Flipping Bits in the James Webb Space Telescope's Cameras

Lance Simms

IEEE Life Members Talk – 05/16/2018

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Lawrence Livermore National Laboratory

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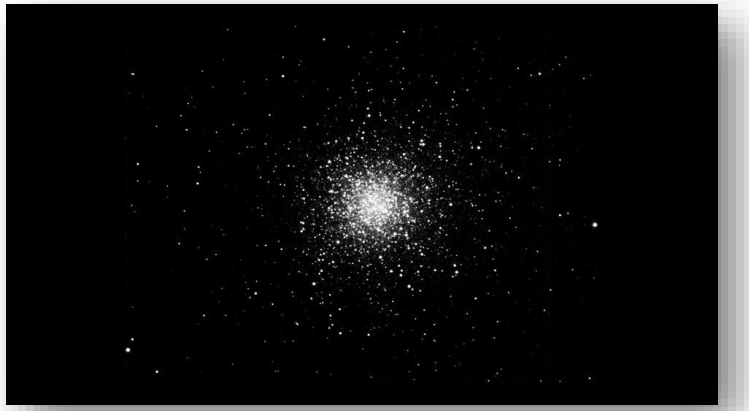
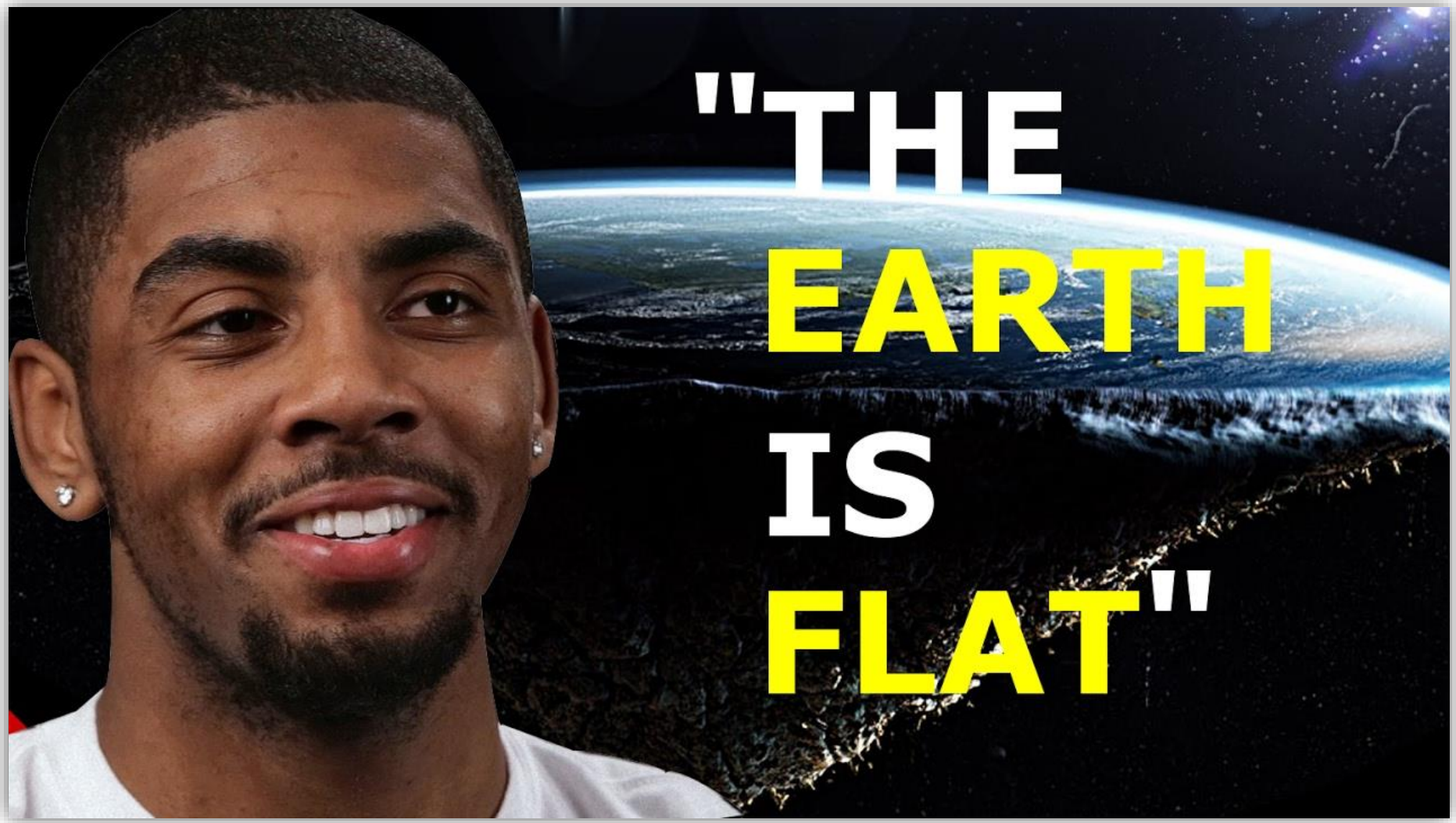
Do you like really cool telescopes?

Do you like fun, interesting people?

Come join the Tri-Valley Stargazers!



