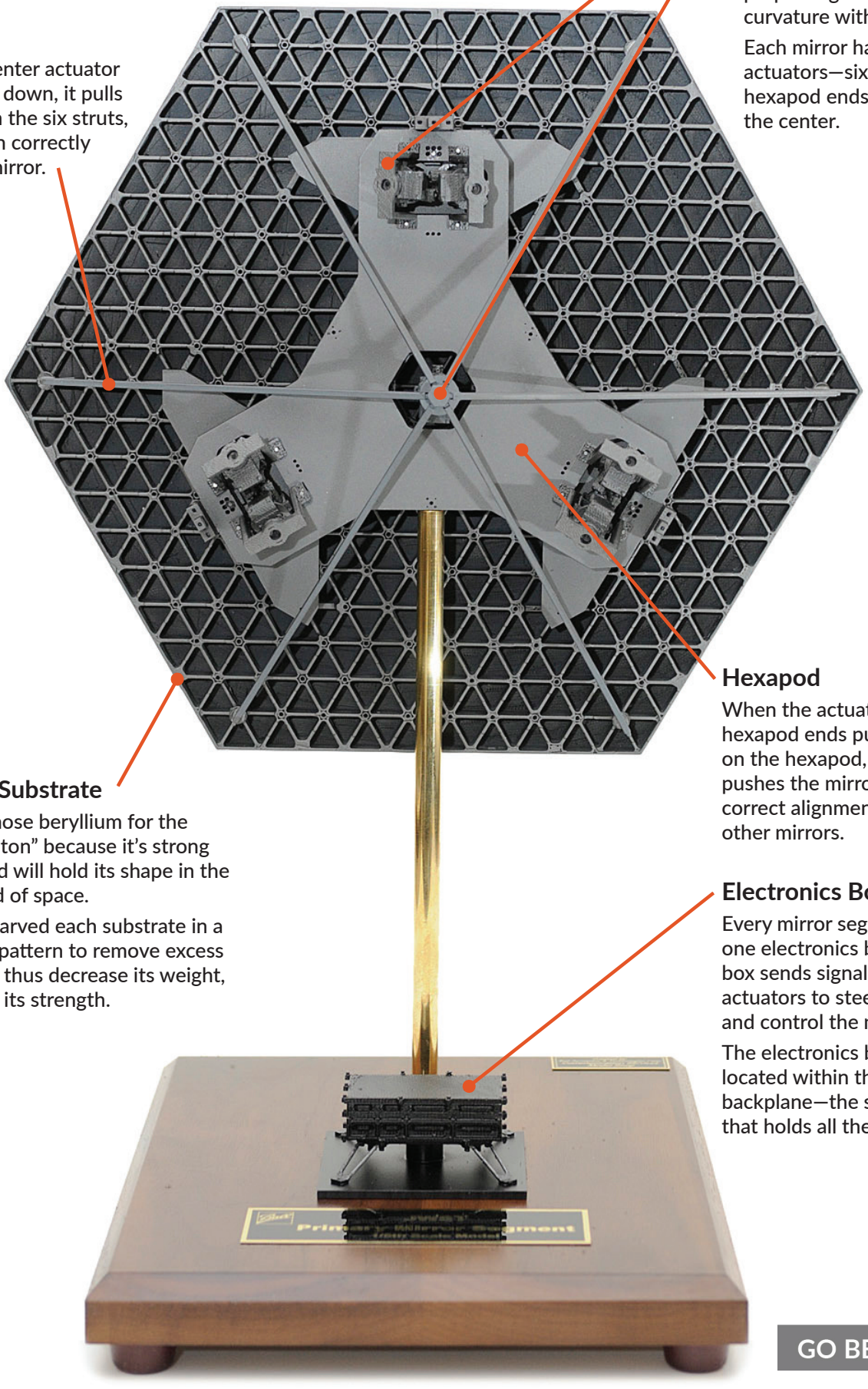
JWST PRIMARY MIRROR SEGMENT
(1/5th scale model)

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
Engineers chose beryllium for the mirror "skeleton" because it's strong and light, and will hold its shape in the extreme cold of space.

Machinists carved each substrate 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.

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QUICK FACTS

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

Primary Mirror Facts

- Composed of 18 hexagonal-shaped mirrors that must work together as one mirror
- Hexagonal shape allows the mirror 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 (21.4 feet), compared to the Hubble telescope's primary mirror diameter of 2.4 meters (7.9 feet)
- Largest mirror ever flown in space (about six times more light-collecting area than Hubble)
- 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 the wavelengths the telescope will see, from visible to mid-infrared light

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 a nanometer's size, think of a sheet of paper—that's about 100,000 nanometers thick.

The actuators will move just 5-6 nanometers when they're making the final adjustments. These movements are so tiny that you'd have to use a special microscope to see them.

The actuators are software 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. People and software will monitor the mirror positions following that time, and make adjustments as needed throughout the mission.

Mirror model created by the Ball Aerospace Marketing & Communications Model Shop.