

Supervised Autonomous Assembly to Create and Evolve Persistent Assets

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Supervised Autonomous Assembly (SAA) to Create and Evolve Persistent Assets: Overview



Term Definitions

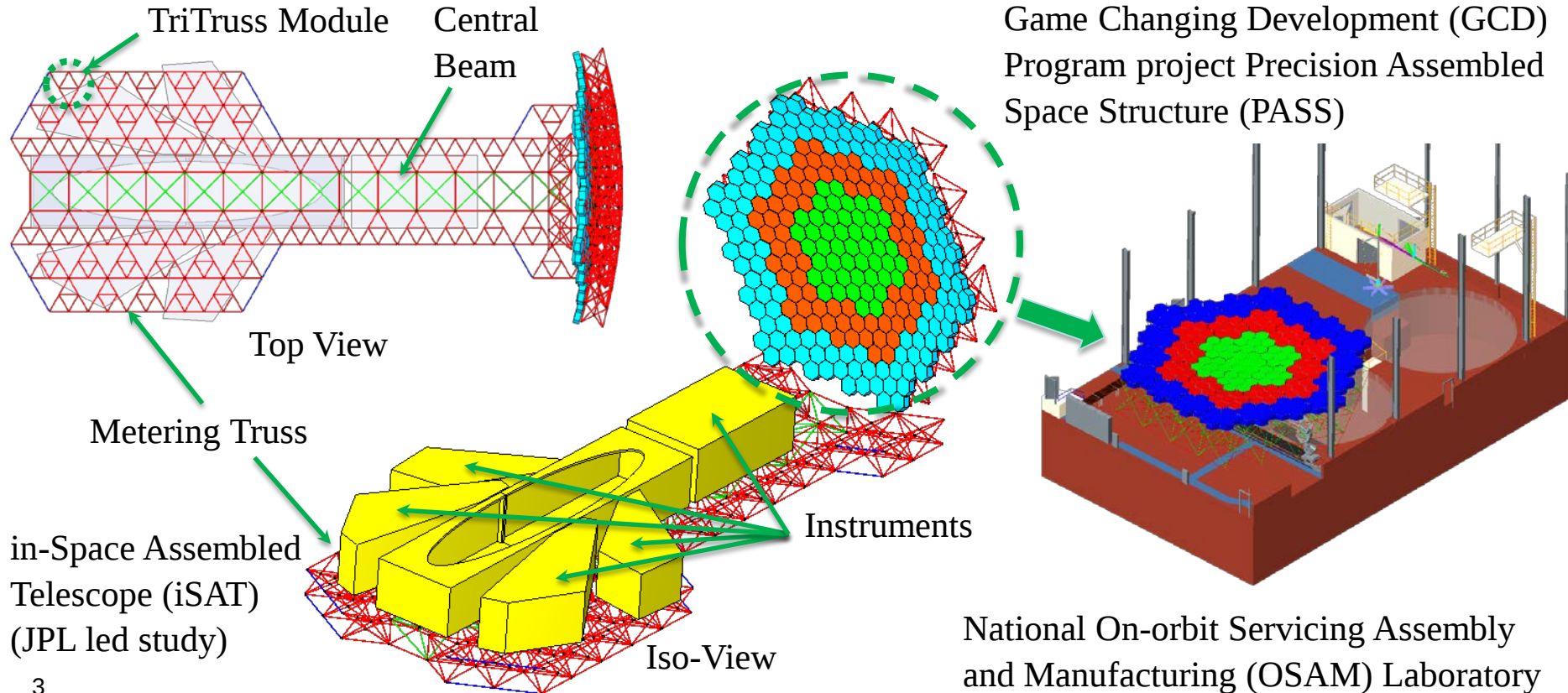
- **Supervised Autonomous Assembly (SAA):** autonomous (robotic) assembly with an operator available to resolve unexpected situations
- **Persistent Asset (PA):** near zero-g or planetary system that benefits from multiple visits

Benefits of SAA

- **Reduced Risk:**
 - Technical: opportunity for post launch correction and inspection
 - Launch: ability to divorce from specific launch vehicle and select launch vehicle late in program
 - Programmatic: adjust to budget fluctuations, launch what is ready then expand, “pay as you go”
- **Increased Design Space:**
 - Design for in-space environment, not the launch environment
 - Unique assembly and packaging options not tied to single launch vehicle