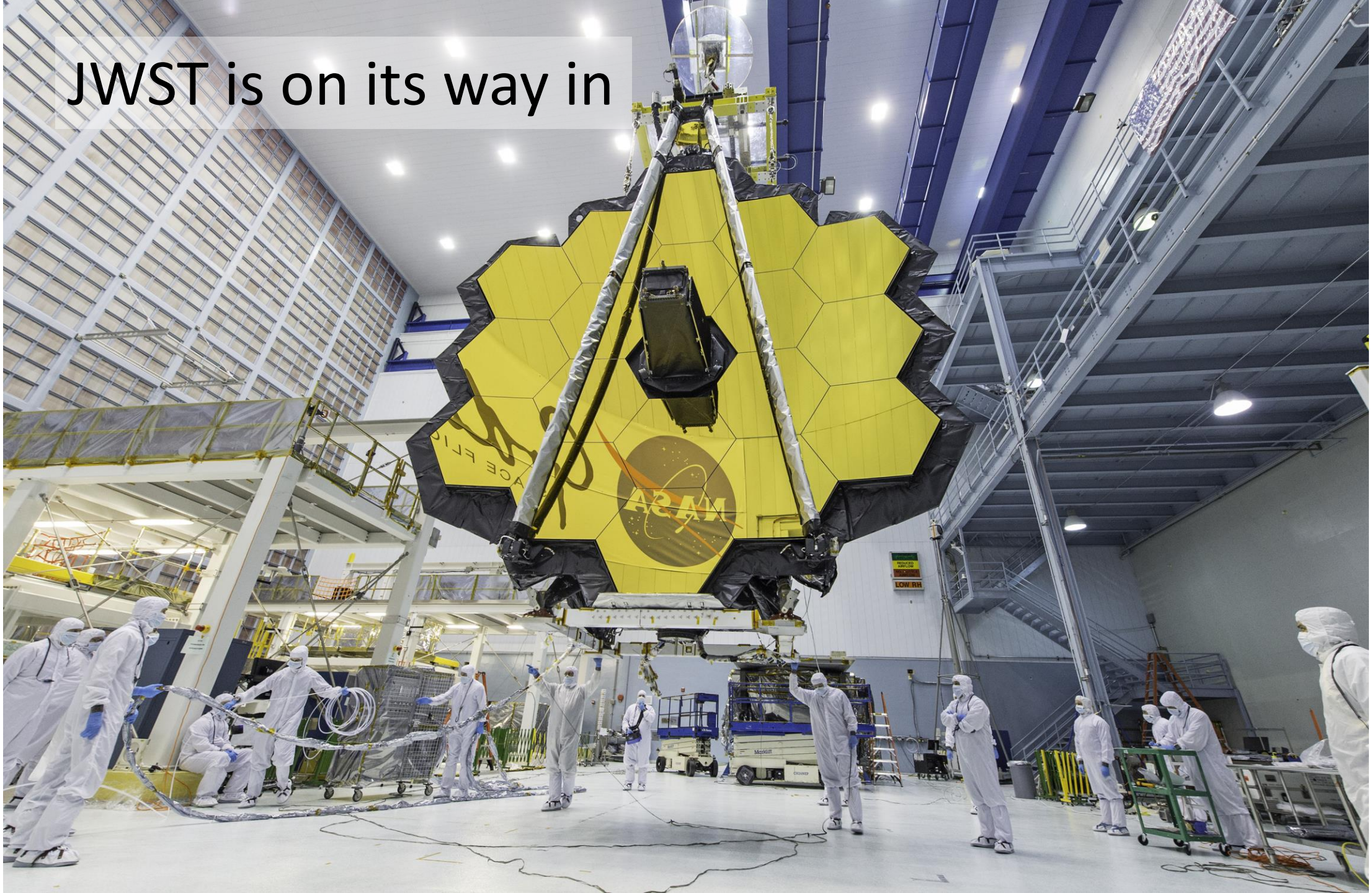
We can turn you from this…



…Into this

Hubble is on its way out

JWST is on its way in



THE JWST TEAM

Image taken from jwst.nasa.gov

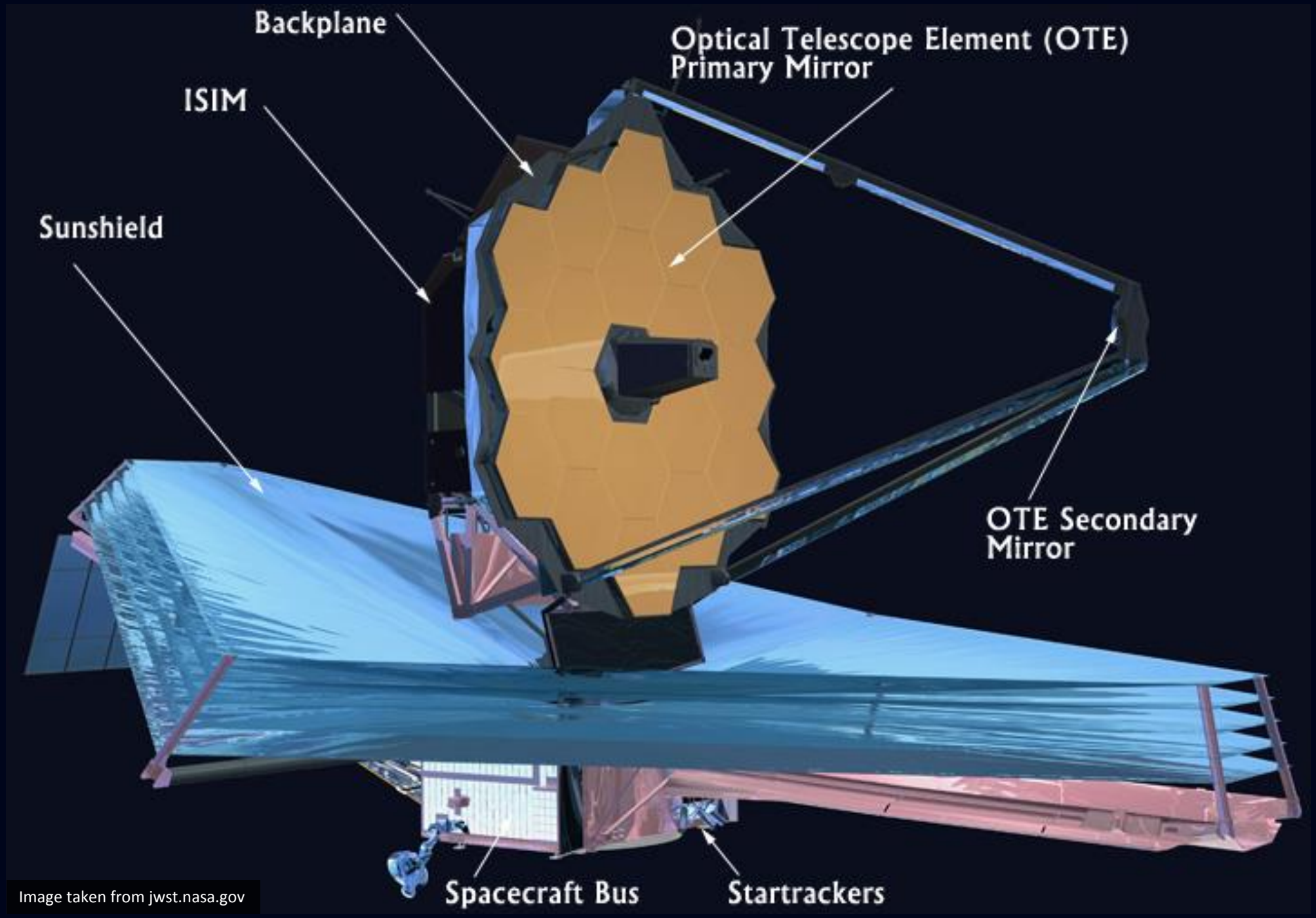
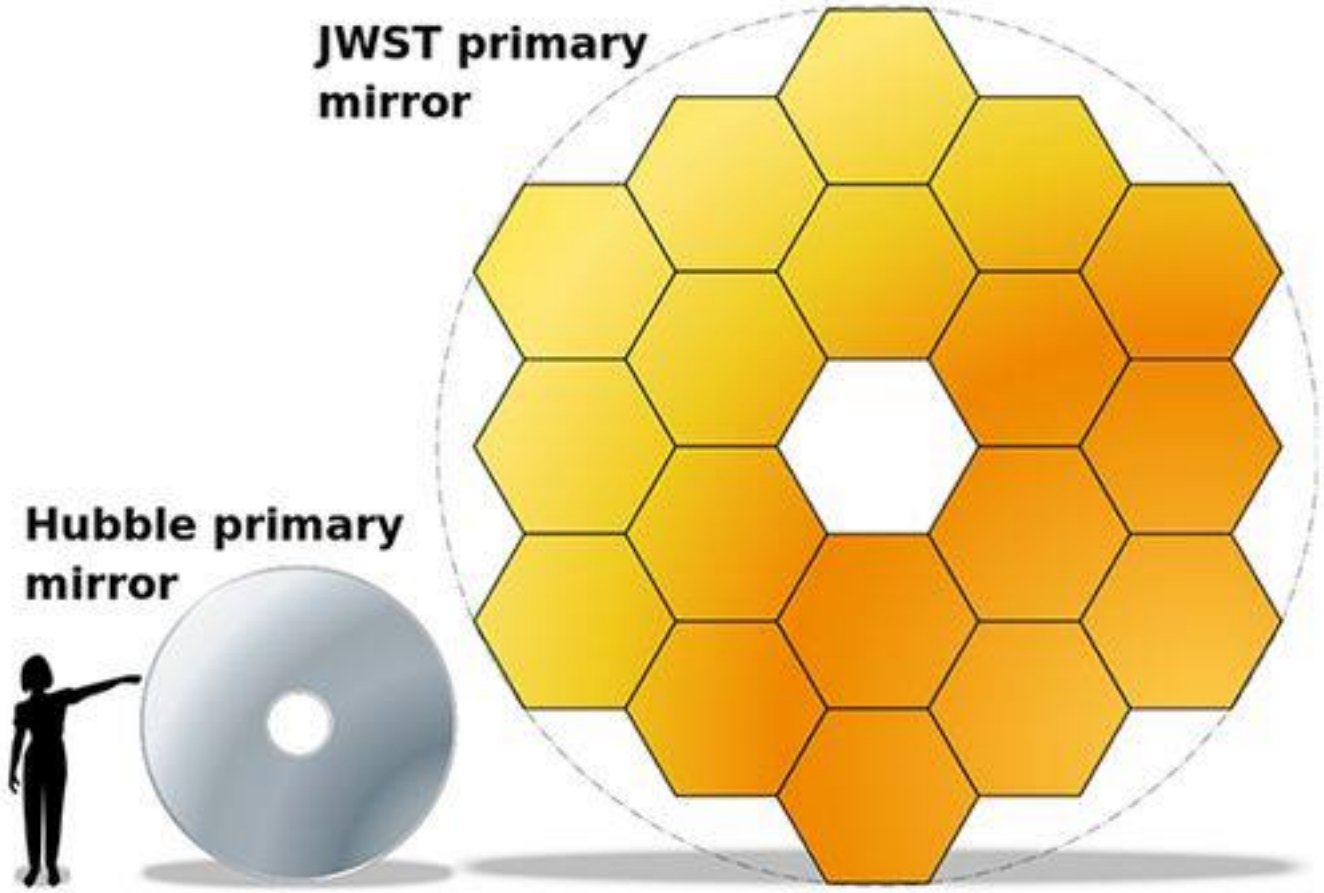


