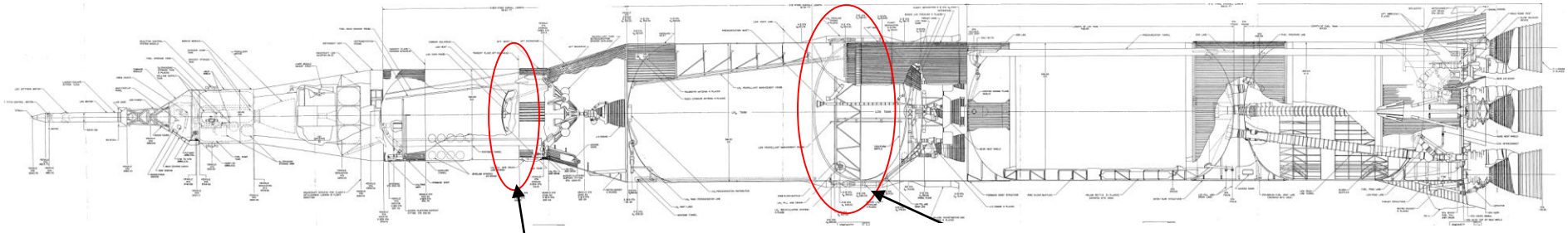


Ares I Upper Stage
Pressurized Structure

Ares I

Common Bulkhead
LH2/LOX CB History

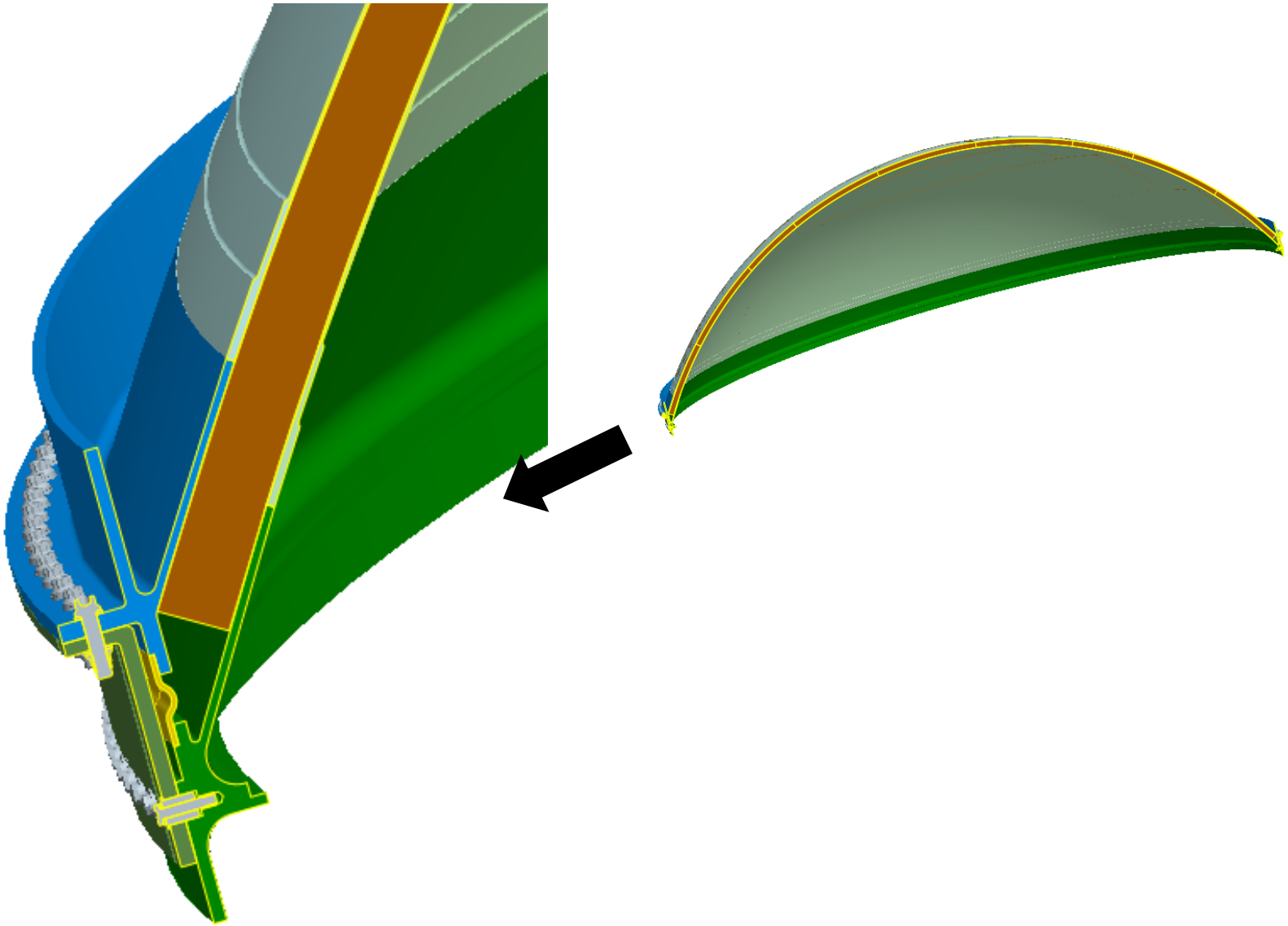
VEHICLE/STAGE	**ARIANE V CORE**	**H1-LAUNCHER**	**CENTAUR**	**S IV**	**S IVb**	**S II**
MATERIAL	AL 2219	AL 2219	SS 301	AL 2014	AL 2014	AL 2014
TANK ARRANGEMENT	LOX FORWARD	LOX AFT	LOX AFT	LOX AFT	LOX AFT	LOX AFT
DIAMETER	212 in	100 in	120 in	220 in	260 in	396 in
COMMON DOME SHAPE	SPHERICAL CAP	SPHERICAL CAP	ELLIPTICAL	SPHERICAL CAP	SPHERICAL CAP	ELLIPTICAL
						



