

Joining and Mechanical Systems at Langley Research Center

Session: Joints and Modular Trusses

**On-Orbit Servicing, Assembly, and
Manufacturing**

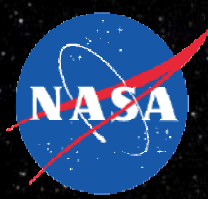
Technology Transfer Industry Day

September 18, 2019

John T. Dorsey

Structural, Mechanics, and Concepts Branch

NASA Langley Research Center



Outline of Technologies to be Presented



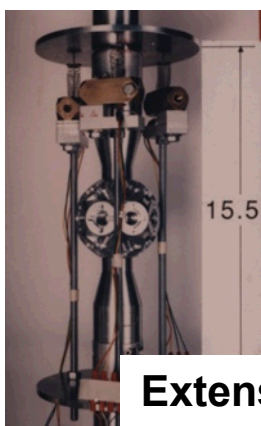
- Truss Joints
 - Extra-Vehicular Assembly (EVA = Astronaut Assembled) Erectable 2-inch diameter
 - EVA Erectable 1-inch diameter
 - Robotic Erectable 1-inch diameter
 - Electron Beam (EBeam) Weldable 1-inch diameter
- Robotic Boom/Beam Joints
 - Dragonfly 2-inch diameter Round
 - Dragonfly 4-inch diameter Square
- Modular Trusses
 - TriTruss
 - Square Bay



