JWST Primary Mirror Segment

(1/5th scale model)

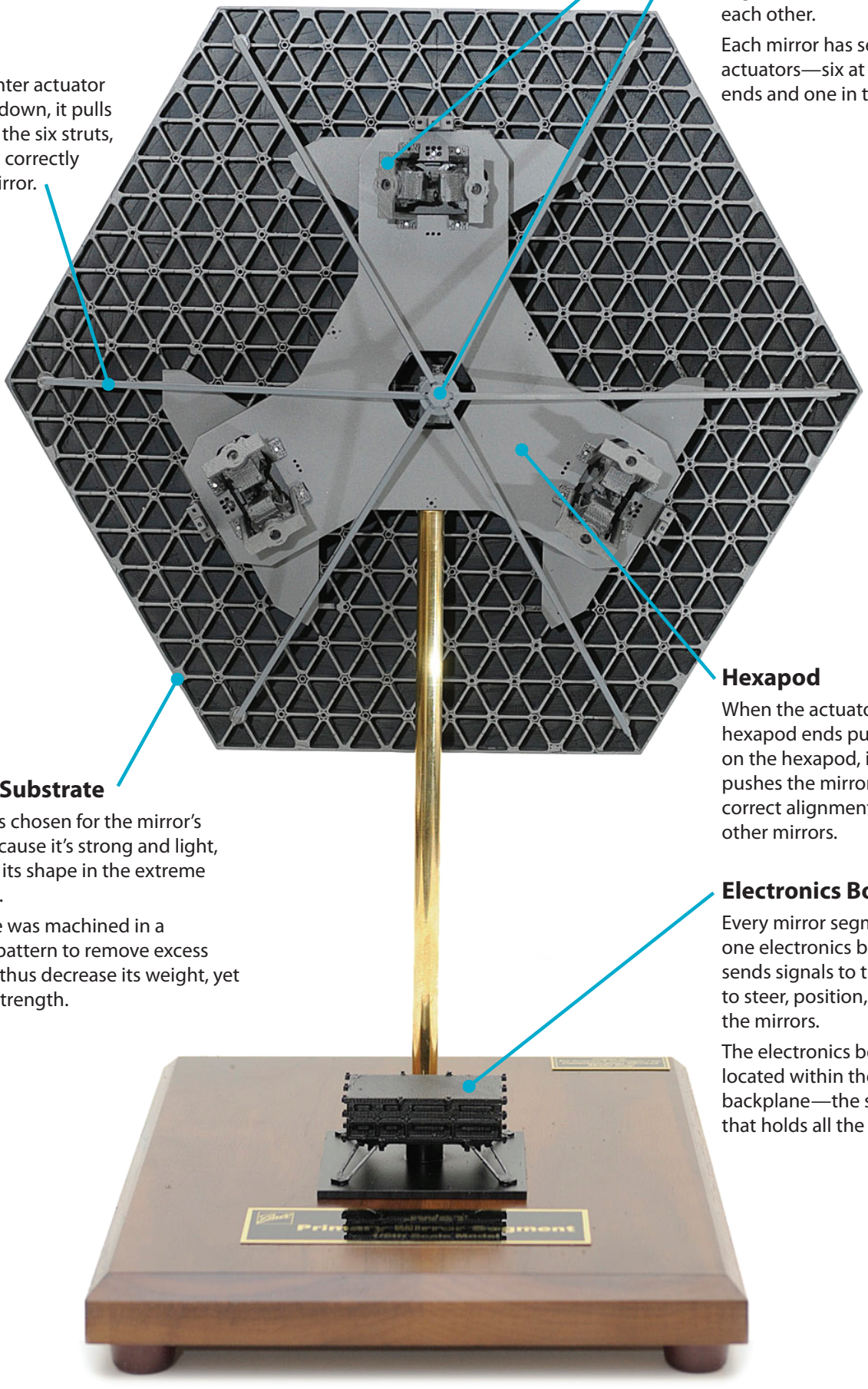
Actuator

The actuators are tiny mechanical motors that move the mirrors into proper alignment and curvature with each other.

Each mirror has seven actuators—six at the hexapod ends and one in the center.

Strut

When the center actuator moves up or down, it pulls or pushes on the six struts, which in turn correctly curves the mirror.



Hexapod

When the actuators at the hexapod ends pull or push on the hexapod, it pulls or pushes the mirror into correct alignment with the other mirrors.

Beryllium Substrate

Beryllium was chosen for the mirror's "skeleton" because it's strong and light, and will hold its shape in the extreme cold of space.

The substrate was machined in a honeycomb pattern to remove excess material and thus decrease its weight, yet maintain its strength.

Electronics Box

Every mirror segment has one electronics box. This box sends signals to the actuators to steer, position, and control the mirrors.

The electronics boxes are located within the backplane—the structure that holds all the mirrors.

Quick Facts

Ball Aerospace is leading the development, design, manufacture, integration, and test of the Webb telescope's groundbreaking optics system, including the Webb's primary, secondary, tertiary, and fine-steering mirrors.

Primary Mirror Facts

- Composed of 18 hexagonal mirrors that must work together as one mirror
- Hexagonal shape allows the segments to fit together without gaps and almost form a circle, the best shape for a telescope mirror
- Total diameter will be 6.5 meters (21 feet 4 inches); six times larger than Hubble's mirror
- Largest mirror ever flown in space
- First mirror to deploy in space

Mirror Segment Facts

- Diameter: 1.3 meters (4.3 feet)
- Weight: About 20 kilograms (46 pounds)
- Coating: Gold, which is highly reflective over all the wavelengths the telescope will see, from visible to mid-infrared

More on the Amazing Actuators

The actuators are tiny mechanical motors that move the mirrors into proper alignment and curvature with each other. Engineers and scientists had to invent how to make actuators that could move tiny amounts—amounts so small that the distance is measured in nanometers.

A nanometer is a measuring unit for measuring extremely small things, such as atoms and molecules. To understand nanometer, think of a sheet of paper—that's about 100,000 nanometers thick.

The actuators will move just 10-12 nanometers when they're making the final adjustments. These movements are so tiny, that you'd have to have a special microscope to see them.

The actuators are computer controlled, some of which is autonomous and some of which is controlled by people on Earth.

After the telescope is deployed in space, it will take about two months to align the mirrors and adjust their curvature. After that, people will regularly monitor their alignment and curvature, correcting those as needed.

Mirror model created by the Ball Aerospace & Technologies Corp. Communication Services Model Shop.