

More thermal Some examples

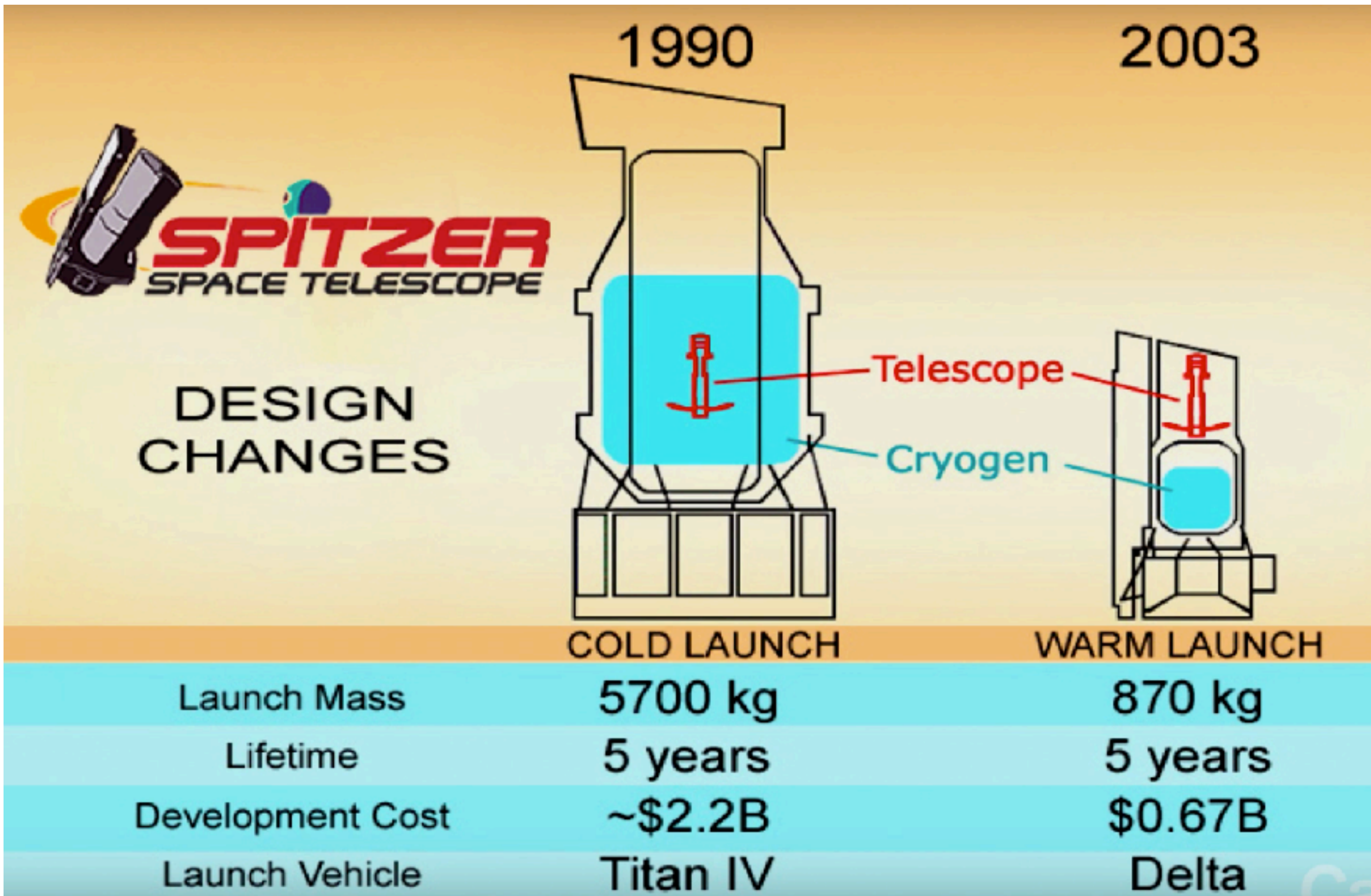
Douglas Ikemi
February 19, 2020

Spitzer Space Telescope

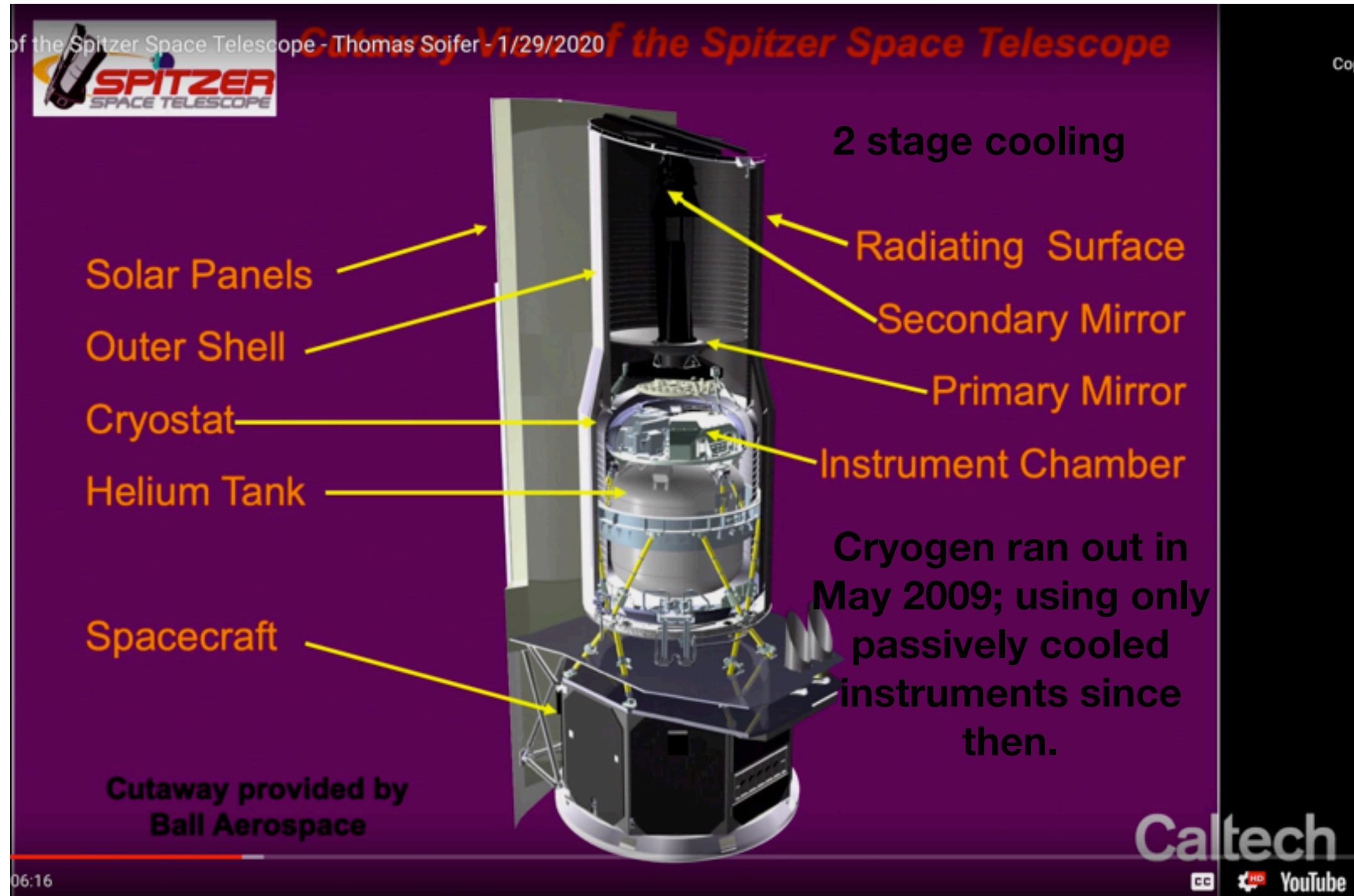
- Key word search: Spitzer, Watson Lecture

<https://www.caltech.edu/campus-life-events/master-calendar/watson-lecture-202001>

