

# Spacecraft Operation Emulation Via Six DOF Tendon-Actuated Robot

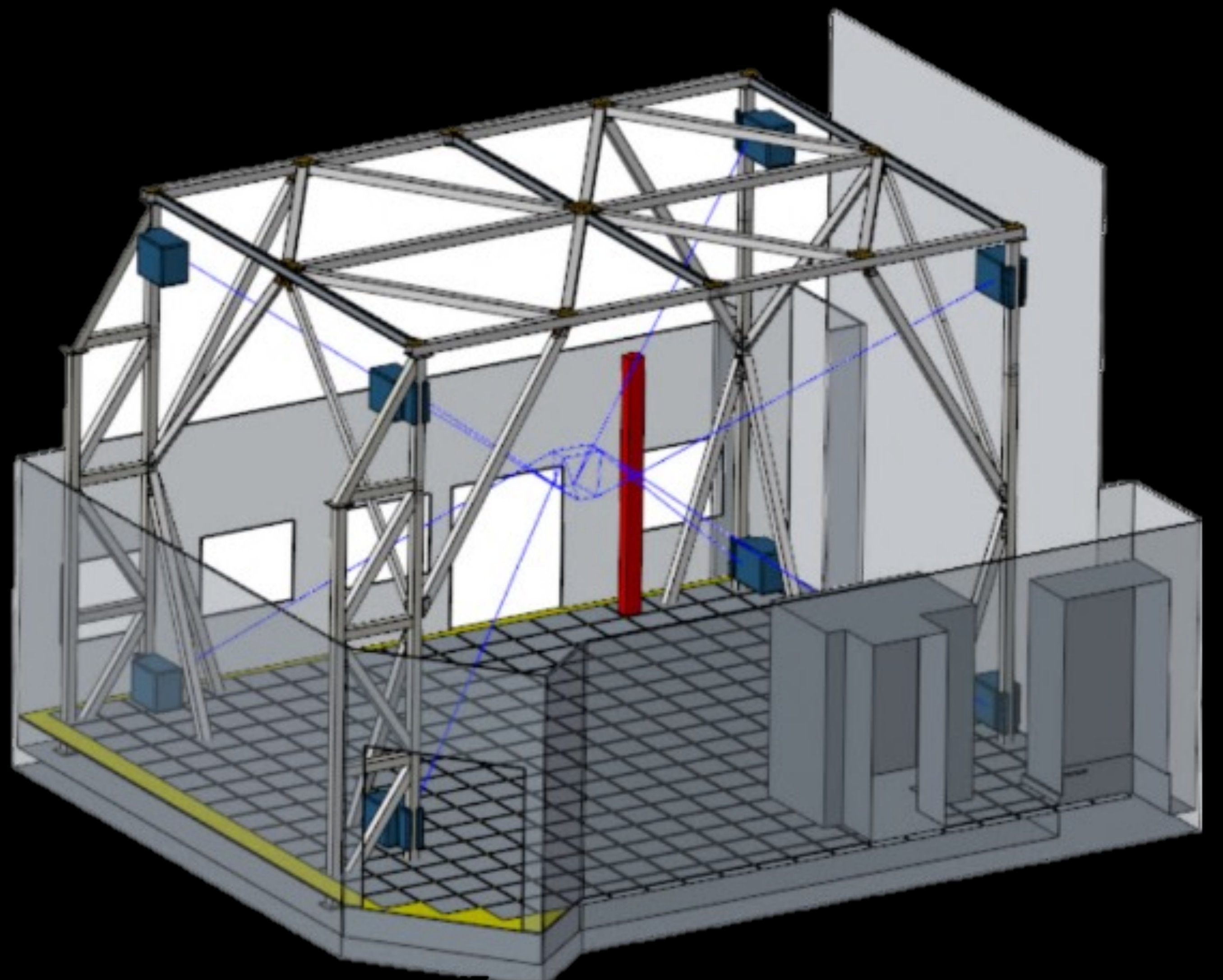
NASA Johnson Space Center's (JSC) Simulation, Emulation, Navigation, Sensors and STAR (SENS) Laboratory has developed a large-scale six degree of freedom tendon-actuated robot (STAR) for emulation of spacecraft proximity operations and Entry, Descent, and Landing approach trajectories to aid in the rapid development and testing of a wide range of guidance, navigation, and control algorithms at low cost.

## STAR Robot Capability

- 6 DOF
- 50kg payload
- 2m/s velocity, 1m/s<sup>2</sup> accel
- 7x10x7m working envelope
- +/-10° pitch/yaw/roll
- API compatible with Trick simulations for simulation-in-the-loop operation

## Facility Information

- Reconfigurable 2D terrain maps and 3D terrain tiles (customer may provide terrain/spacecraft model)
- OptiTrack Prime truth system (mm-level accuracy)
- Multi-modal sensor payload providing real time IMU, image, and LIDAR data



## Completed Test Campaigns

- Velocimeter LIDAR measurement model validation for RPOD and TRN applications – Texas A&M
- Verification testing of novel compact vision navigation sensor suite, UltraNav – Astrobotic Technologies
- Machine learning based relative pose estimation during spacecraft proximity operations – UT Austin

## Ongoing Projects

- HWIL testing for the SPLICE GN&C system
- Fused 2D/3D vision and inertial sensor informed navigation filter
- Large-scale lunar south-pole terrain tile development
- Modular navigation filter framework