Image taken from jwst.nasa.gov

Primary Mirror: 6.5 meter diameter aperture



7X improvement in light-gathering

Image taken from jwst.nasa.gov

Image taken from jwst.nasa.gov

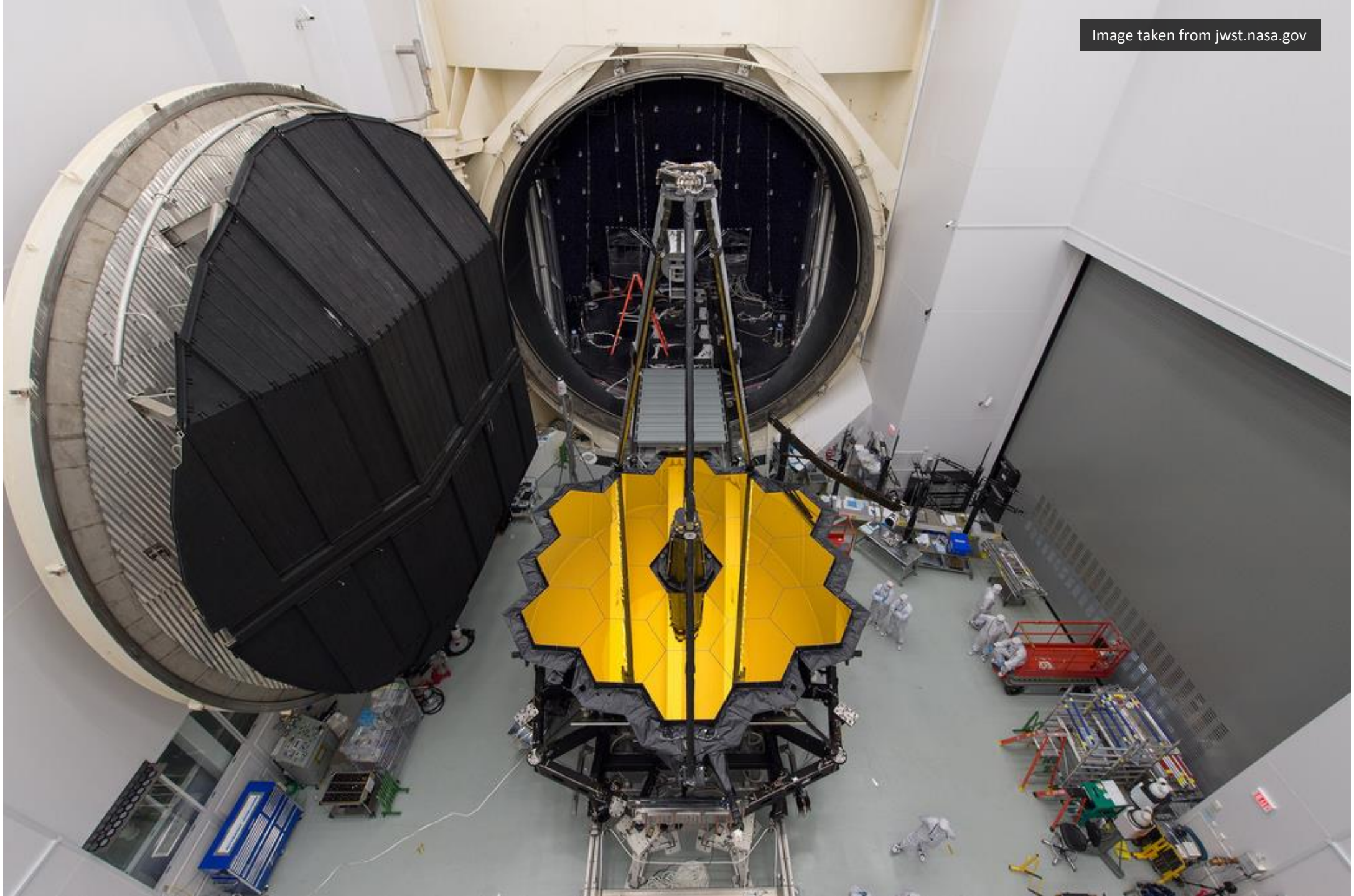


Image taken from jwst.nasa.gov

The Sunshade

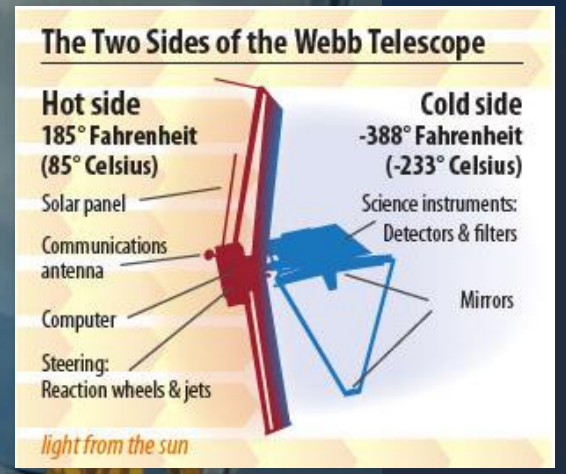
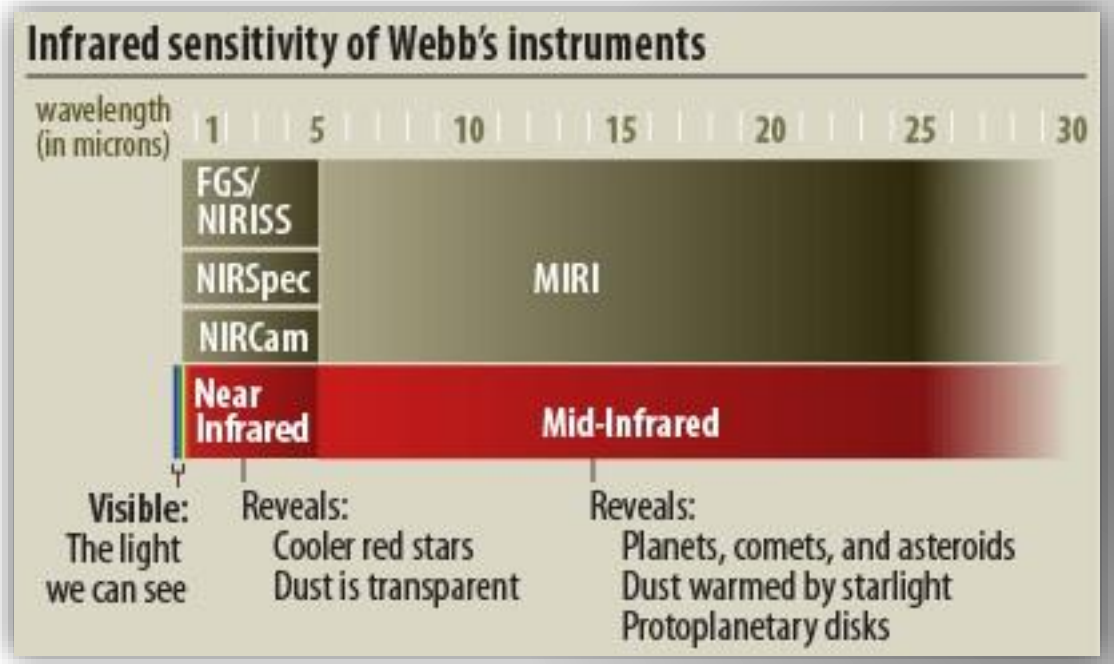
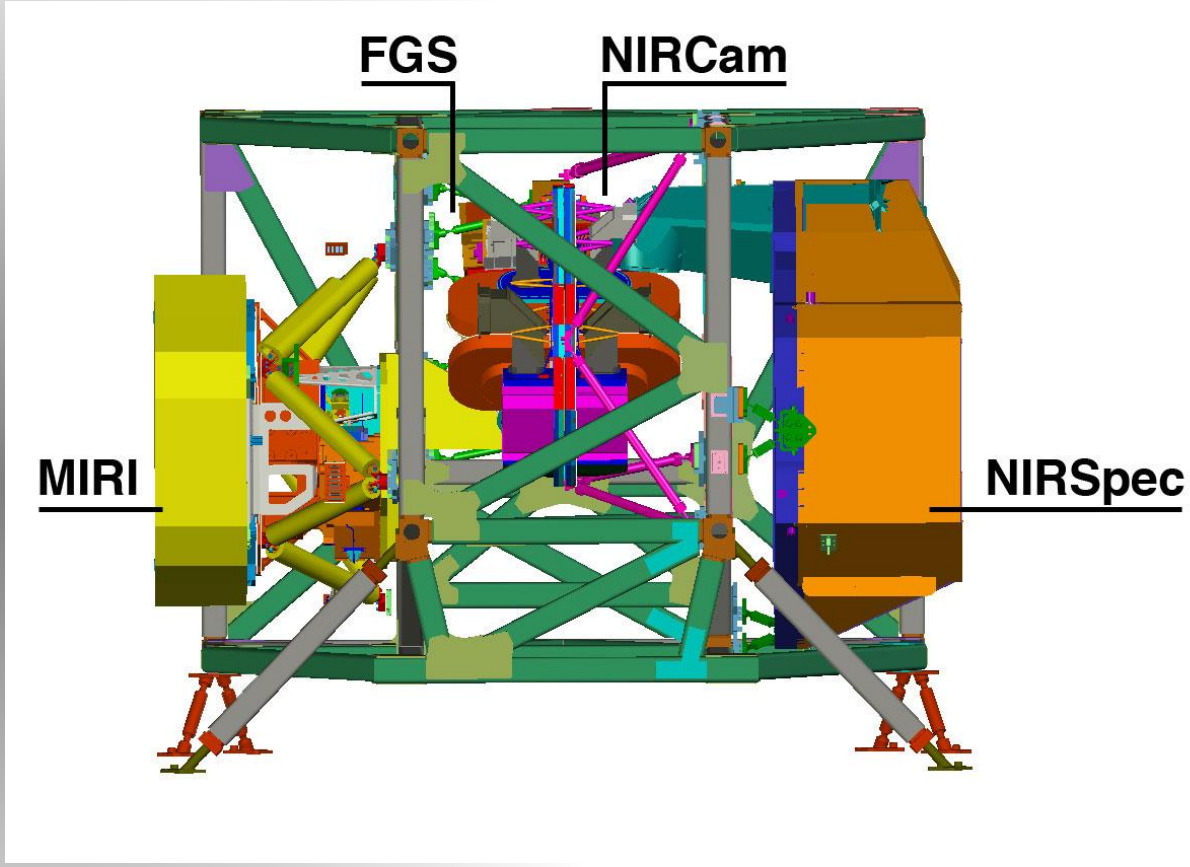


Image taken from jwst.nasa.gov

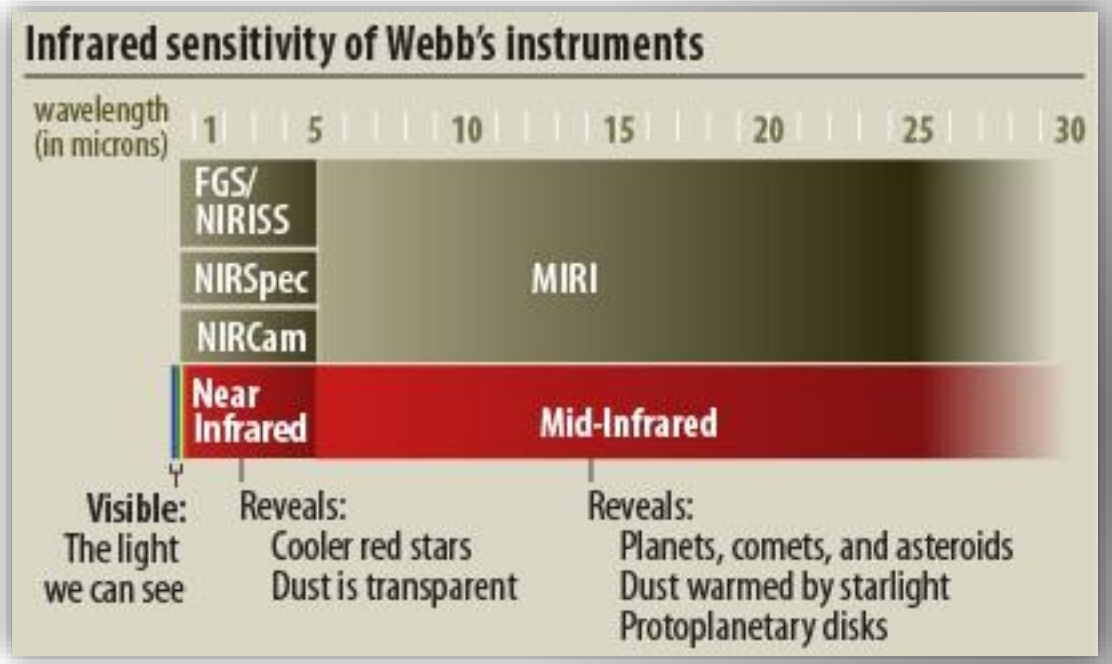
Integrated Science Instrument Module (ISIM)