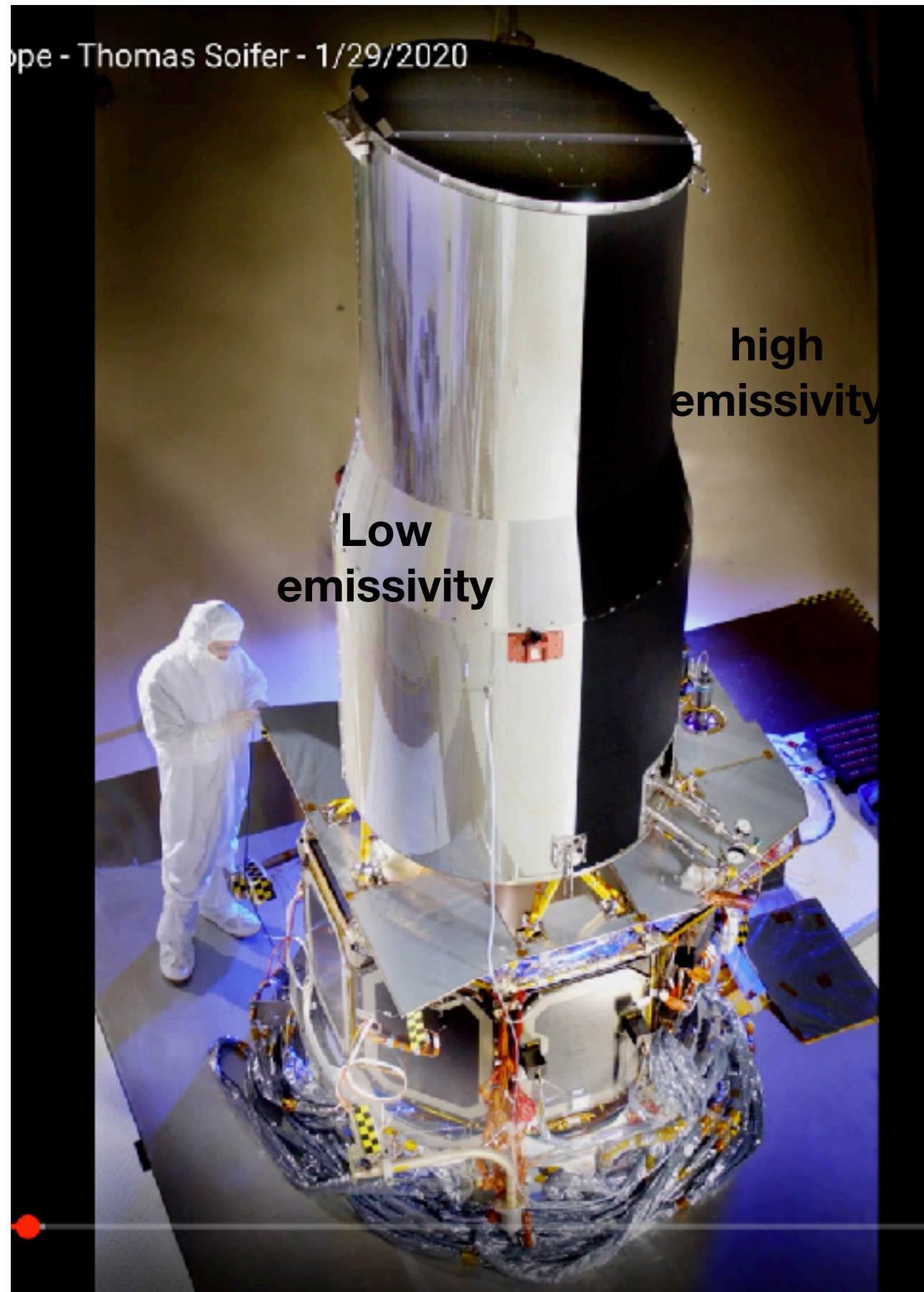
Design Evolution



Layout



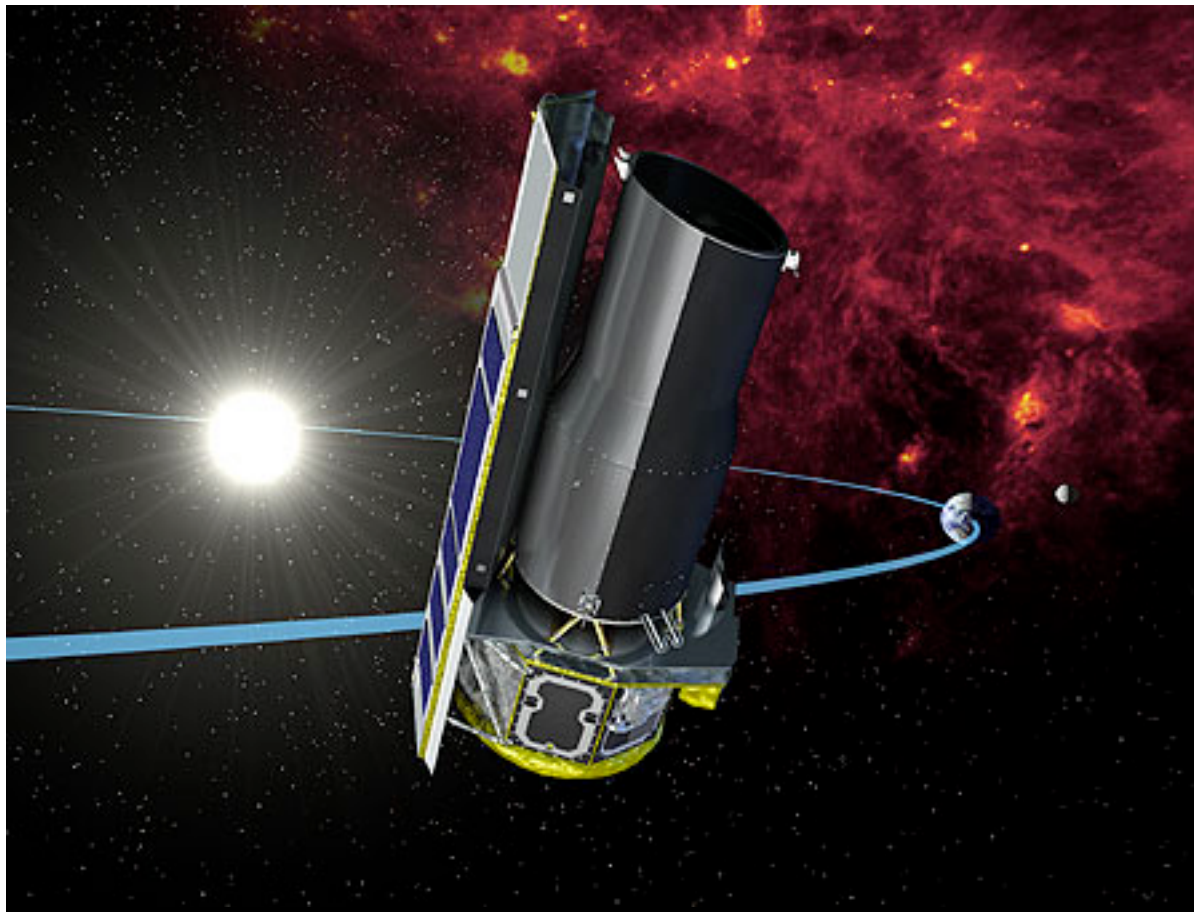
Thermal finish



Spitzer Orbit

<http://www.spitzer.caltech.edu/mission/195-Clever-Choice-of-Orbit> <http://spitzer.caltech.edu/file/69-earth-trailing2small>