Truss Joint – EVA Erectable 2-inch Diameter



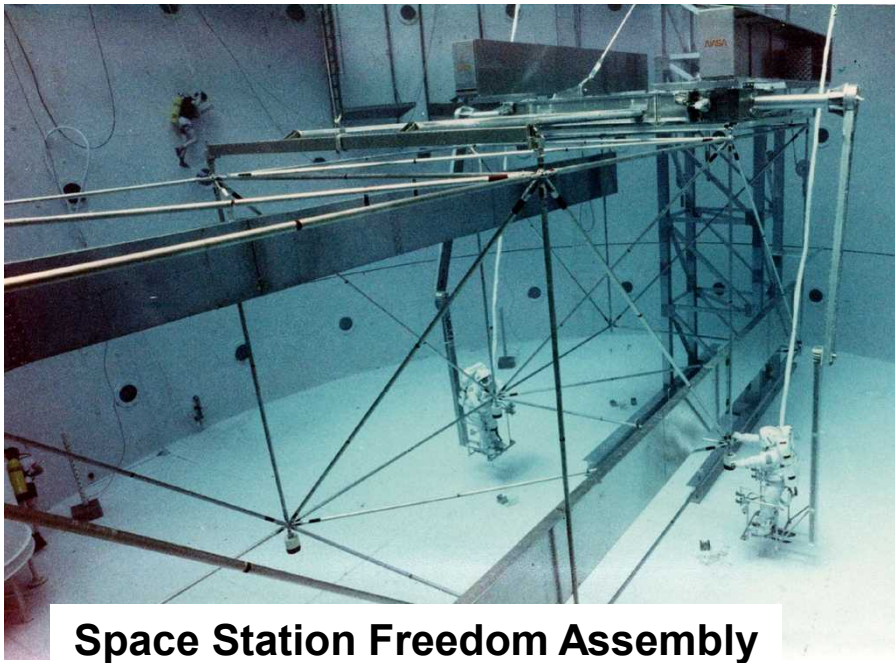
Proven flight heritage



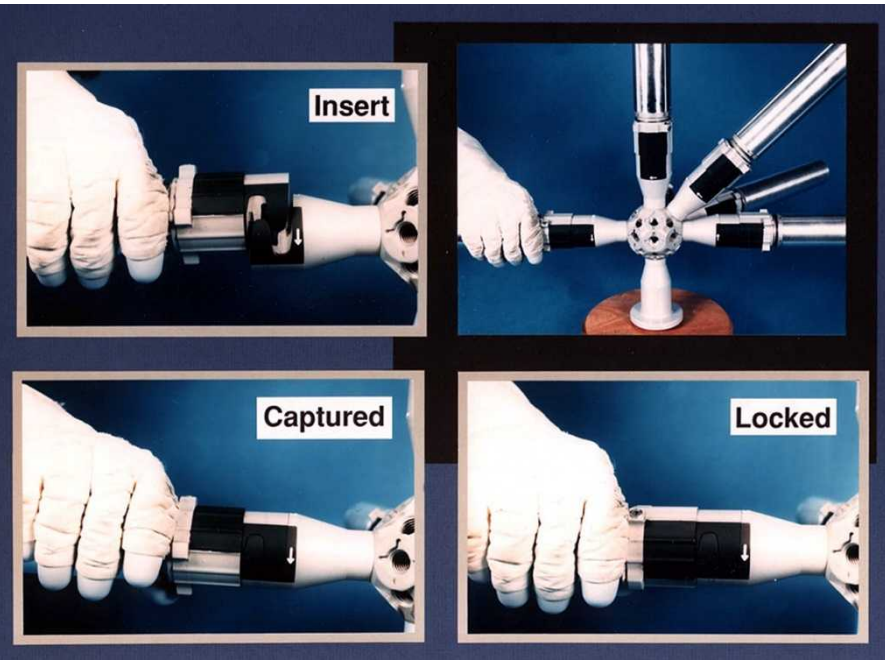
Extensive Testing



Flight Verified



Space Station Freedom Assembly

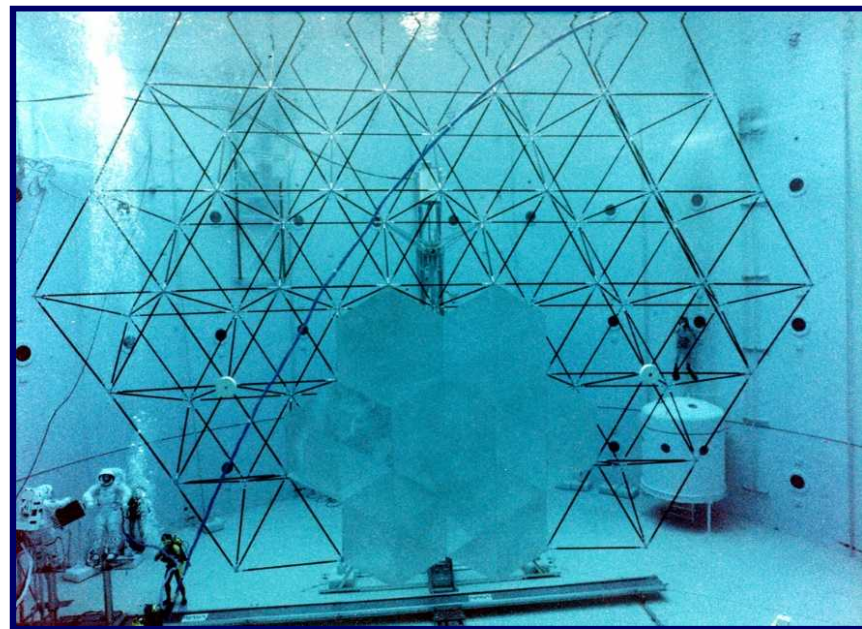
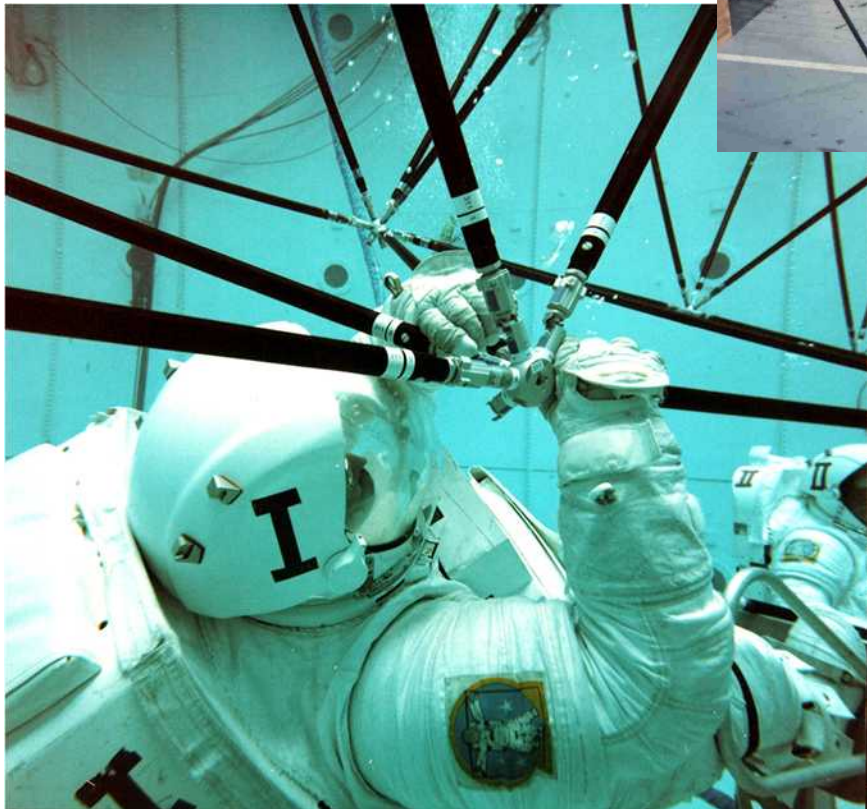
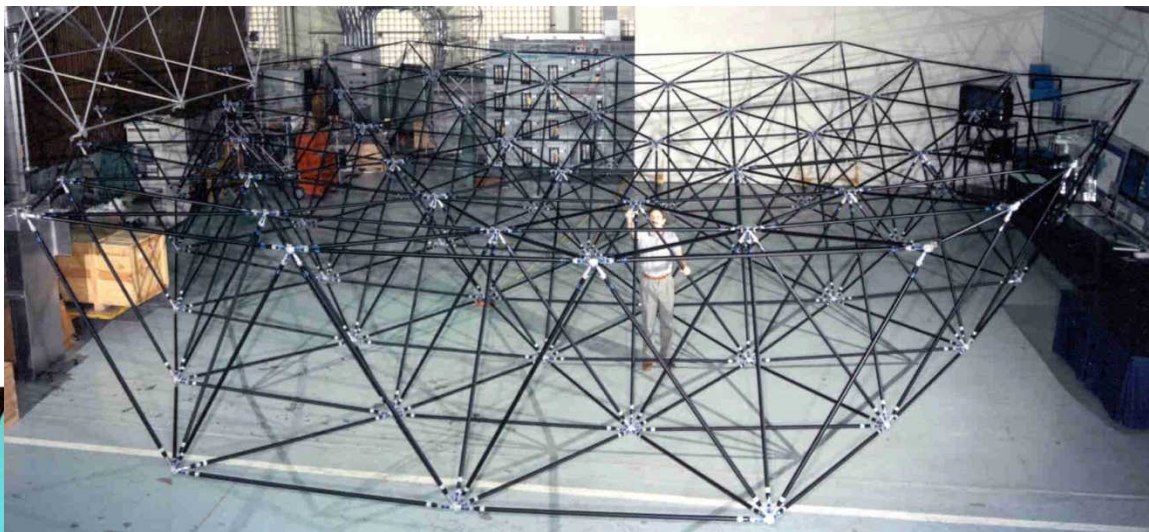
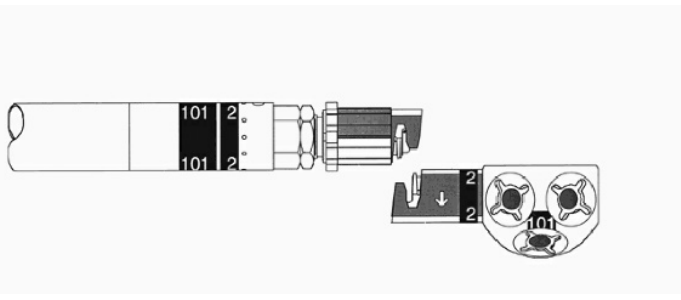