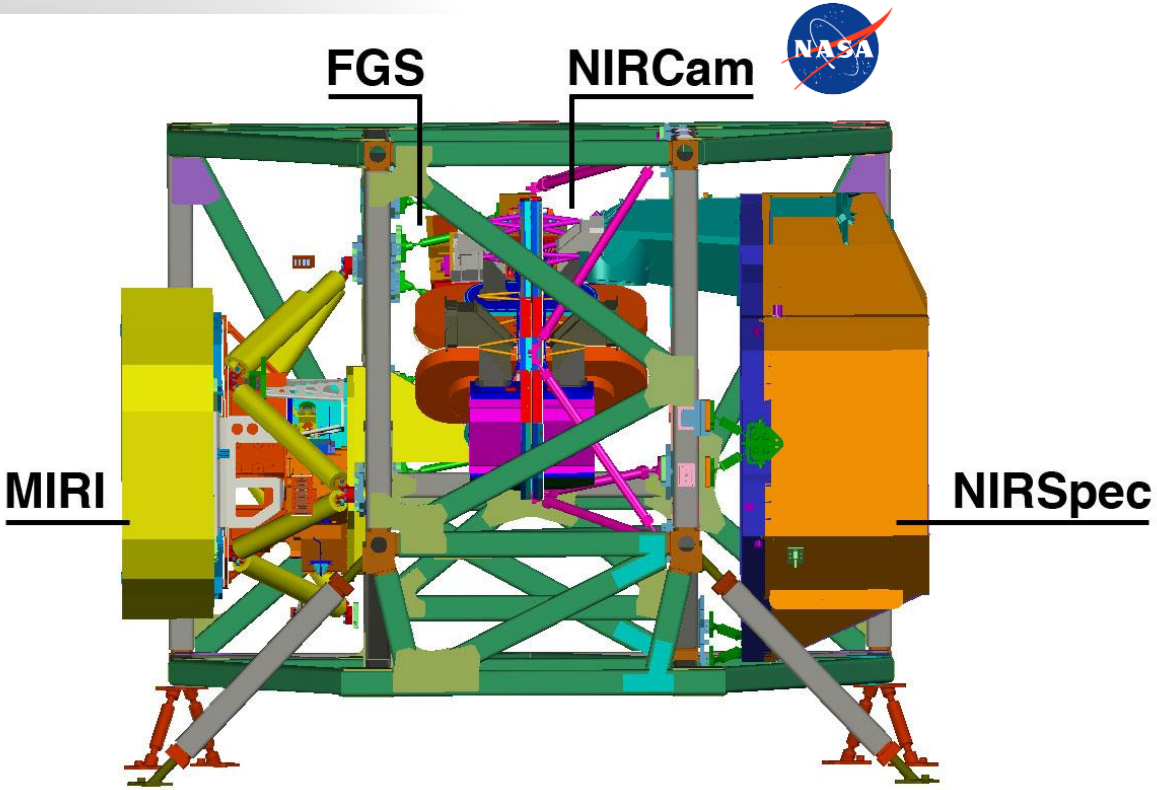
*Graphic and info taken from jwst.nasa.gov



Integrated Science Instrument Module (ISIM)

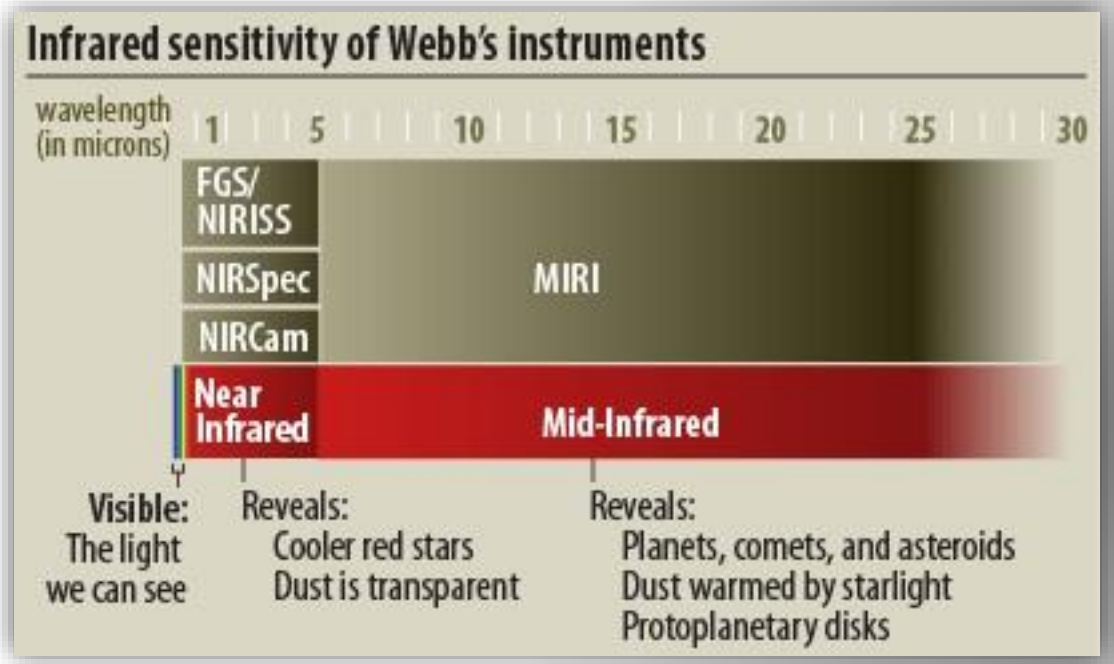


*Graphic and info taken from jwst.nasa.gov

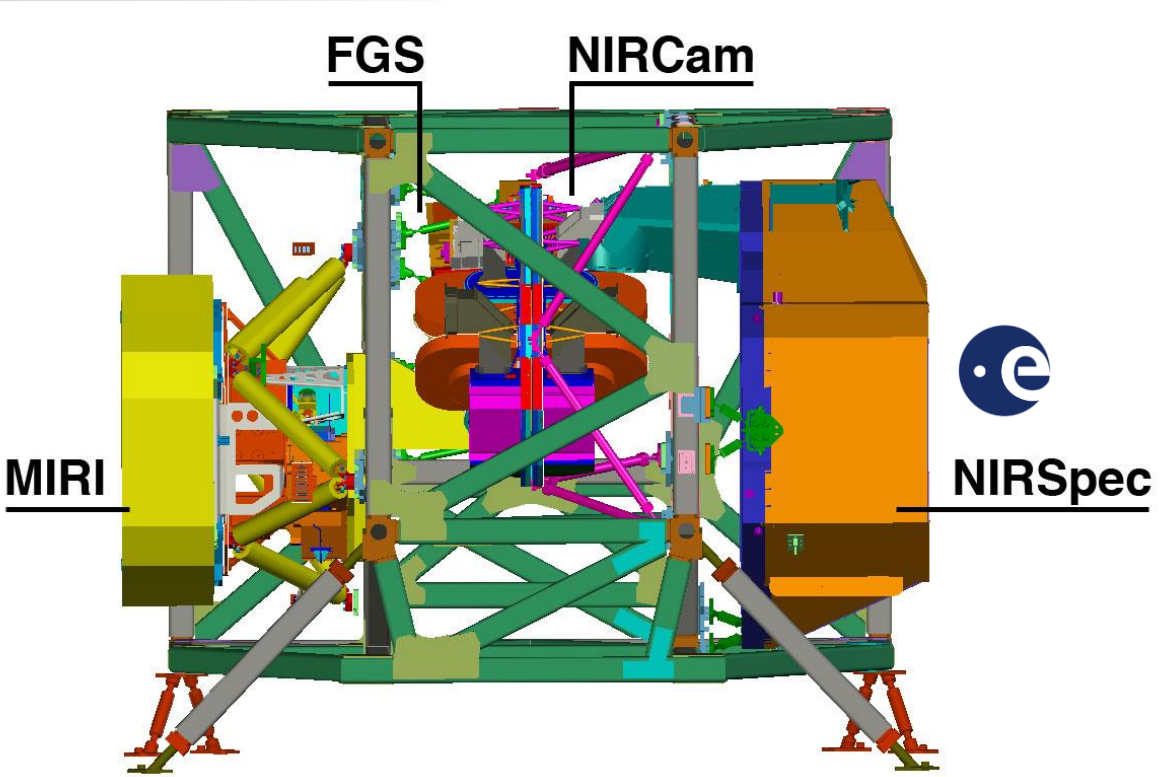


<u>The Near Infrared Camera (NIRCam)</u> – will detect light from: the earliest stars and galaxies in the process of formation; the population of stars in nearby galaxies; as well as young stars in the Milky Way and Kuiper Belt objects.