Overview of a Modular Assembled Primary Mirror Support Structure which Illustrates Advantages of SAA



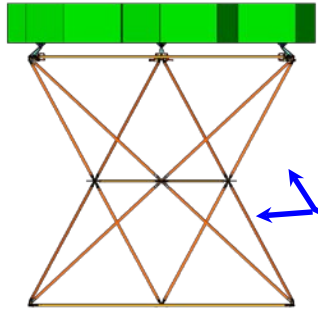
Game Changing Development (GCD)
Program project Precision Assembled
Space Structure (PASS)

in-Space Assembled
Telescope (iSAT)
(JPL led study)

National On-orbit Servicing Assembly
and Manufacturing (OSAM) Laboratory



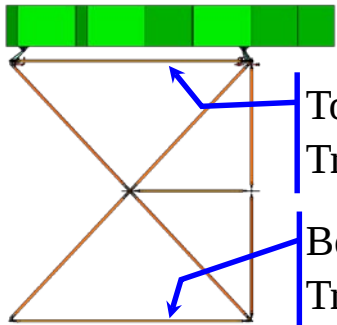
Overview of a Modular Assembled Primary Mirror Support Structure which Illustrates Advantages of SAA



a) Front View

TriTruss
Module

Core Members

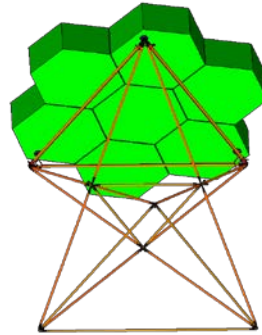


b) Side View

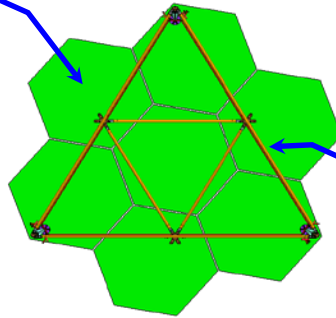
1 of 7 Mirrors
Cells

Top Equilateral
Triangle

Bottom Equilateral
Triangle

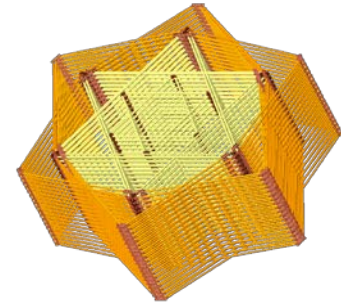


c) Bottom Iso-View

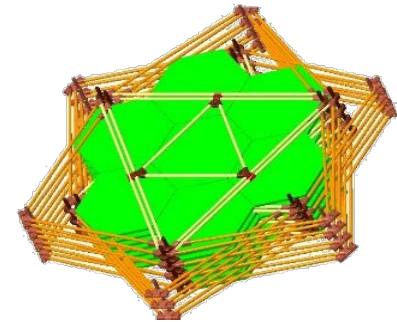


d) Bottom View

Equilateral
Triangle
(top and
bottom)



