



The Unique Gear that Helps Enable the James Webb Telescope Search for the Dawn of the Universe.

The James Webb Space Telescope has been operational for more than a year and is providing the world with breathtaking images and scientists with the data that will help them understand the beginnings of our universe. The image of the Carina Nebula (above) was captured with Webb's Near Infrared Camera (NIRCam) which operates at a temperature of 37 K (–236° C; –393° F). This amazing science instrument is enabled, in part, by a Harmonic Drive® strain wave gear, a unique mechanism that has a long heritage of spaceflight. This novel gear was developed by an innovator who believed that anything was possible.

C. Walton Musser invented the strain wave gear, a precise and robust device used on a multitude of satellites and space missions over the past six decades. If you have ever checked the weather forecast, listened to Sirius XM satellite radio or used GPS navigation, your life has been touched by his work.

Walt Musser held over 200 patents for complex inventions including the recoil-less rifle and jet aircraft ejection seat. He was awarded the Commendation for Exceptional Civilian Service (the highest civilian award bestowed by the US government) for his invention of the recoilless rifle. He was trained in mechanical engineering and had exceptional intellect, boundless curiosity and was unafraid to challenge “common wisdom.” That personality trait led to perhaps his most influential invention, the strain wave gear. Highly accurate and reliable positioning systems play an essential role in many machine designs.

Before Musser, the prevailing wisdom was that gears must be rigid. Musser realized that the opposite could also be true and that a design utilizing the elastic properties of metals could vastly improve both performance and reliability. This led to his seminal work in the field of non-rigid body mechanics and the development of the strain wave gear.

He worked closely with USM Corp. to commercialize his invention and today these high-precision gears are manufactured under the trademark Harmonic Drive® by Harmonic Drive LLC in Beverly, MA, a descendant of USM.



NIRCam Science Instrument

In addition to its use in the NIRCam, Harmonic Drive® gearing is also used to position Webb's Earth-Pointing Antenna which is its primary means of communication with Earth.

Spaceflight applications demand the ultimate in performance and spaceflight hardware must perform reliably for the planned life of the mission and beyond. The Voyager 1 and 2 spacecraft are both still operational after 45 years and are now traveling in interstellar space, billions of miles from earth. Harmonic Drive® gears were used throughout the Mars Rovers Spirit and Opportunity, in the robotic arm of the Perseverance Rover and on the wheel drives of the Lunar Rovers that the Apollo 15, 16 and 17 astronauts drove on the moon. The Mercury Messenger Probe, the Hubble Space Telescope, GPS Satellites, GOES weather Satellites and Robonaut – the first humanoid robot to serve as a crew member of the International Space Station – all owe their success, in part, to the genius of C. Walton Musser.