Truss Joint – EVA Erectable 1-inch Diameter

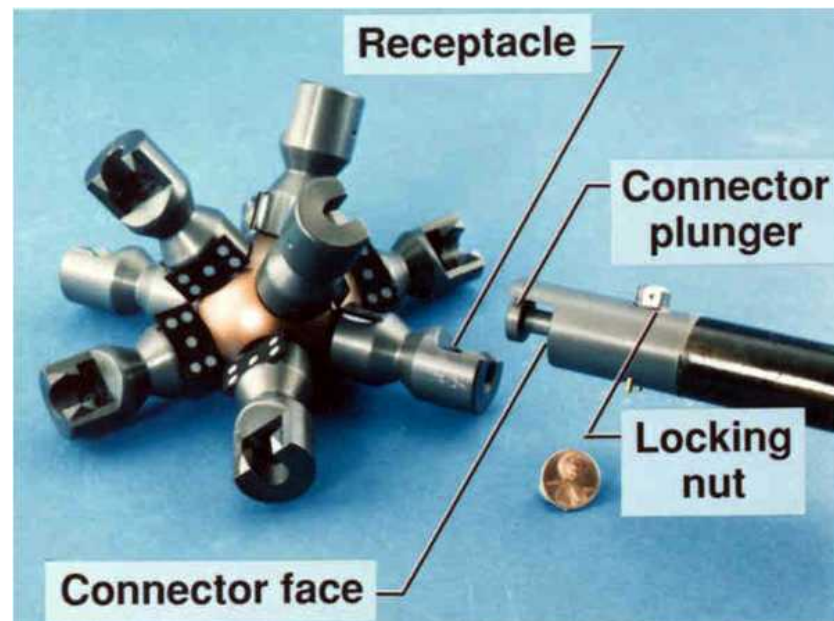
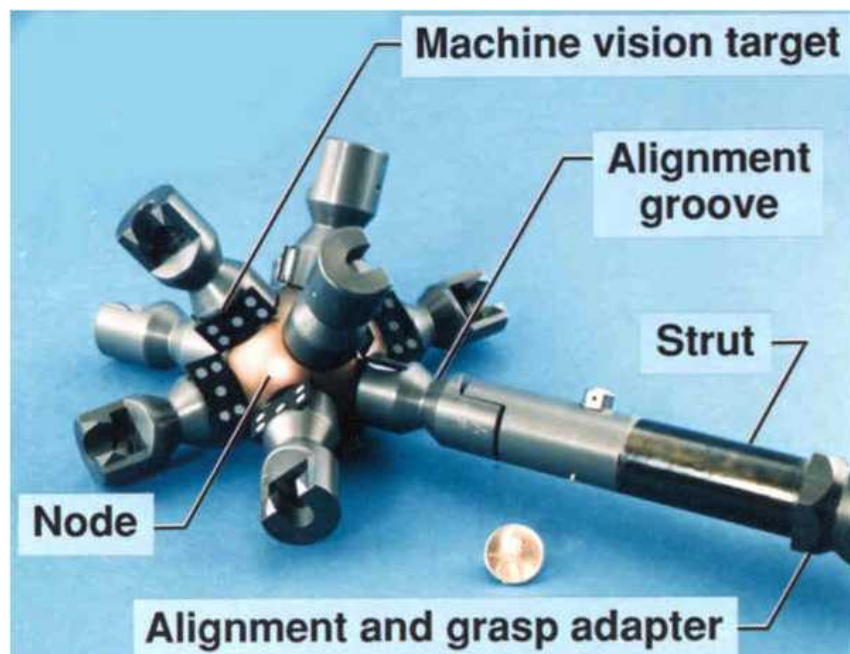


