National Aeronautics and Space Administration

Technologies for International Science Space Station

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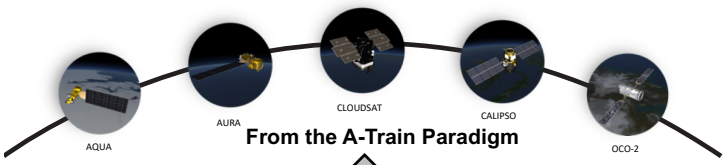
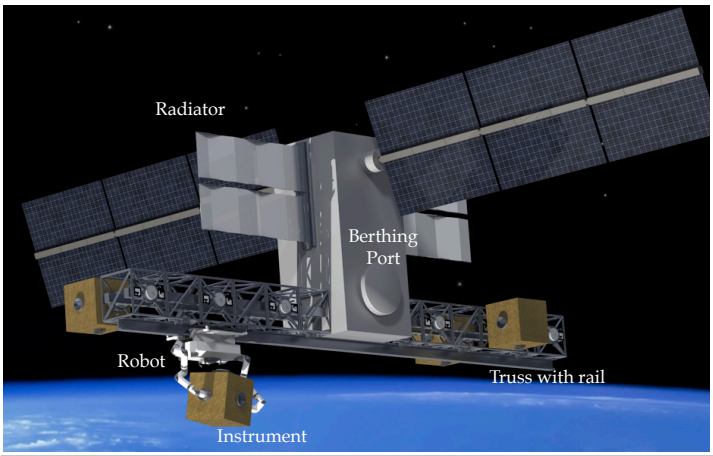
Program: Strategic



From the A-Train Paradigm

To The Science Station



Project Objective:

Our objective is to develop the architecture and technologies for the "Science Station" as a feasible and beneficial approach for physically and temporally collocated Earth Science remote sensing observations from multiple, diverse, instruments to model the Earth as a "system". This would be a major advancement beyond our current abilities of measuring concurrently from one or two instruments. The concept has strong tie back to the Earth Science Decadal Survey findings.

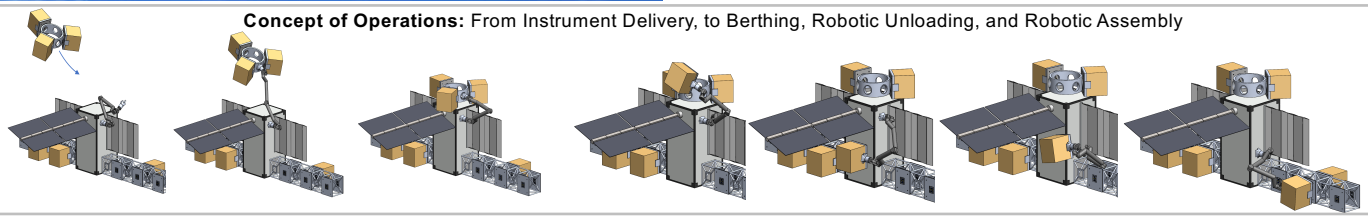
What is the Science Station?

Science Station is a concept of a robotically serviced persistent platform at LEO that can host multiple Earth observing instruments. Instruments can be regularly updated via secondary launches and robotic servicing and assembly. It is a commercial spacecraft fitted with two hinged trusses and an embedded robot. The trusses have standard interfaces that provide structural stability, power, fluid (for thermal) and communication to instruments. The robot berths delivery vehicles, unloads and assembles the instruments.

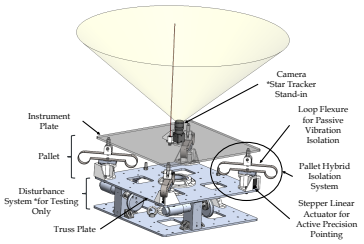
Benefits to NASA and JPL (or significance of results):

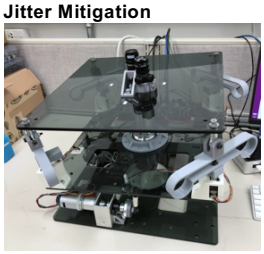
This effort is developing the overall architecture and technologies for critical subsystems for the Science Station concept. When successful, this concept has the potential to enable a breakthrough in current Earth Science observation capabilities. It will address key decadal survey questions in a cost effective manner. Our effort this year has focused on developing initial architecture study, critical subsystem prototyping and development of a robotic test bed to demonstrate the autonomous assembly and servicing. This is to be further developed in the following years of the study to develop an end-to-end concept for the Science Station and demonstrate its feasibility.

Concept of Operations: From Instrument Delivery, to Berthing, Robotic Unloading, and Robotic Assembly

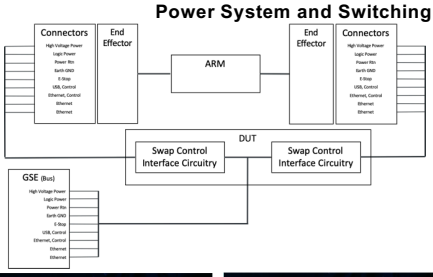


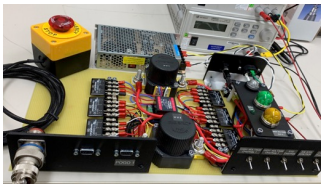
Active Vibration and Jitter Mitigation

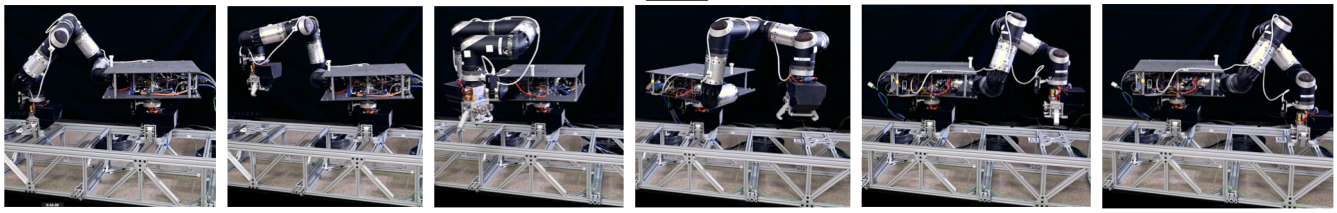


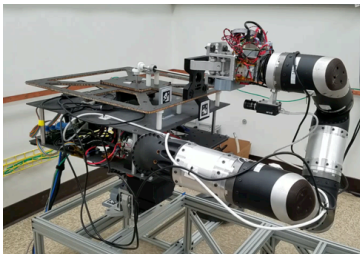


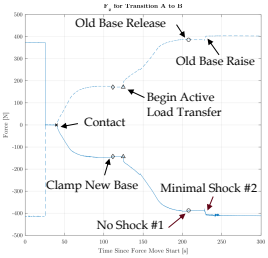
Power System and Switching for Robotic Walking











Autonomous Walking Robot

Storyboard shows our robot with a backpack. The robot has grippers at both ends and it walks on a truss using vision based localization and force-controlled dexterous manipulation. The backpack is for carrying cargo. Figure to the left shows "self-contact" based assembly of cargo on the backpack. Loads during walking are also shown.

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