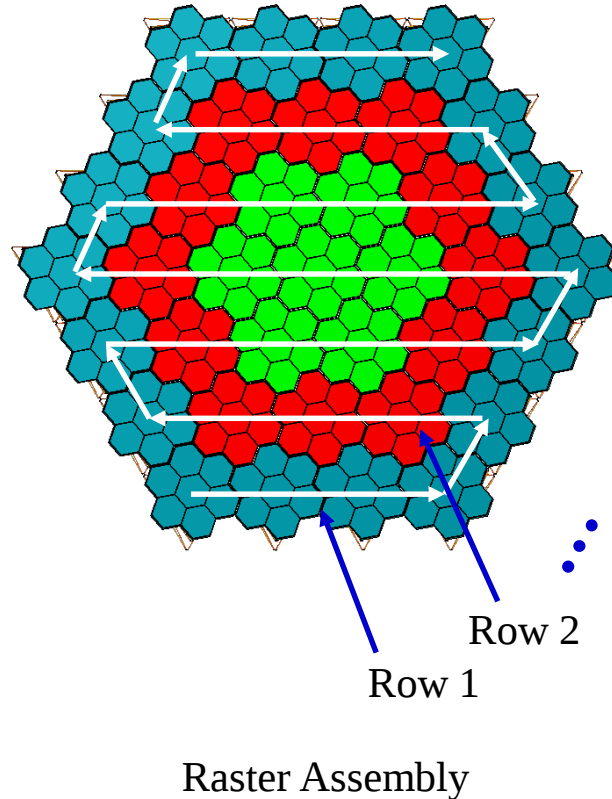
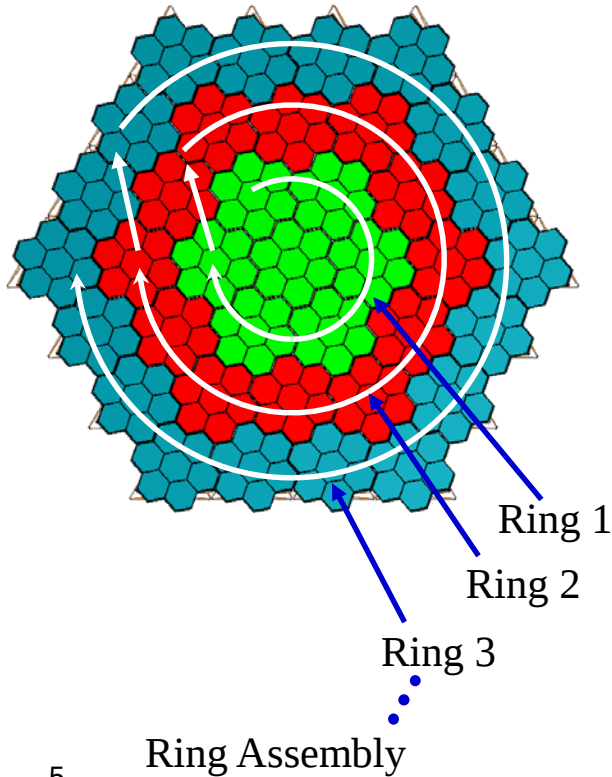
e) 37 Packaged TriTrusses (3 Rings)



f) 7 Packaged TriTrusses with
7 Hexagonal Panel Mirror Rafts



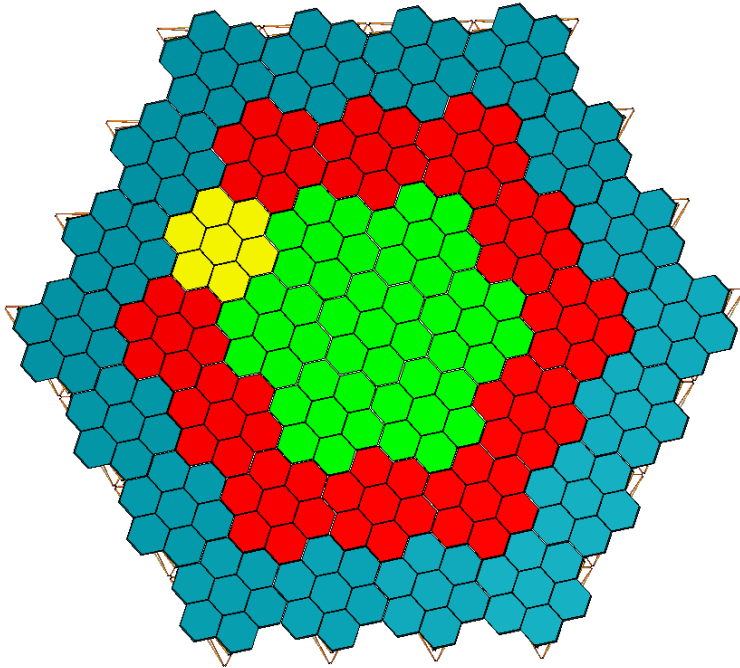
Unique Design and Assembly Implementation Options Enabled by SAA



- SAA approach (Ring vs. Raster) can be selected late in development cycle
- Assembly can occur with pre-attached mirrors or assemble structure then place mirrors
- SAA enables incremental assembly over years