1-inch Diameter Hardware



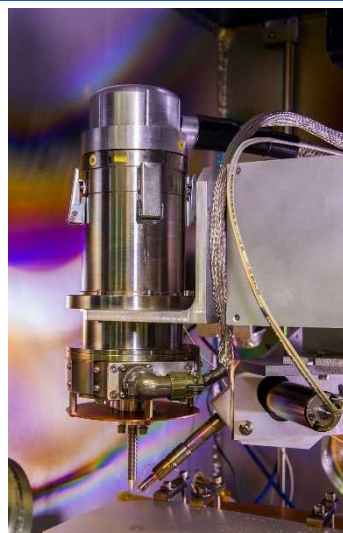


Truss Joint – Robotic Erectable 1-inch Diameter



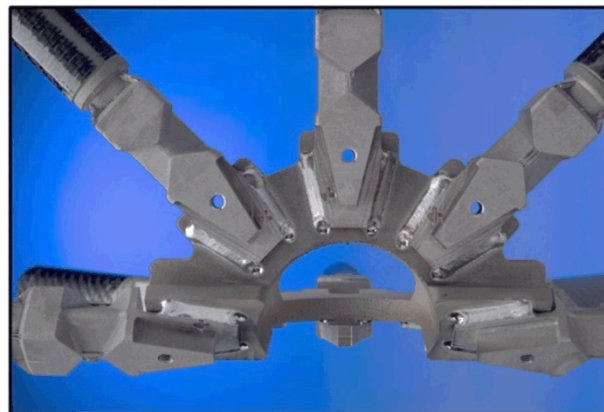
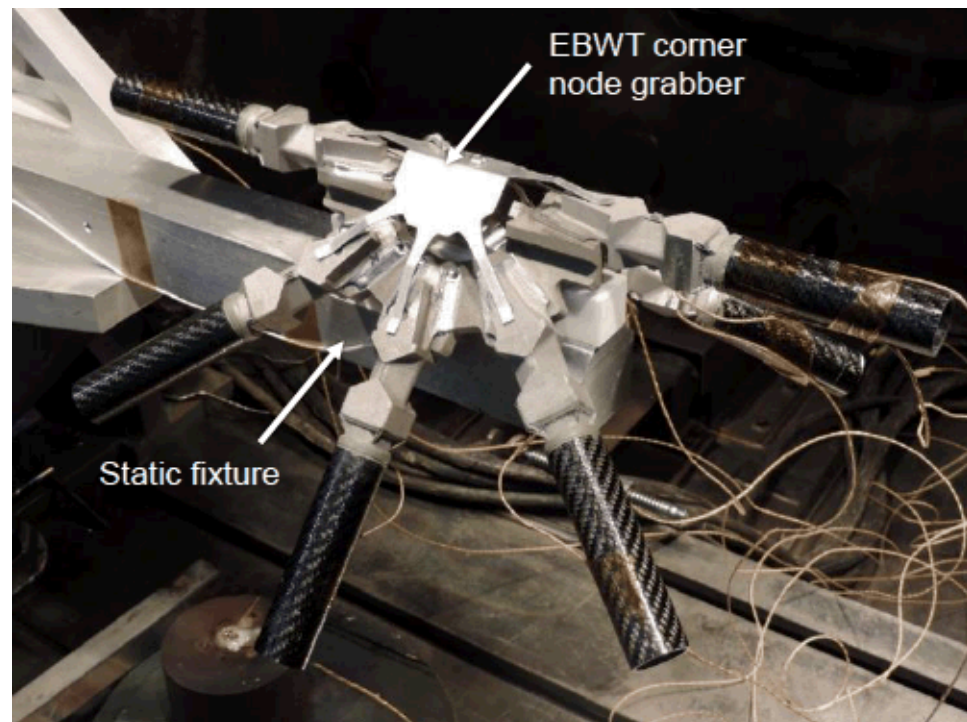


Truss Joint – EBeam Weldable (EBW) 1- inch Diameter

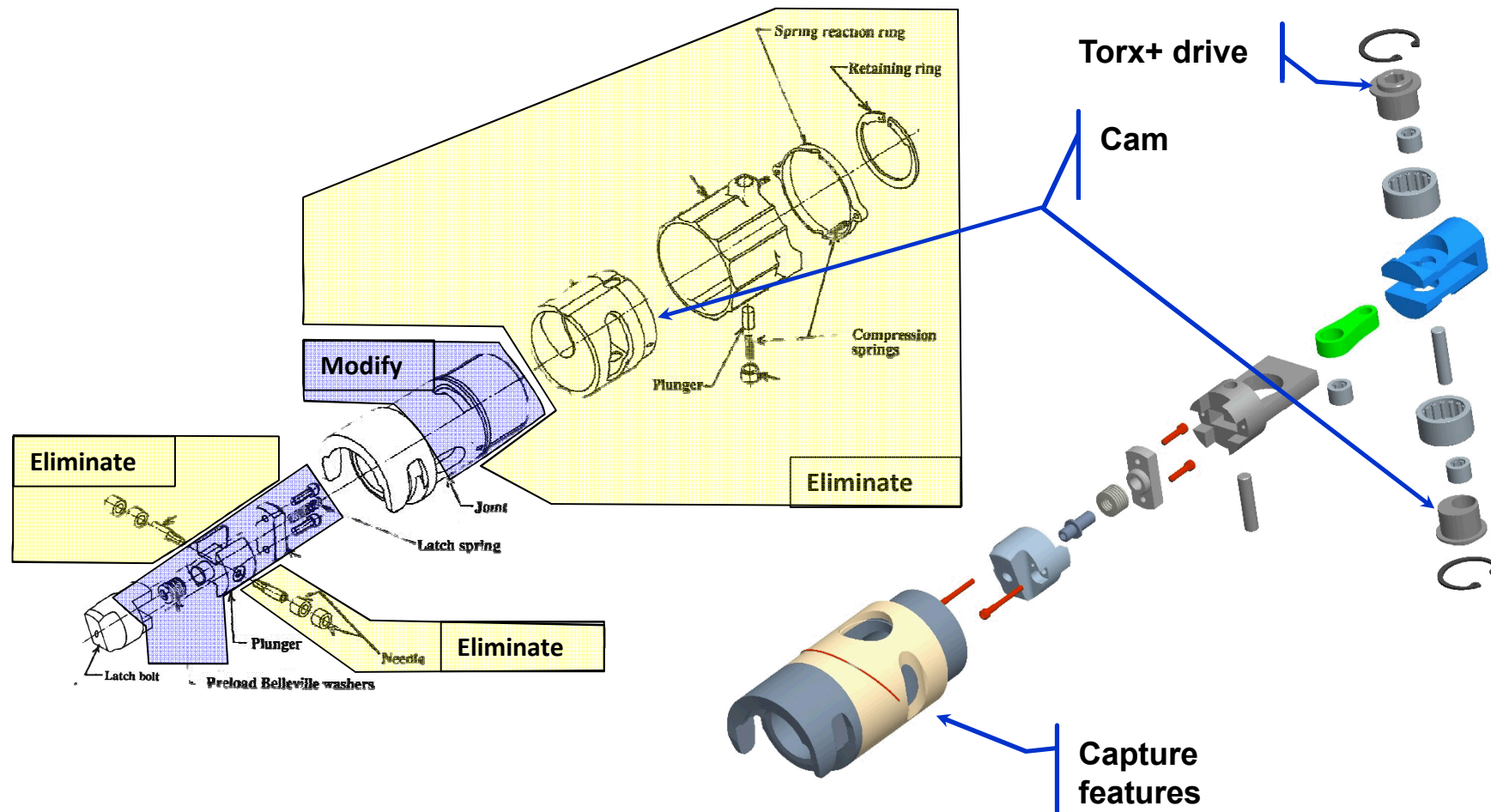


Smaller EBW gun at
LaRC

- Custom built for terrestrial lab use
- 20 kV, 100 mA
- Gun: 6 in. dia., 14 in. long



8 strut end
fittings welded
onto fully-
populated node
of flight-like joint



- EVA compatible joint half with flight heritage.
- Difficult to assemble robotically.