Integrated Science Instrument Module (ISIM)

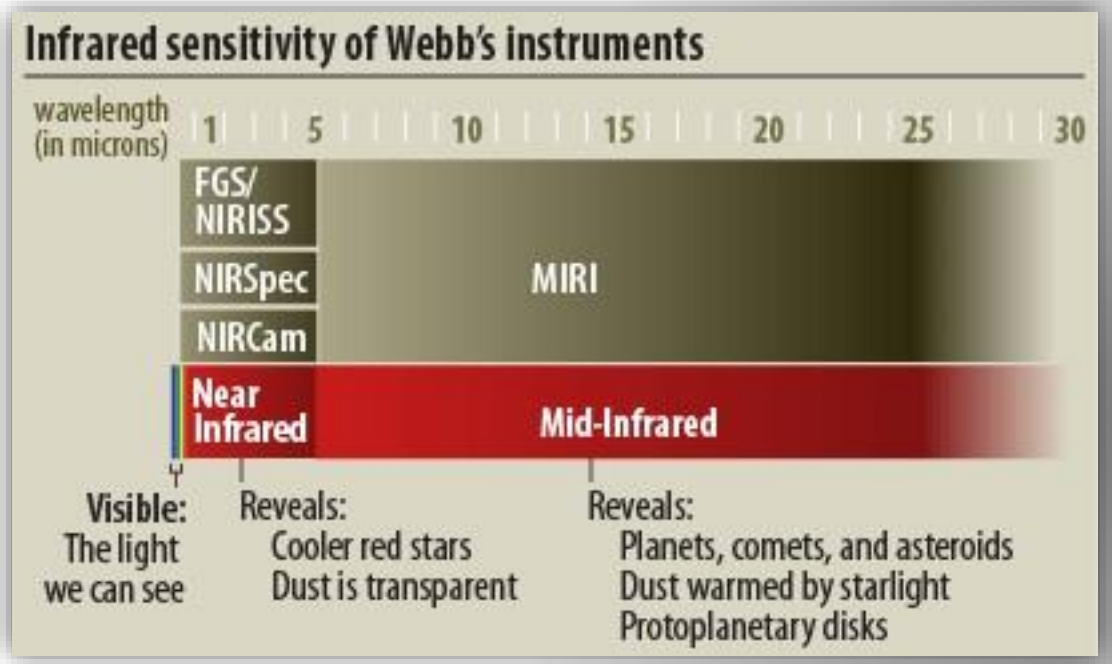


*Graphic and info taken from jwst.nasa.gov

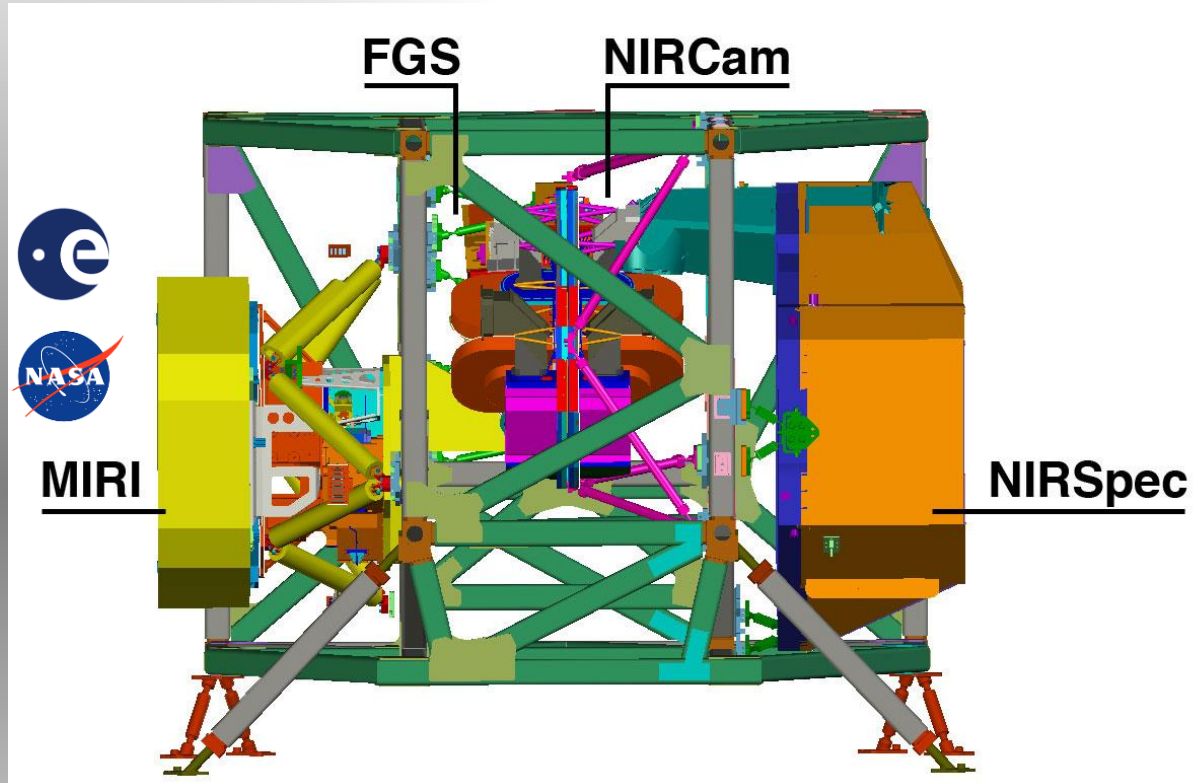


<u>The Near Infrared Spectrograph (NIRSpec)</u> – can tell us about an object's physical properties, including temperature, mass, chemical composition, and rotation (for the case of extended objects like galaxies)

Integrated Science Instrument Module (ISIM)

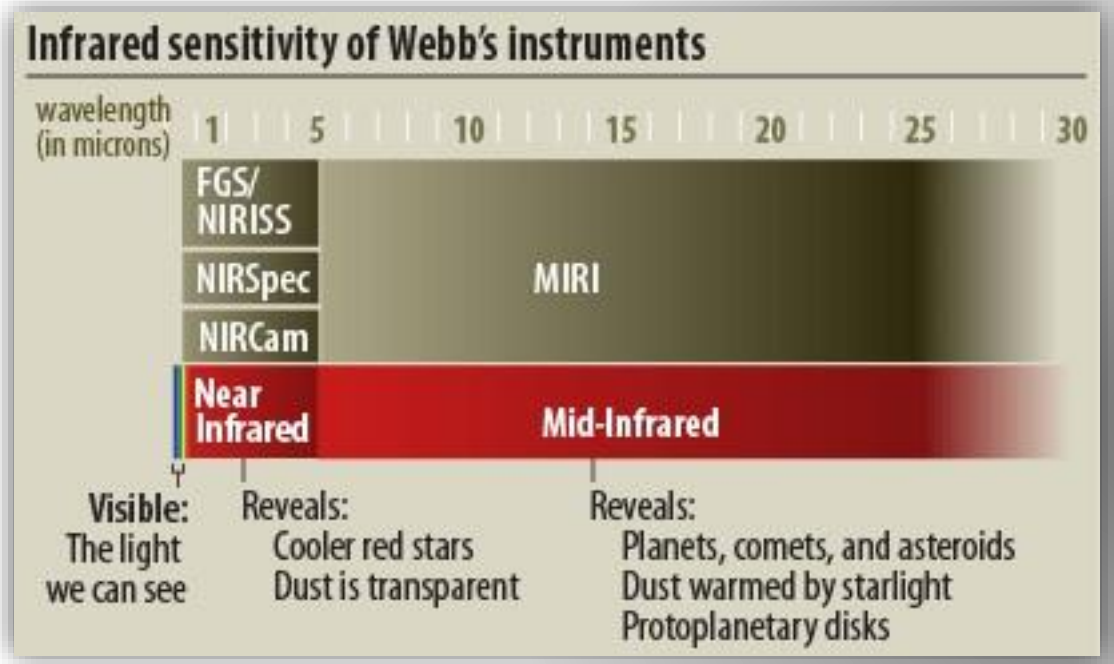


*Graphic and info taken from jwst.nasa.gov



<u>Mid-Infrared Instrument (MIRI)</u> – will see the redshifted light of distant galaxies, newly forming stars, and faintly visible comets as well as objects in the Kuiper Belt. MIRI's camera will provide wide-field, broadband imaging that will continue the breathtaking astrophotography that has made Hubble so universally admired.

Integrated Science Instrument Module (ISIM)



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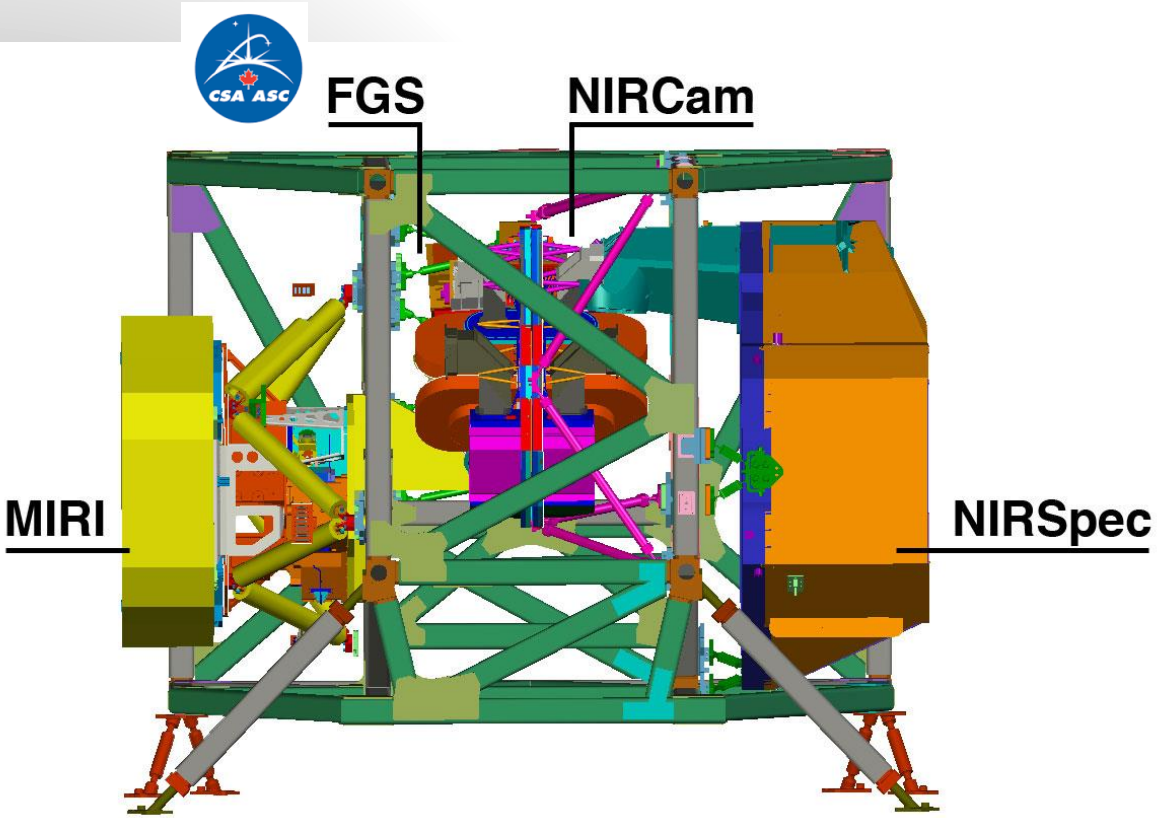