Properly Designed Persistent Assets are Inherently Evolvable and Repairable



Exchange Module Without Requiring Removal of Neighboring Modules

Evolve Capability

- Exchange a damaged module or mirror raft system
- Incrementally evolve capability by upgrading and replacing key modules

Tools and Agents are used for Short Periods

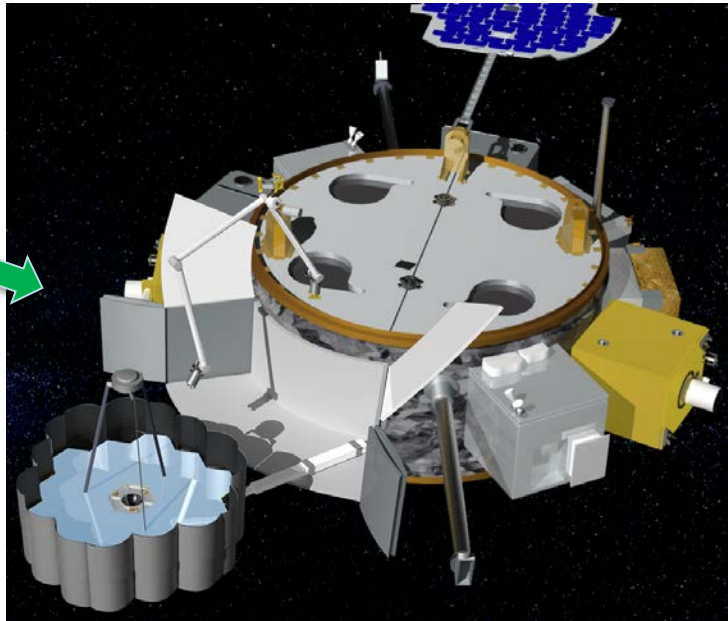
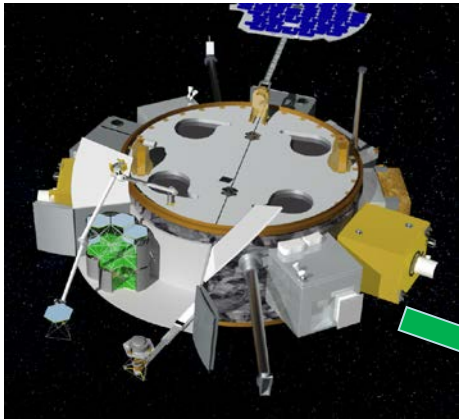
- Tools can be verified on ground and brought with new module or components
- As persistent assets proliferate, servicing vehicles and associated agents will be engaged for short duration tasks such as transportation and module installation



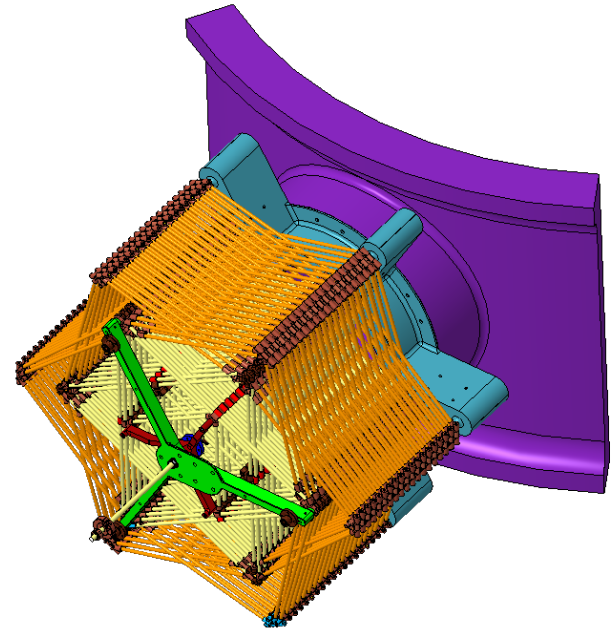
Closing Remark: Modest Flight Experiment Needed to Validate the Supervised Autonomous Assembly Paradigm



Assembly Experiment: Not an Instrument



Assembly of Deployed Modules



Packaged Modules which Deploy Prior to On-Orbit Assembly

QUESTIONS?