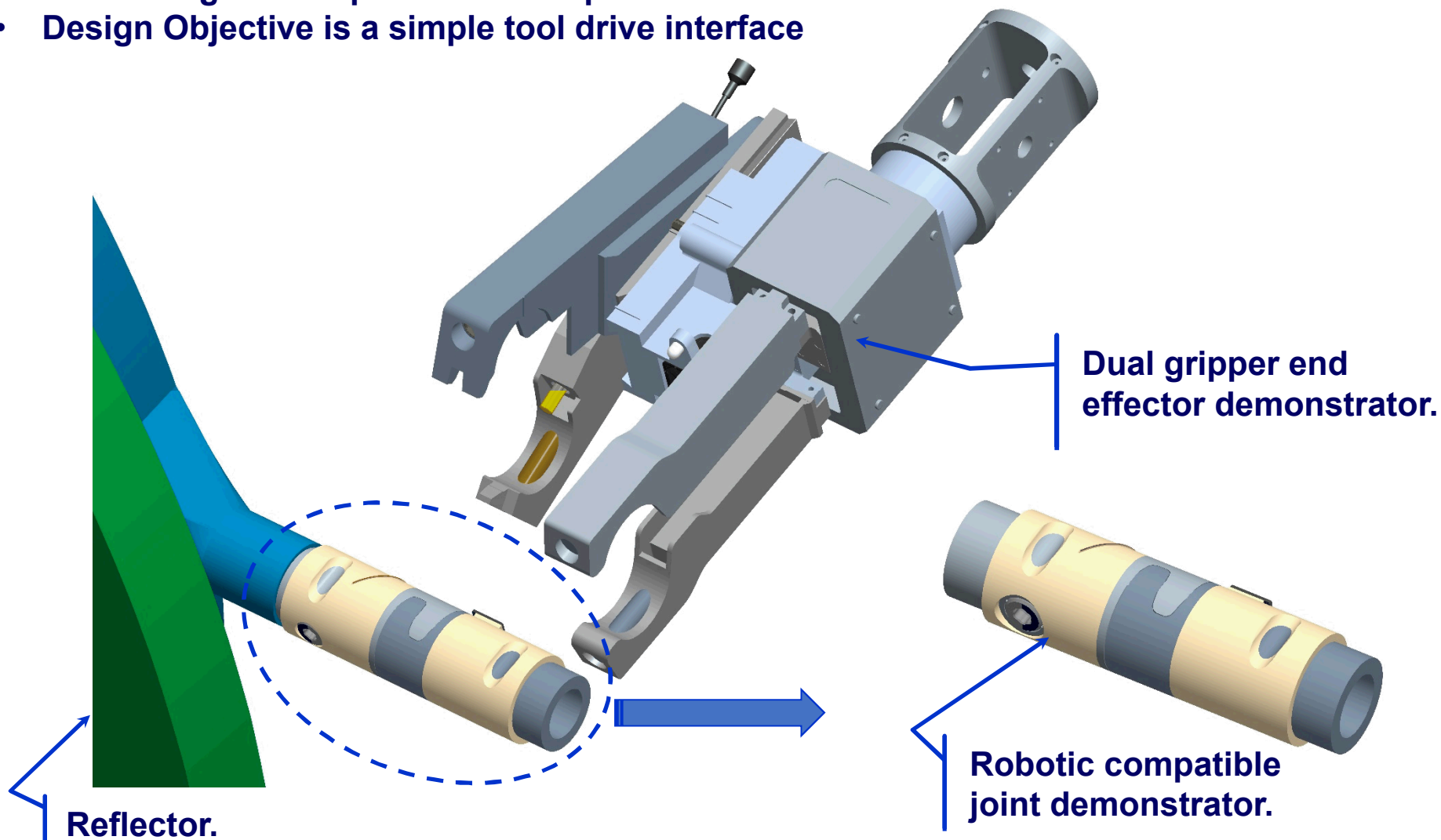
- **Same structural features as EVA joint half.**
- **Simple tool interface for robotic or EVA assembly.**
- **Adjustable latch and preload force.**
- **Robotic approach enables mass reduction.**



Robotic Boom/Beam Joint: 2-inch Round

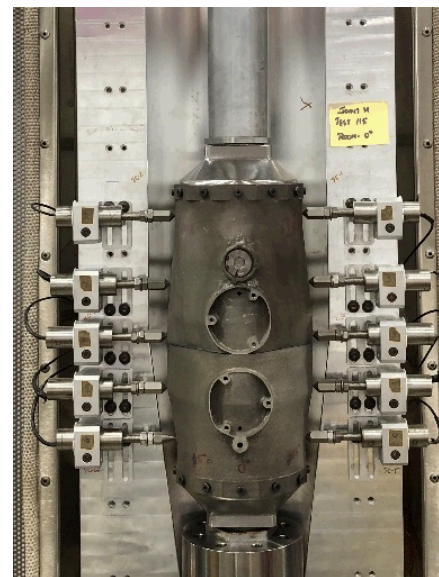
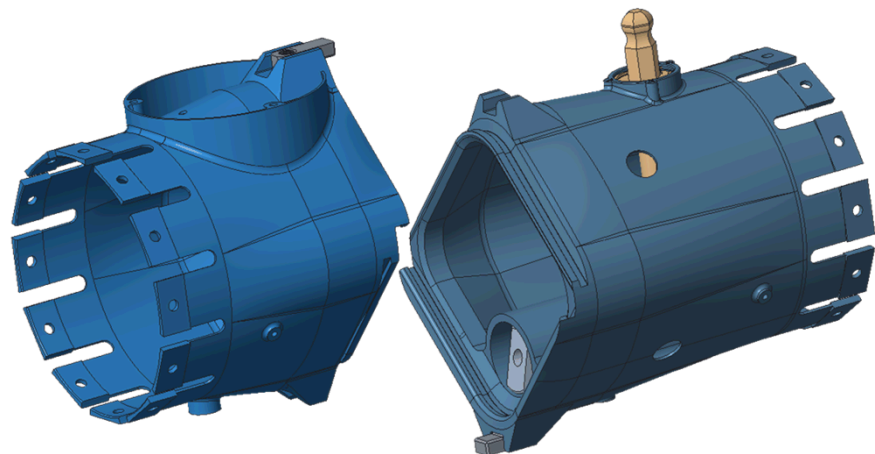