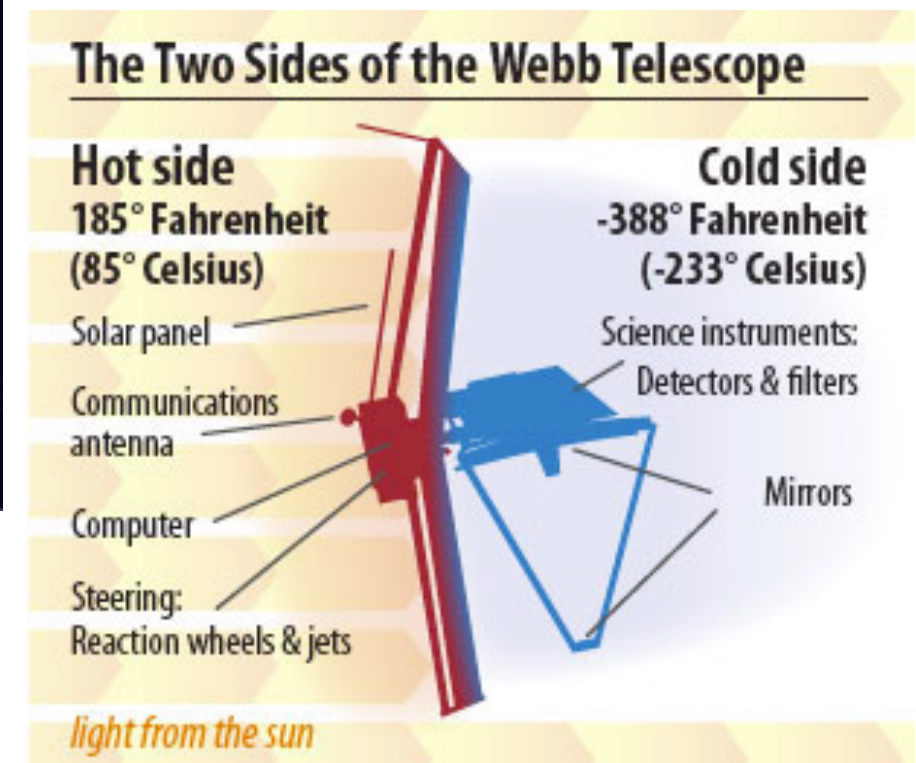
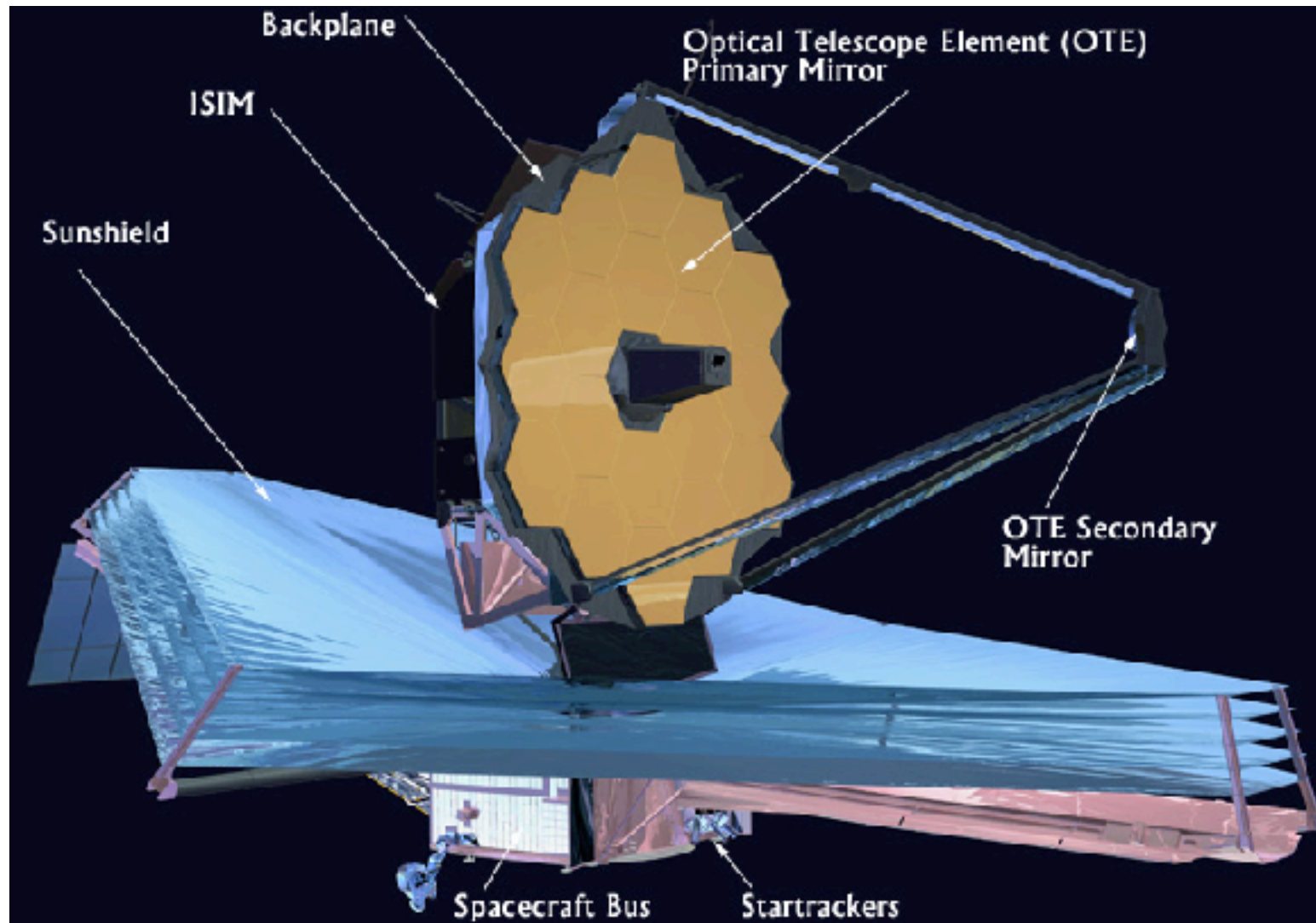
“The Spitzer redesign also managed to cut costs by placing the observatory into an Earth-trailing orbit. Instead of orbiting Earth itself, the observatory trails behind Earth as it orbits the Sun and drifts away from us at about 1/10th of one astronomical unit per year.” <http://spitzer.caltech.edu/file/69-earth-trailing2small>