Fine-Guide Sensor (FGS) – allows Webb to point precisely, so that it can obtain high-quality images. The Near Infrared Imager and Slitless Spectrograph part of the FGS/NIRISS will be used to investigate the following science objectives: first light detection, exoplanet detection and characterization, and exoplanet transit spectroscopy.

Integrated Science Instrument Module

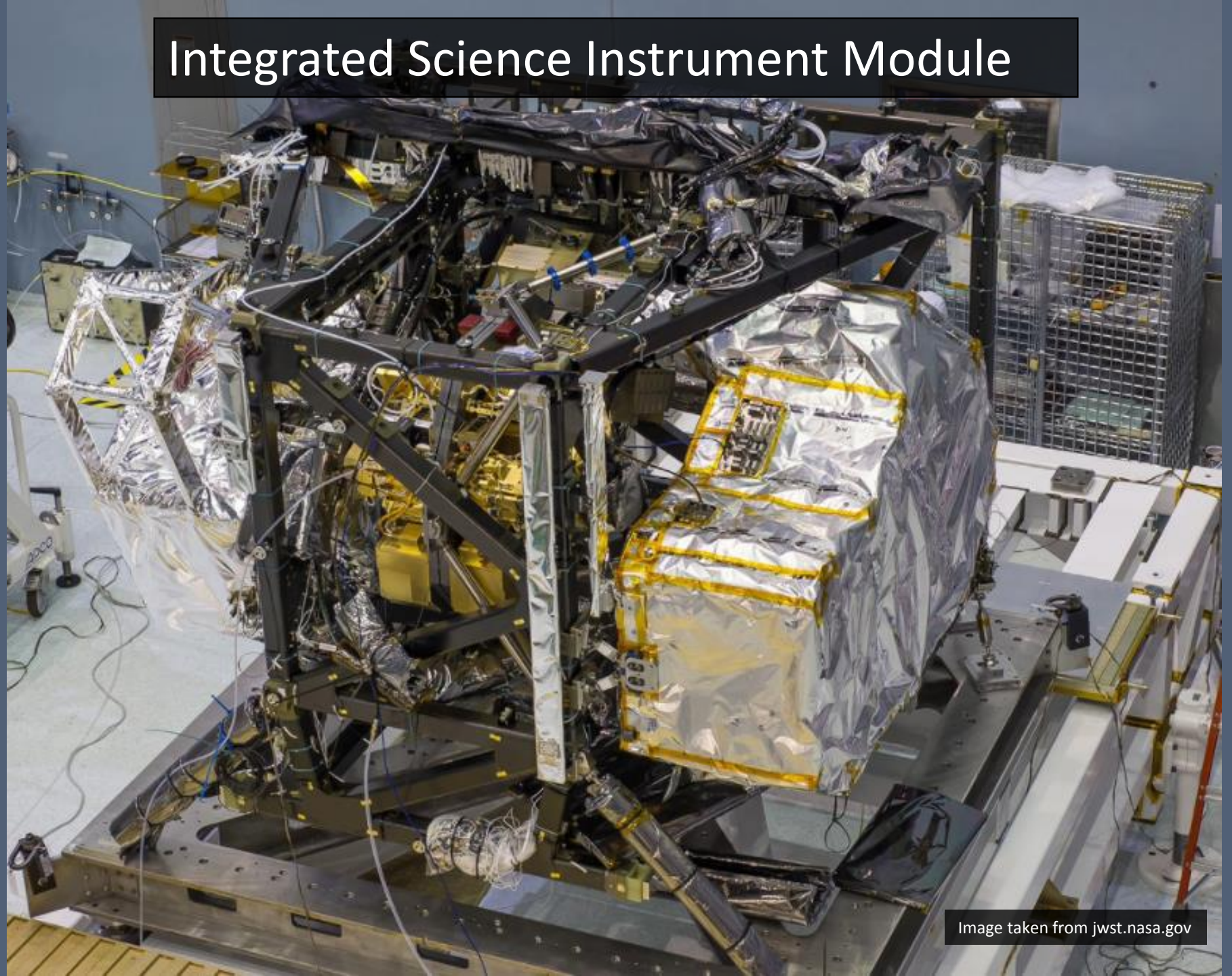
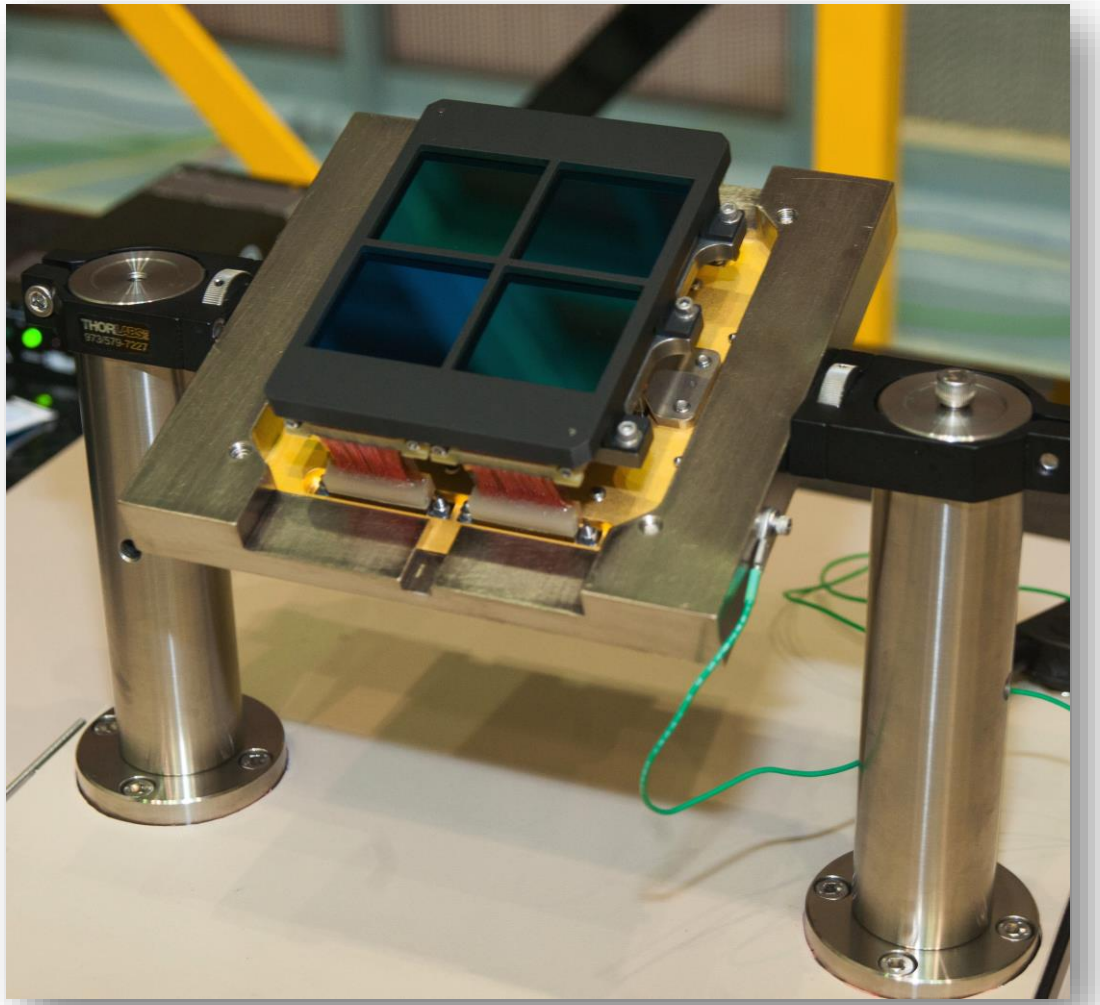
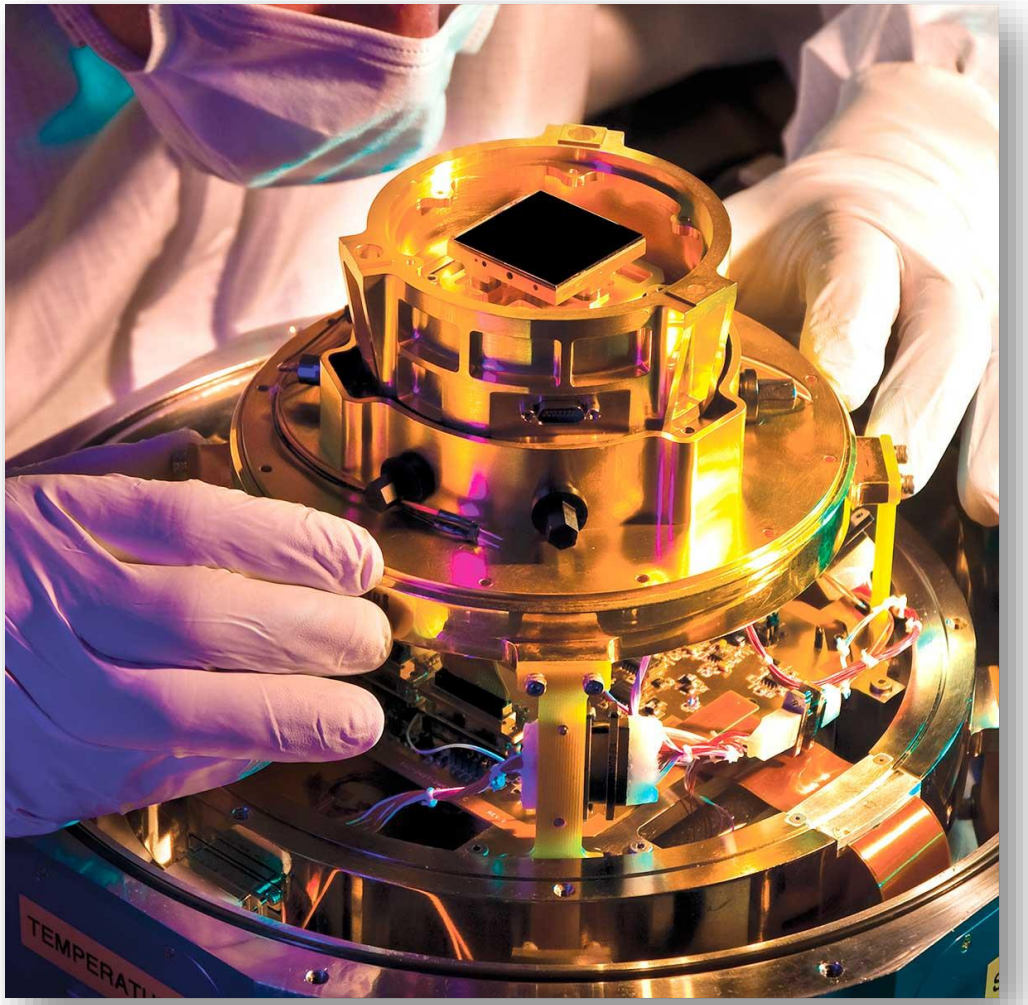