- End-effector optimized for robust assembly.
- Joint designed to optimize in-situ performance.
- Design Objective is a simple tool drive interface

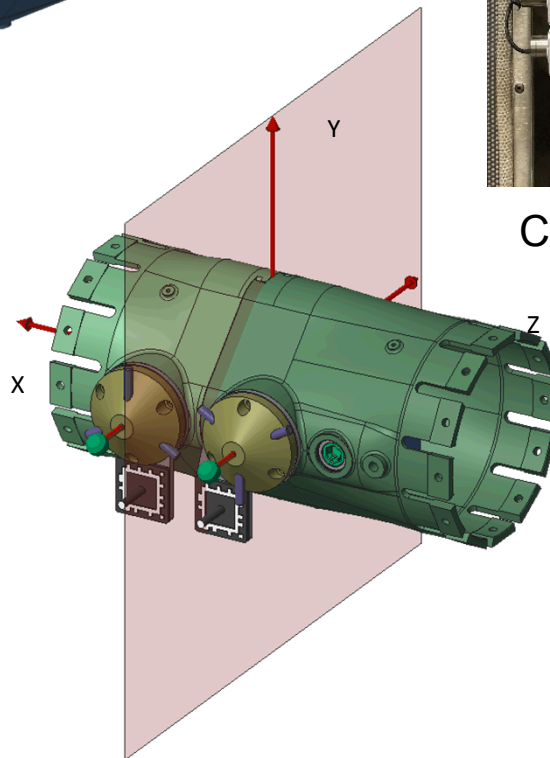
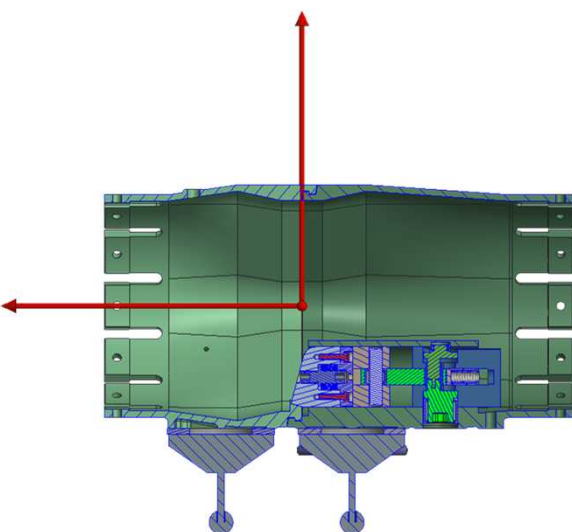