**Keep vehicle far away
from IR heat sources
(the Earth!)**

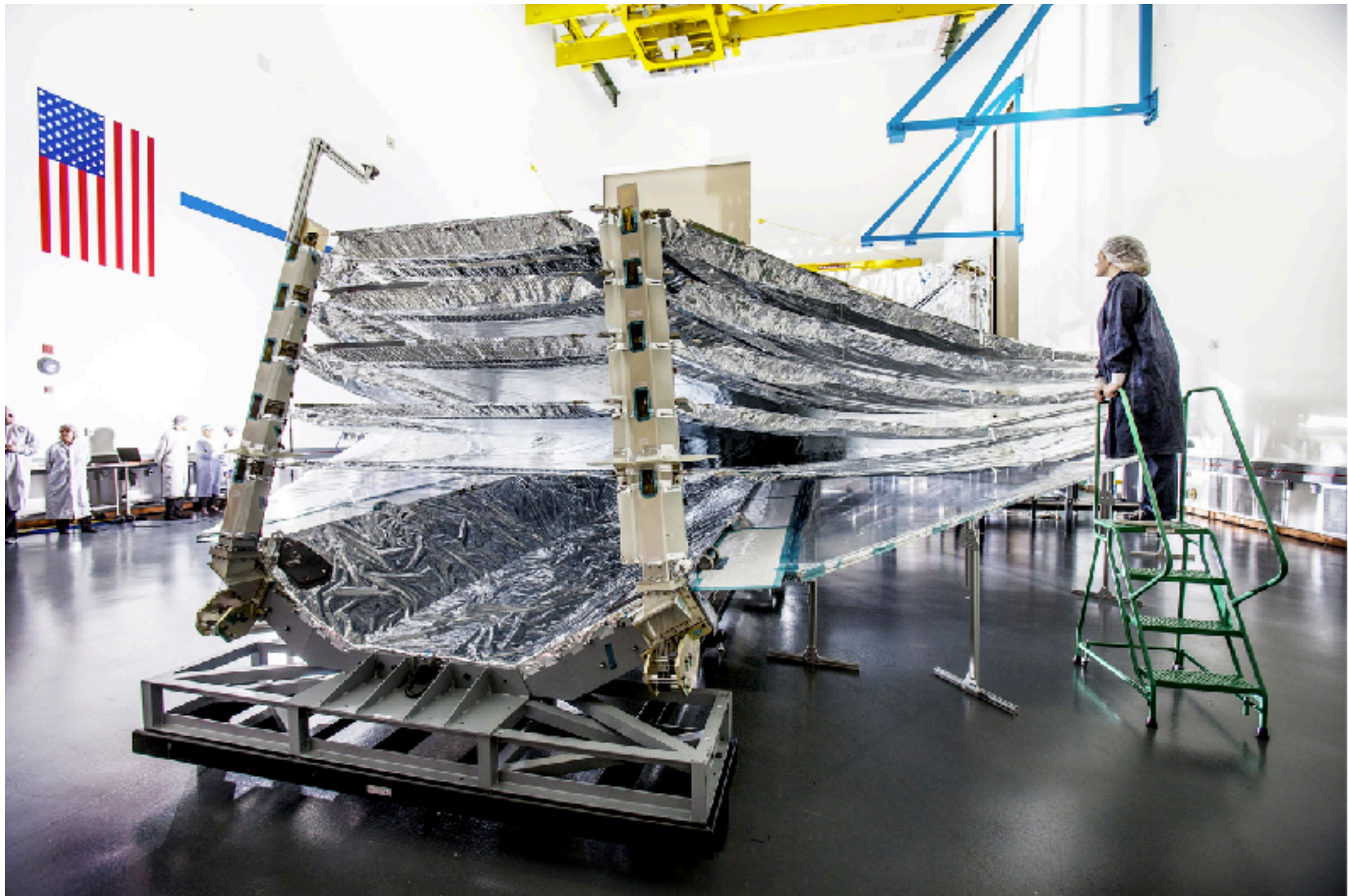
JWST

<https://jwst.nasa.gov/content/about/orbit.html>



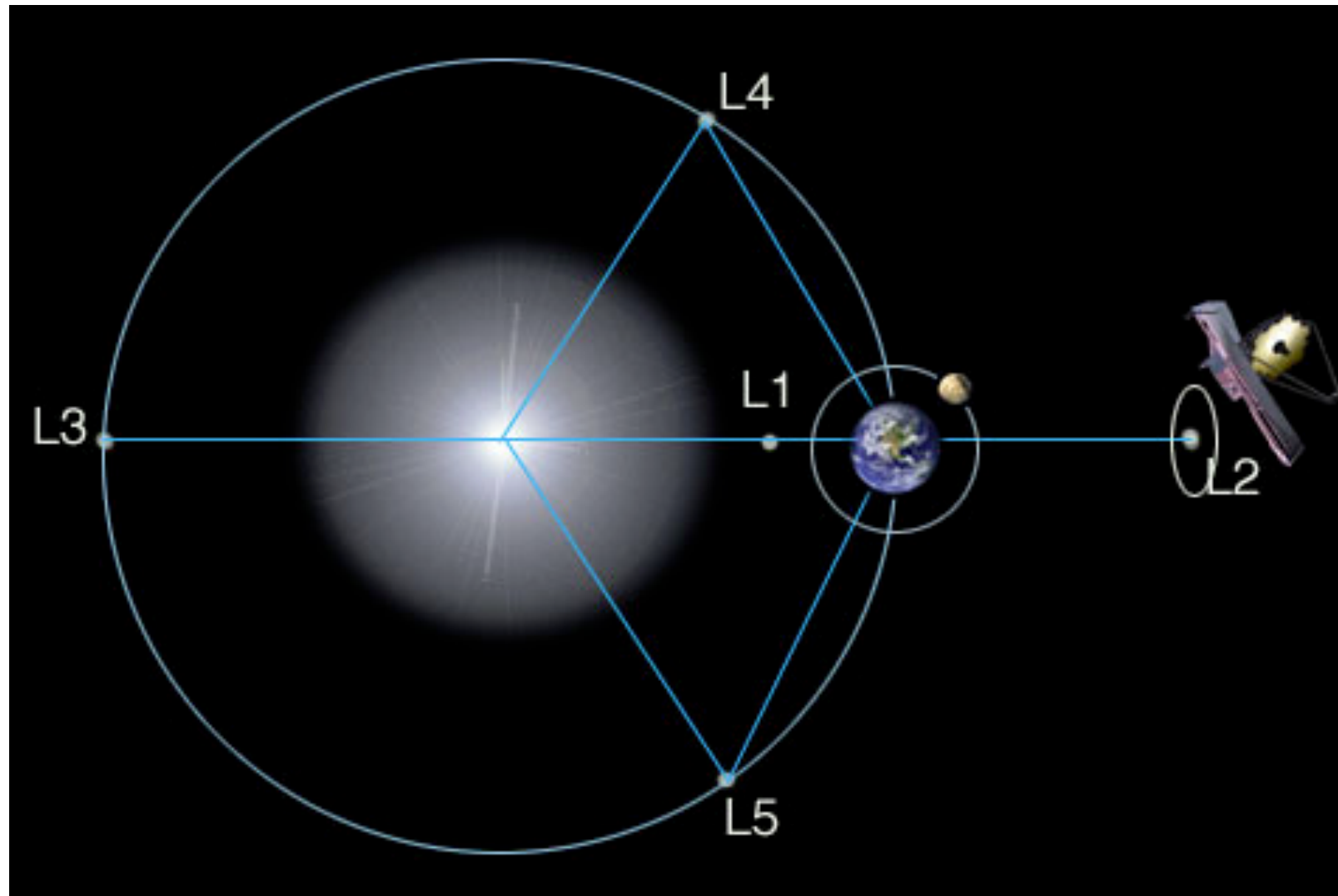
JWST sunshield

[https://en.wikipedia.org/wiki/Sunshield_\(JWST\)#/media/File:James_Webb_Space_Telescope_Sunshield_Test_Unfolds_Seamlessly_\(15235550340\).jpg](https://en.wikipedia.org/wiki/Sunshield_(JWST)#/media/File:James_Webb_Space_Telescope_Sunshield_Test_Unfolds_Seamlessly_(15235550340).jpg)