Image taken from jwst.nasa.gov

The Detectors

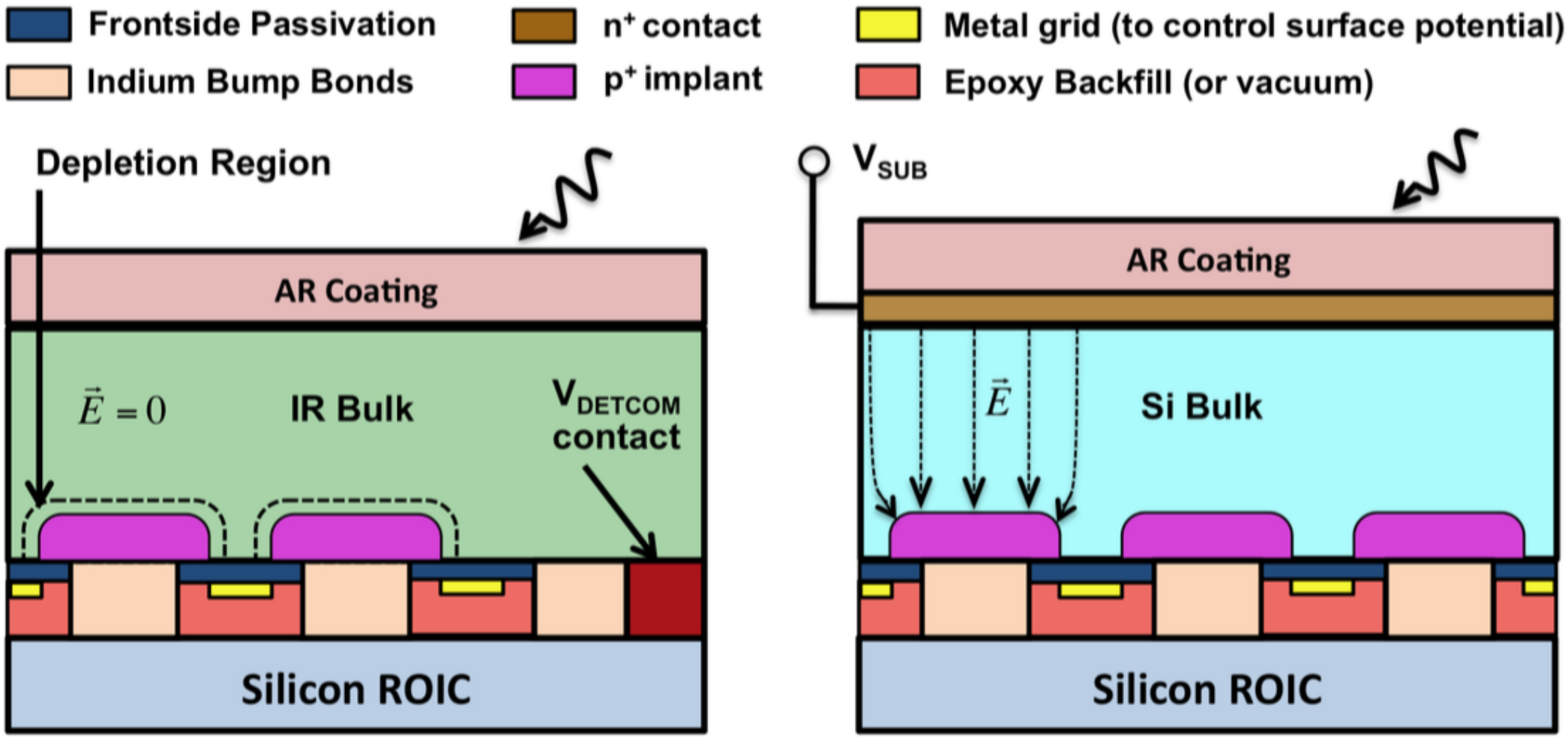


4 H2RG NIRCAM detector detectors taken from jwst-docs.stsci.edu



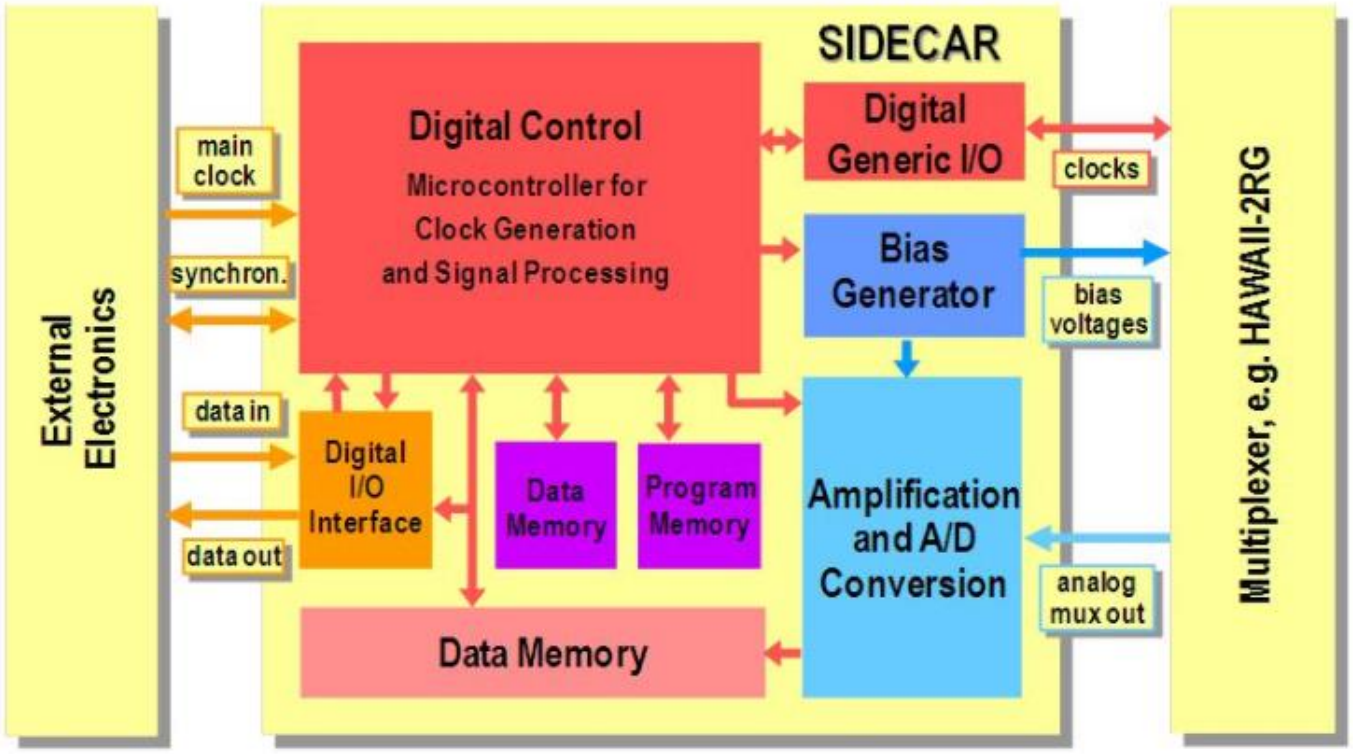
FGS sensor being tested at Teledyne Scientific Imaging for cryogenic performance testing (image taken from http://www.osa-opn.org/).