Robotic Boom/Beam Joint: 4-inch Square

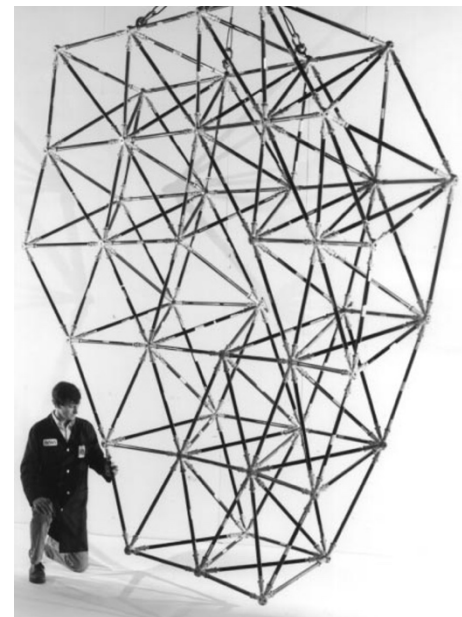
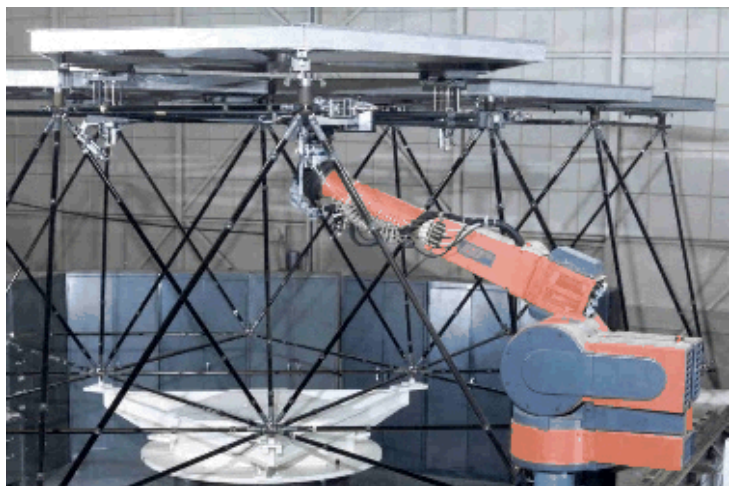
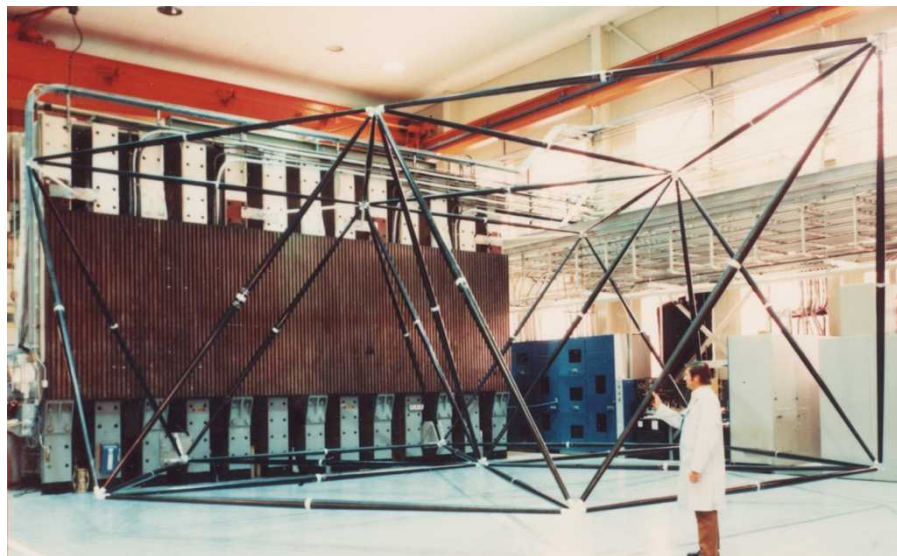
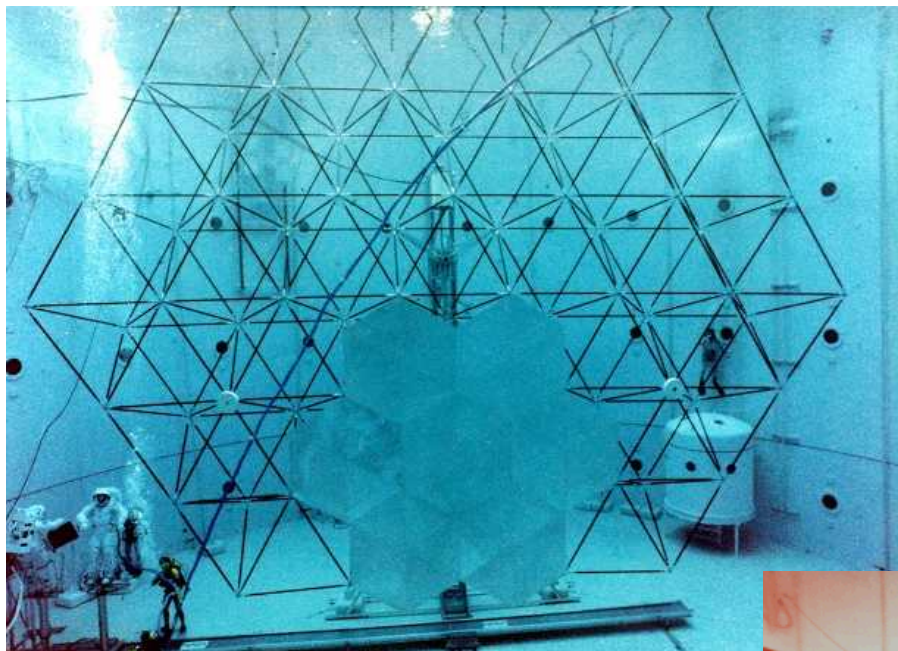


Cantilever Bending
and Shear Test



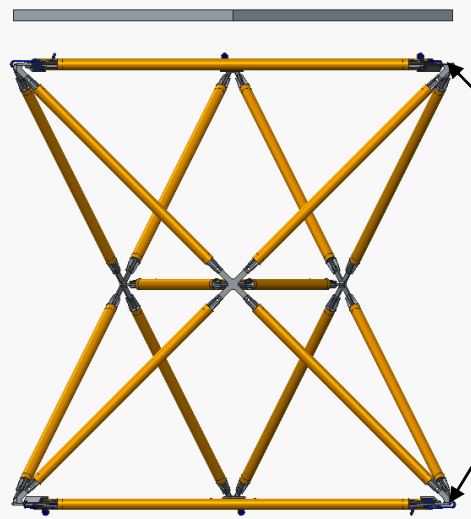


Modular Trusses: Tetrahedral (Individual Strut Construction)

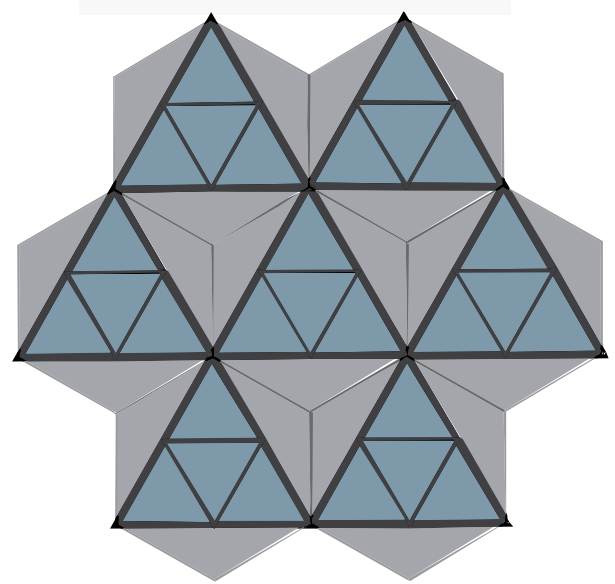
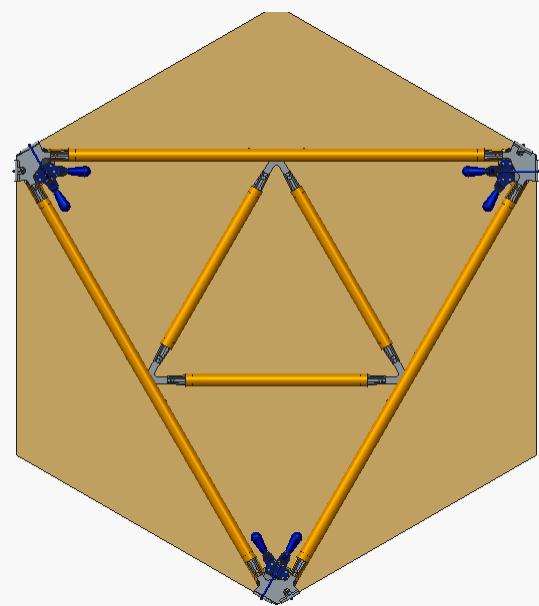
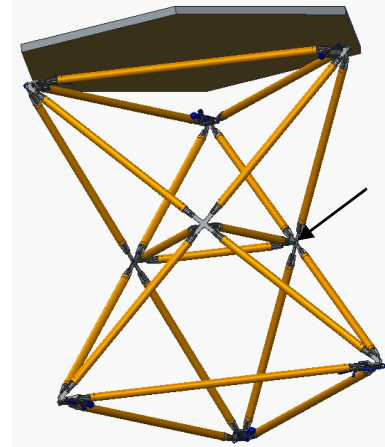