JWST orbit

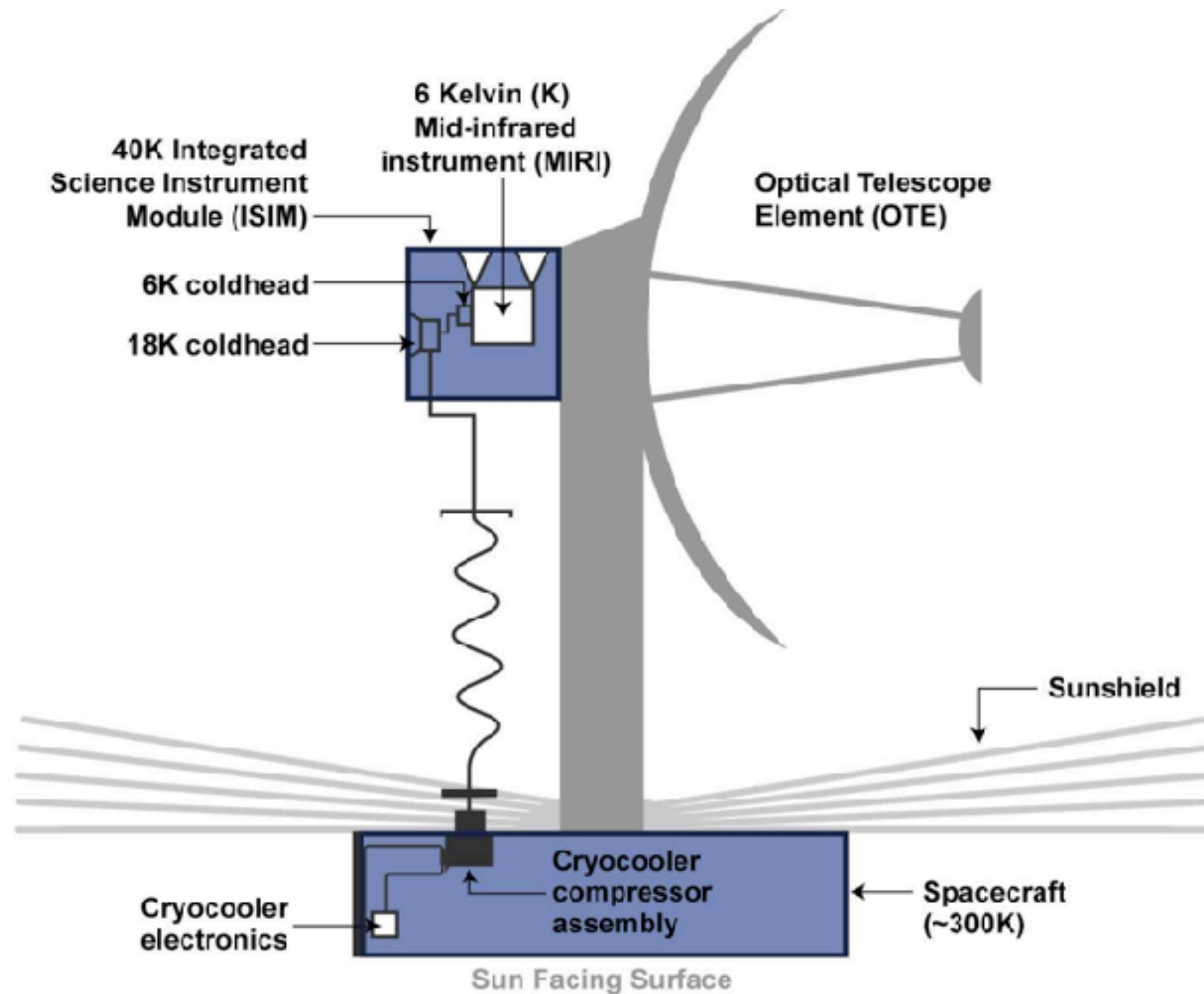
<https://jwst.nasa.gov/content/about/orbit.html>