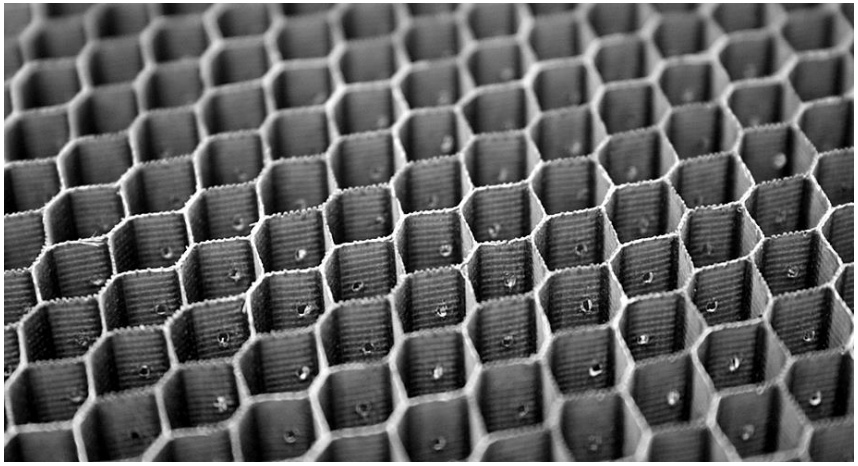
SIVB Common Bulkhead

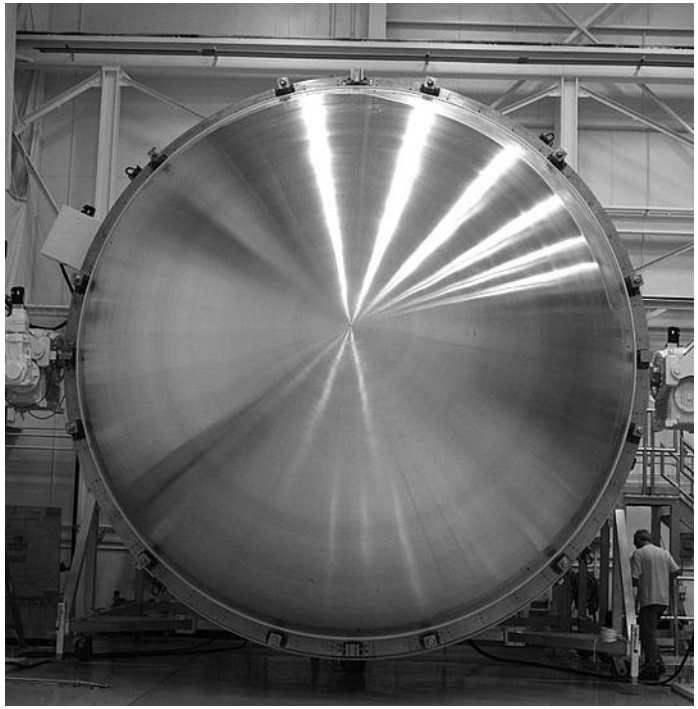
SII Common Bulkhead

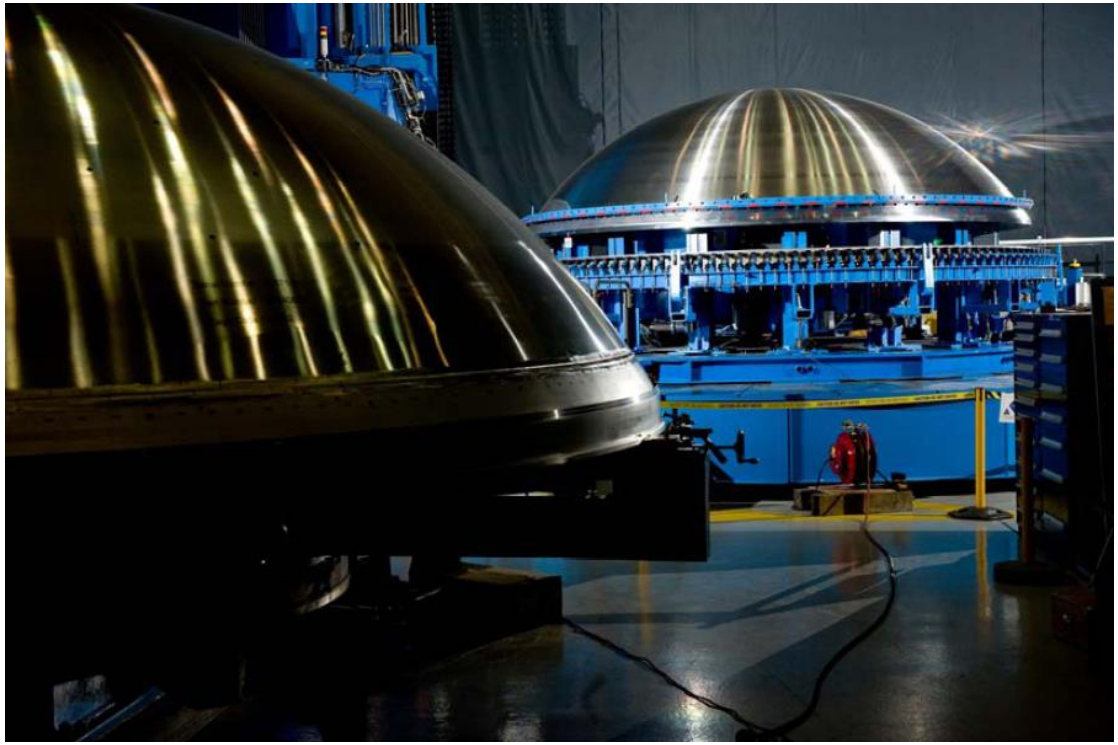
Ares I Common Bulkhead Joint



Ares I Common Bulkhead







Ref: Common Bulkhead Aft MDA Dome, Bldg 4708

Learning from Heritage
Saturn V and Greybeards