Modular Trusses: TriTruss (Individual Module Assembly)



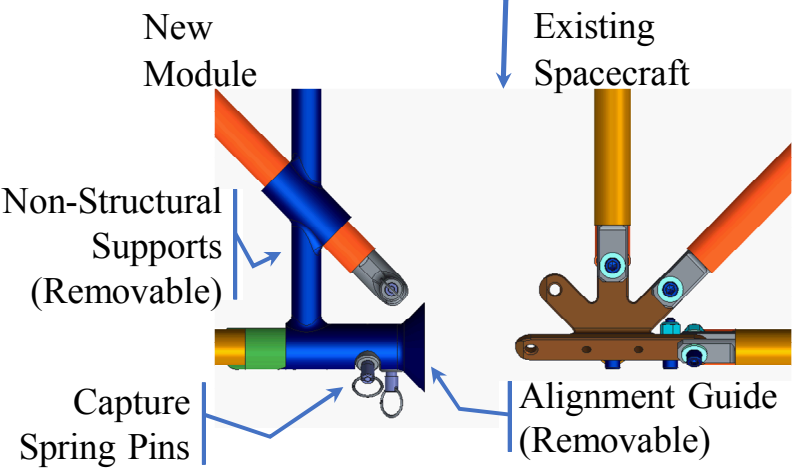
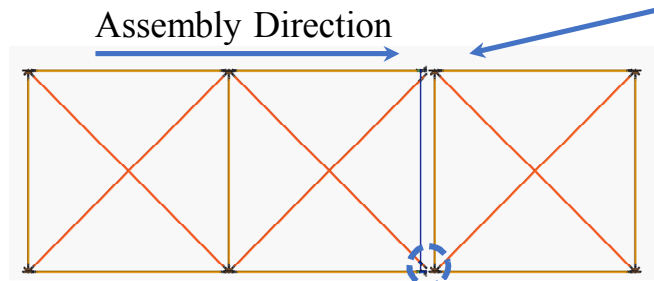
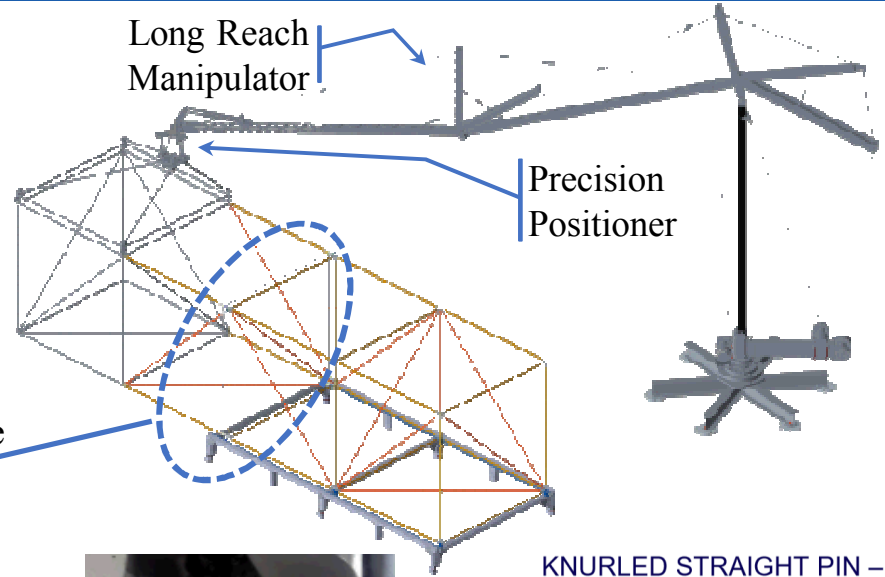
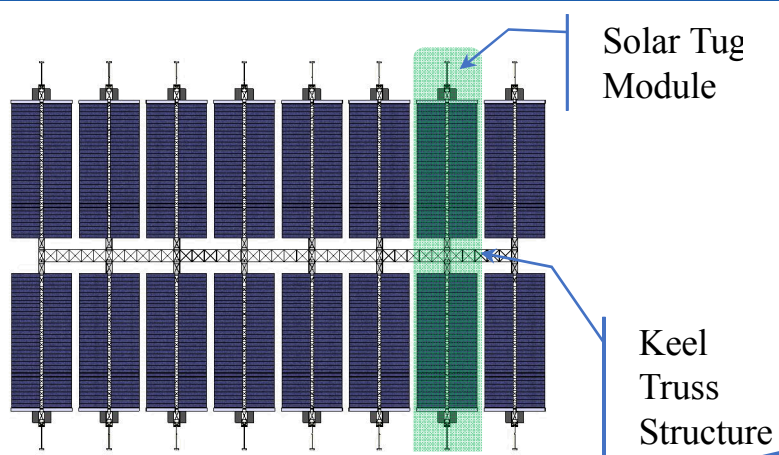
1/3 nodes



Module Assembly



Modular Trusses: Square Bay (Individual Module Assembly)



KNURLED STRAIGHT PIN – KS02005