Halo orbit

https://en.wikipedia.org/wiki/Lagrangian_point

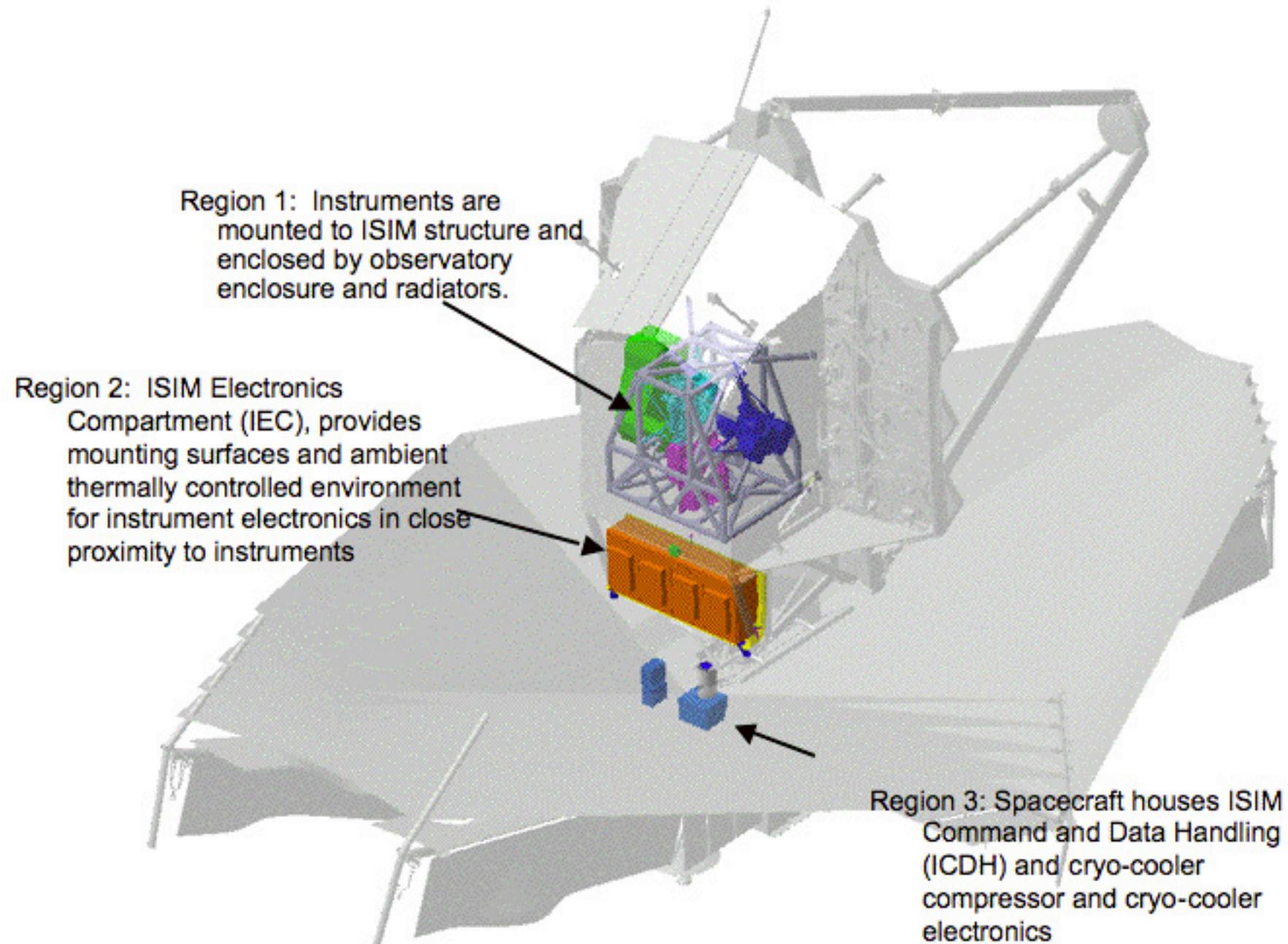
Instruments



ISIM

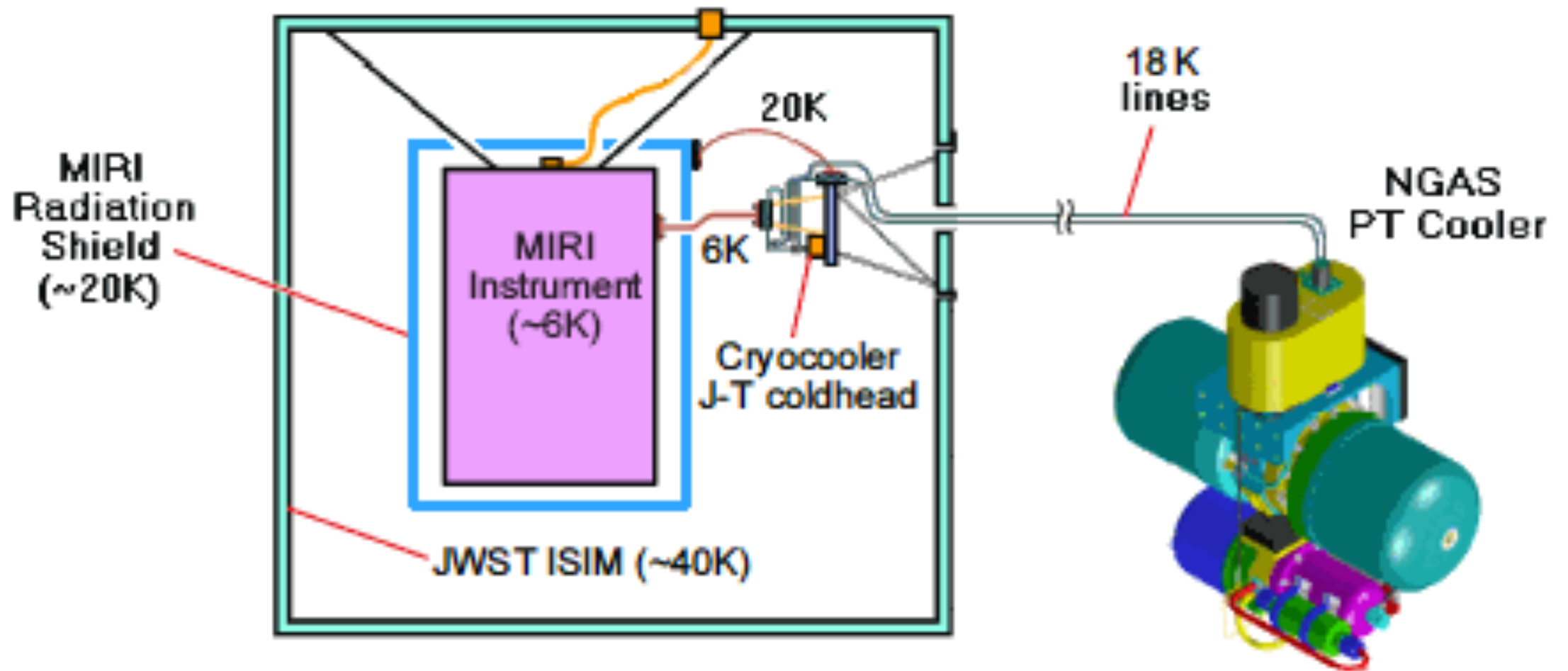
https://en.wikipedia.org/wiki/Integrated_Science_Instrument_Module

ISIM Components within the Observatory



Cryocoolers

https://www2.jpl.nasa.gov/adv_tech/coolers/ACTDP_MIRI.htm



https://en.wikipedia.org/wiki/Pulse_tube_refrigerator

ISS thermal control

https://en.wikipedia.org/wiki/External_Active_Thermal_Control_System

Thermal Control System (TCS)

The TCS maintains ISS temperatures within defined limits. The four components used in the Passive Thermal Control System (PTCS) are insulation, surface coatings, heaters, and heat pipes.

The Active Thermal Control System services point source heat loads such as electrical equipment on cold plates as well as providing heat rejection for the crew cabin using pumps to move heat rejection fluids through the vehicle. The water-based internal cooling loops are used in controlling humidity and removing heat loads generated by the crew and electronic equipment. This heat is transferred to interface heat exchangers located on the exterior of the vehicle. The interface heat exchangers flow water on one side, and transfer the heat to anhydrous ammonia flowing on the other side. The warmed ammonia rejects heat to space from the six large Heat Rejection Subsystem (HRS) radiators. There is a single independent Photovoltaic Thermal Control System (PVTCS) radiator for each of the four pairs of solar array wings that use pumps and anhydrous ammonia to reject heat from the power generating equipment. In the Japanese Exposed Facility (JER) a fluid commonly used in electronics 3M Fluorinert FC72 is used to cool its external payloads.