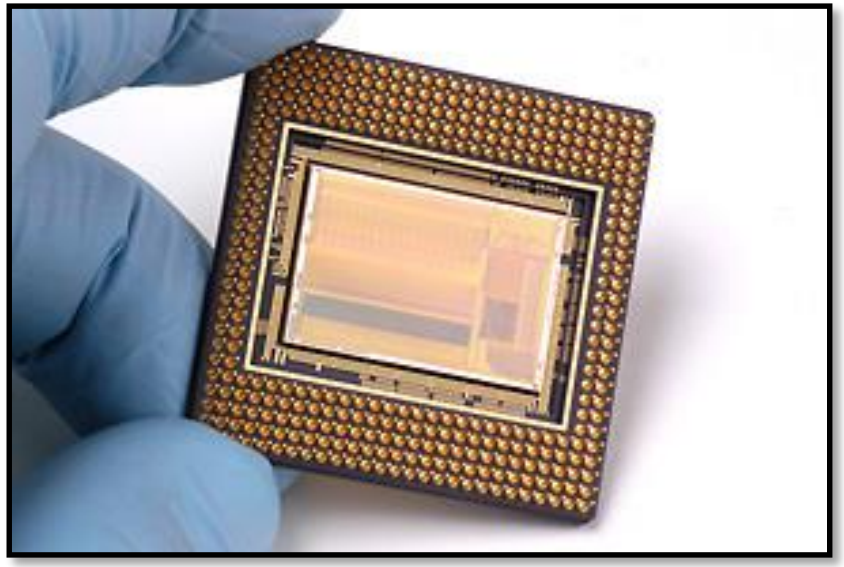
The Detector Cross-Section



Taken from *Hybrid CMOS SiPIN Detectors as Astronomical Imagers*, L. Simms, 2009

The SIDECAR Controller

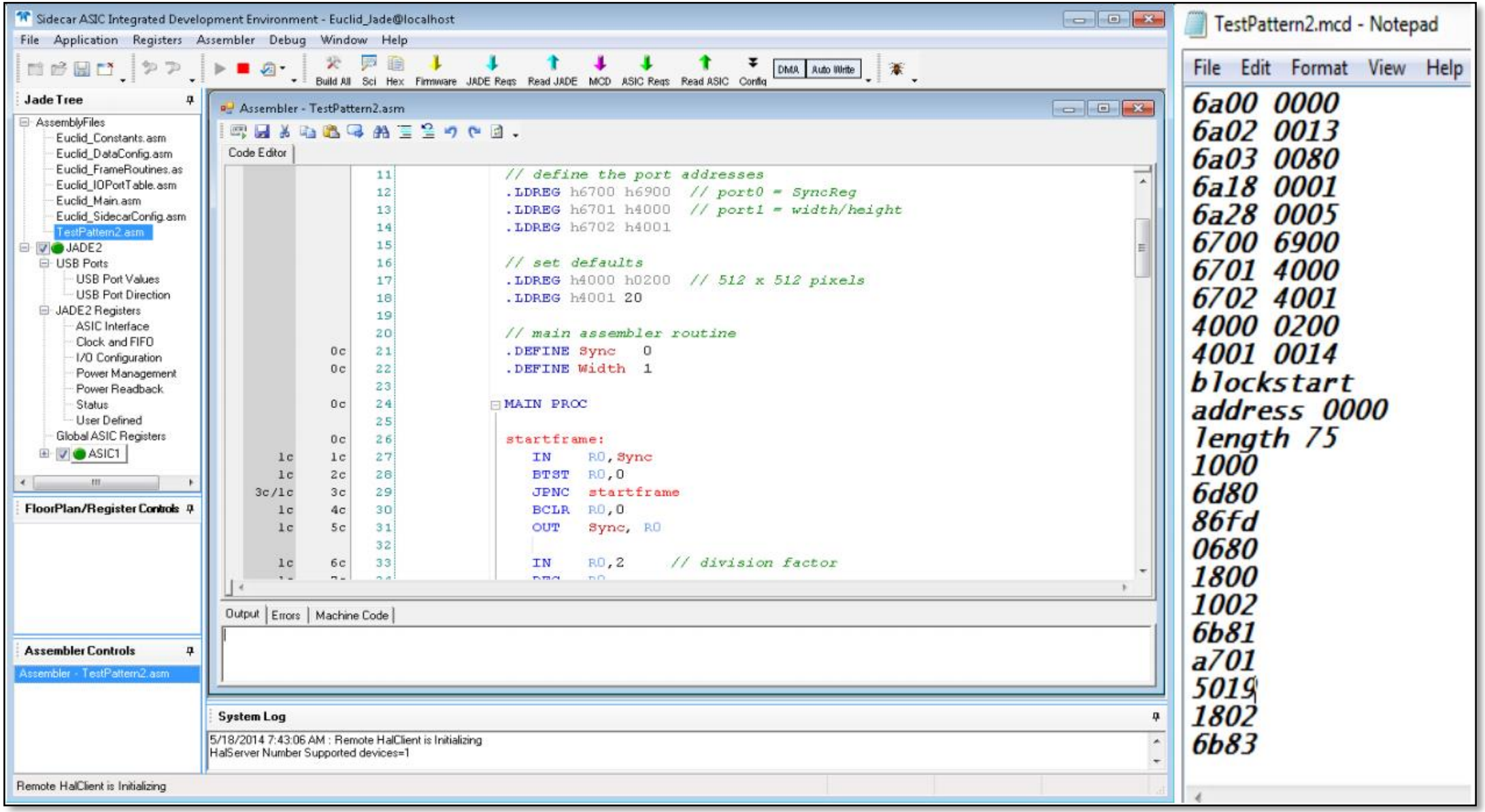


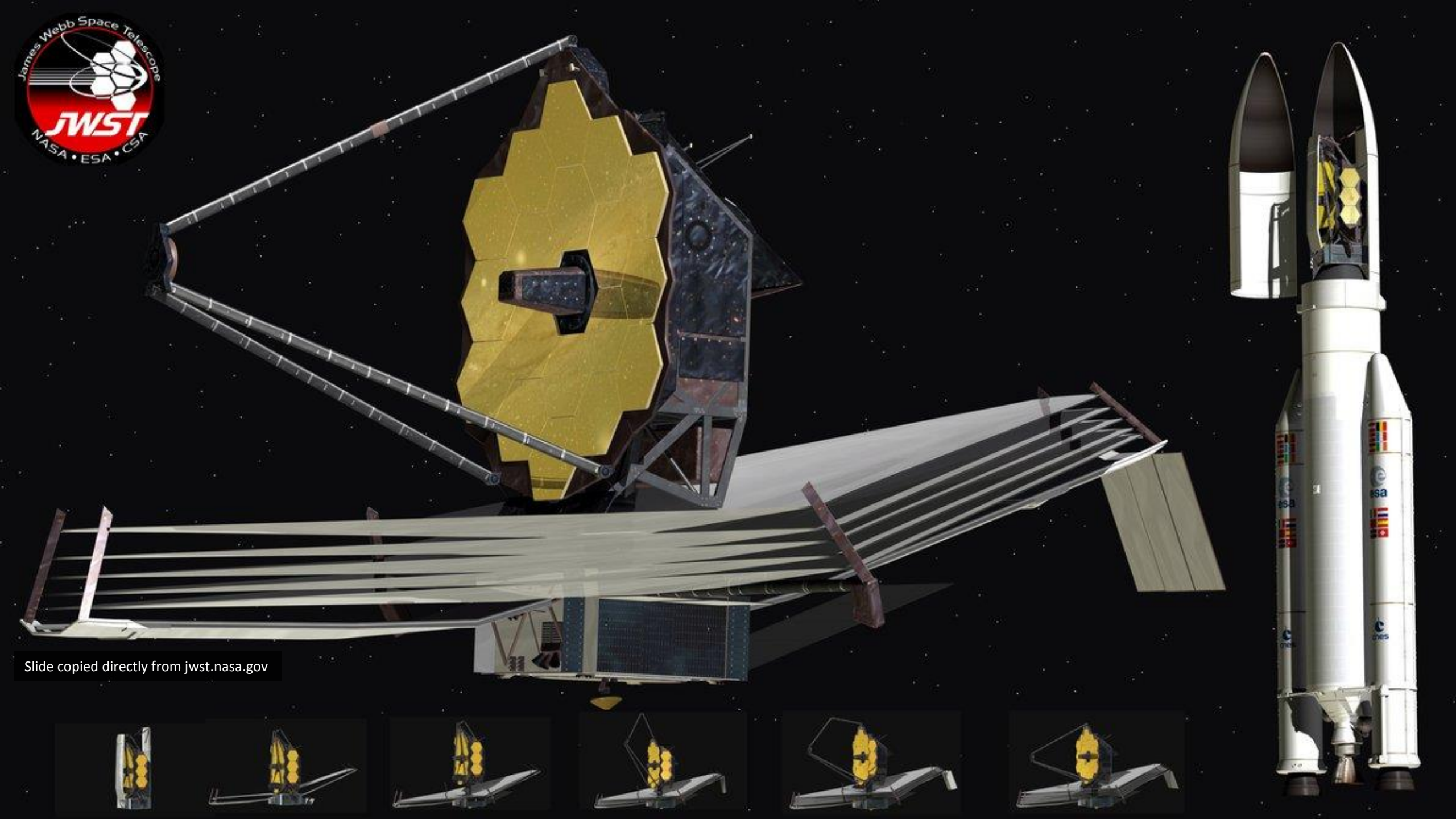


System for Image Digitization, Enhancement, Control And Retrieval

Images taken from Teledyne Scientific and Imaging websites

The Assembly Code (Image taken from Chen et al., Proc. of SPIE Vol. 9154 915426-1)

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