

KEX project: James Webb mirror hexapod

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James Webb space telescope (JWST) is the largest and the most powerful space telescope ever created. It is a culmination of 30 years of cutting-edge engineering which resulted in truly impressive performance under extreme conditions. Excellent image quality of the most distant objects in the observable universe hinges upon precise alignment of main mirrors. The purpose of this project is to investigate some of the technical solutions behind the 6-axis motion control of JWST primary mirrors.

The main mirrors of JWST consist of 18 hexagonal segments mounted on hexapod stages allowing for individual movement with 6 degrees of freedom. Each stage is made out of 6 actuators working at low temperature with sub-micrometer resolution. The project involves of simulating (COMSOL), designing (Solid Edge), building and testing a working replica of the JWST mirror actuator. Students can use a 3D printer in order to create needed parts and a Raspberry Pi module to control the movement. Expansion of the project to a full hexapod stage replica is possible.

The proposed activities form an engineering project which primary purpose is to build a demo of an accurate motion-controlling device. Students participating in the project will gain hands-on experience with designing and building complex mechanical devices and obtain insight into programming of hardware interfaces.

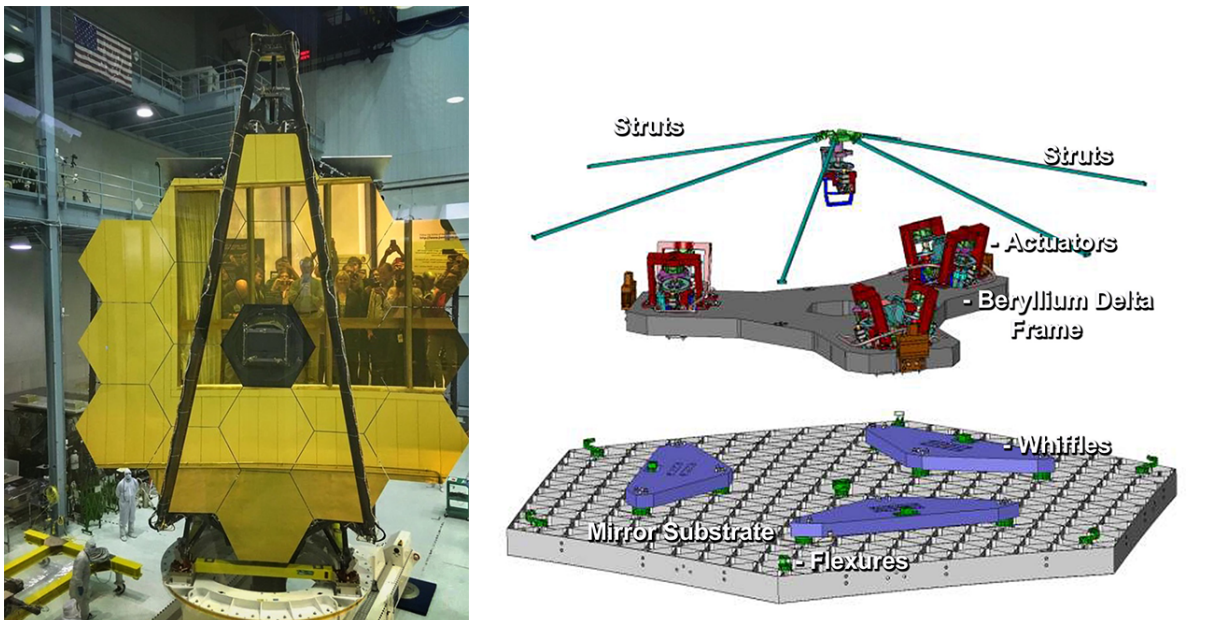


Figure 1: James Webb space telescope (left) and hexapod stage moving the primary mirror segments (right). Source: NASA.