

THE VALUE OF PERFORMANCE.
NORTHROP GRUMMAN

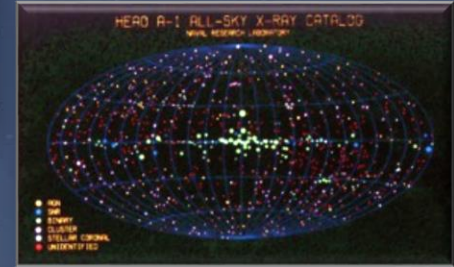
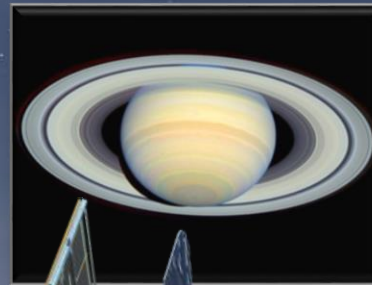
James Webb Space Telescope

Engineering the Beginning

Amy S. Lo PhD

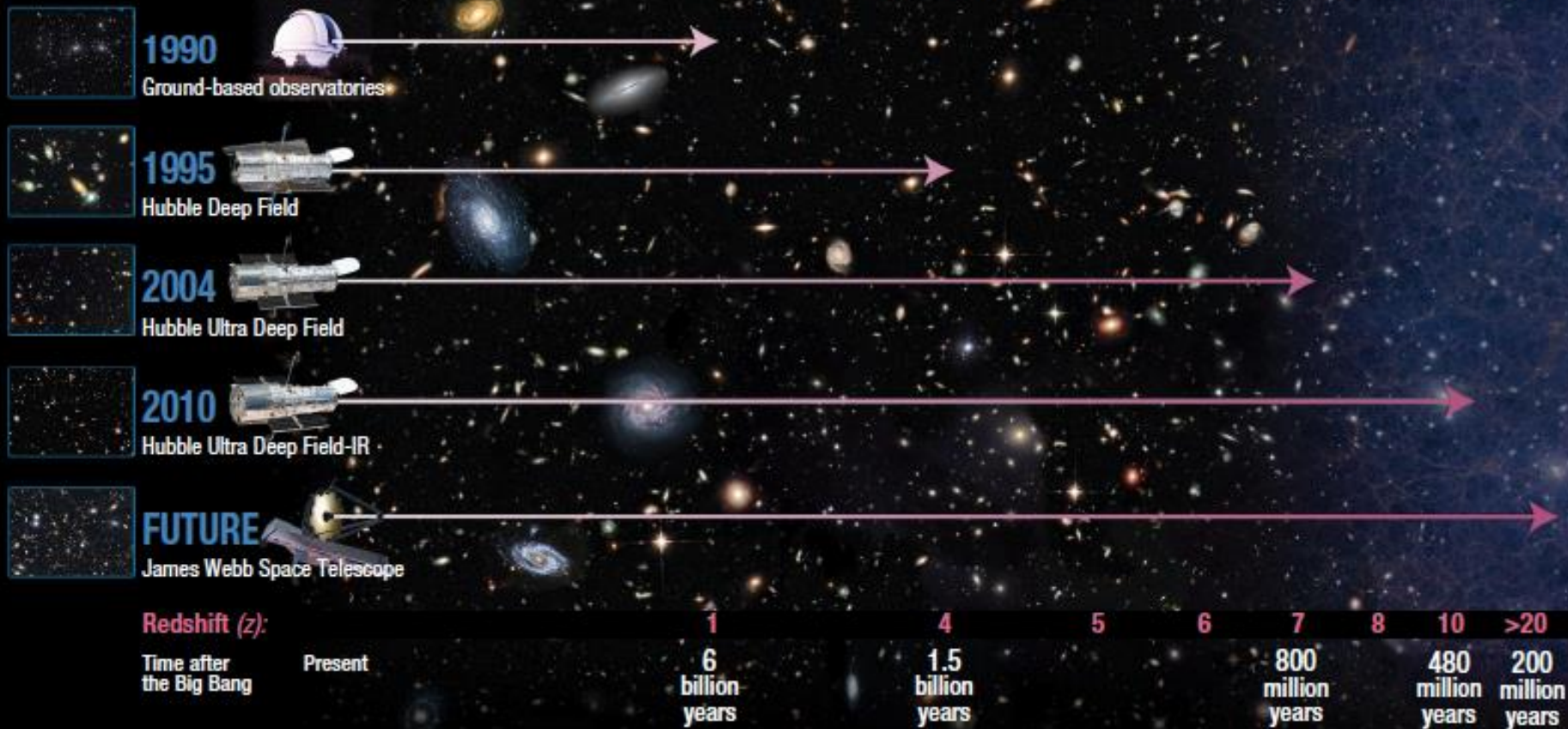
JWST Alignment Lead

Space-Based observation has enabled giant leaps in our understanding of the universe



Looking back in time

Hubble Probes the Early Universe



The Webb Telescope will build on Hubble's observations and answer the questions:

- How did the universe make galaxies?
- How are stars made?
- Are there other planets that can support life?



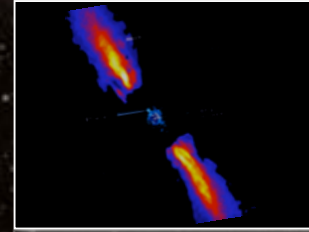
First Light



The Assembly of Galaxies



Birth of Stars and Planets

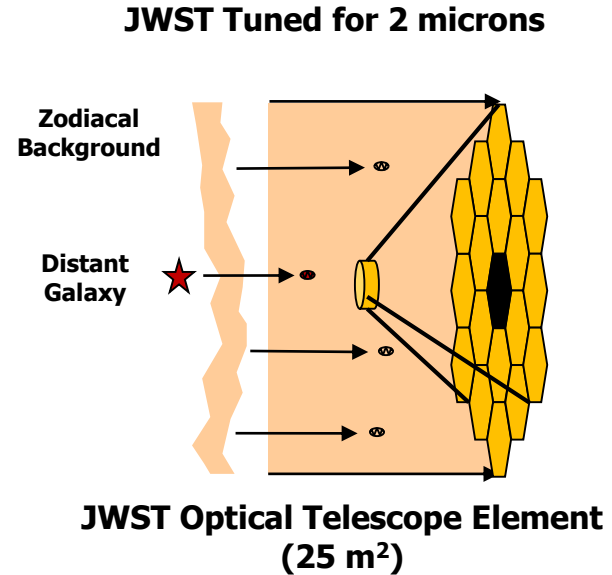


Planets and the Origins of Life

Science Drives Engineering

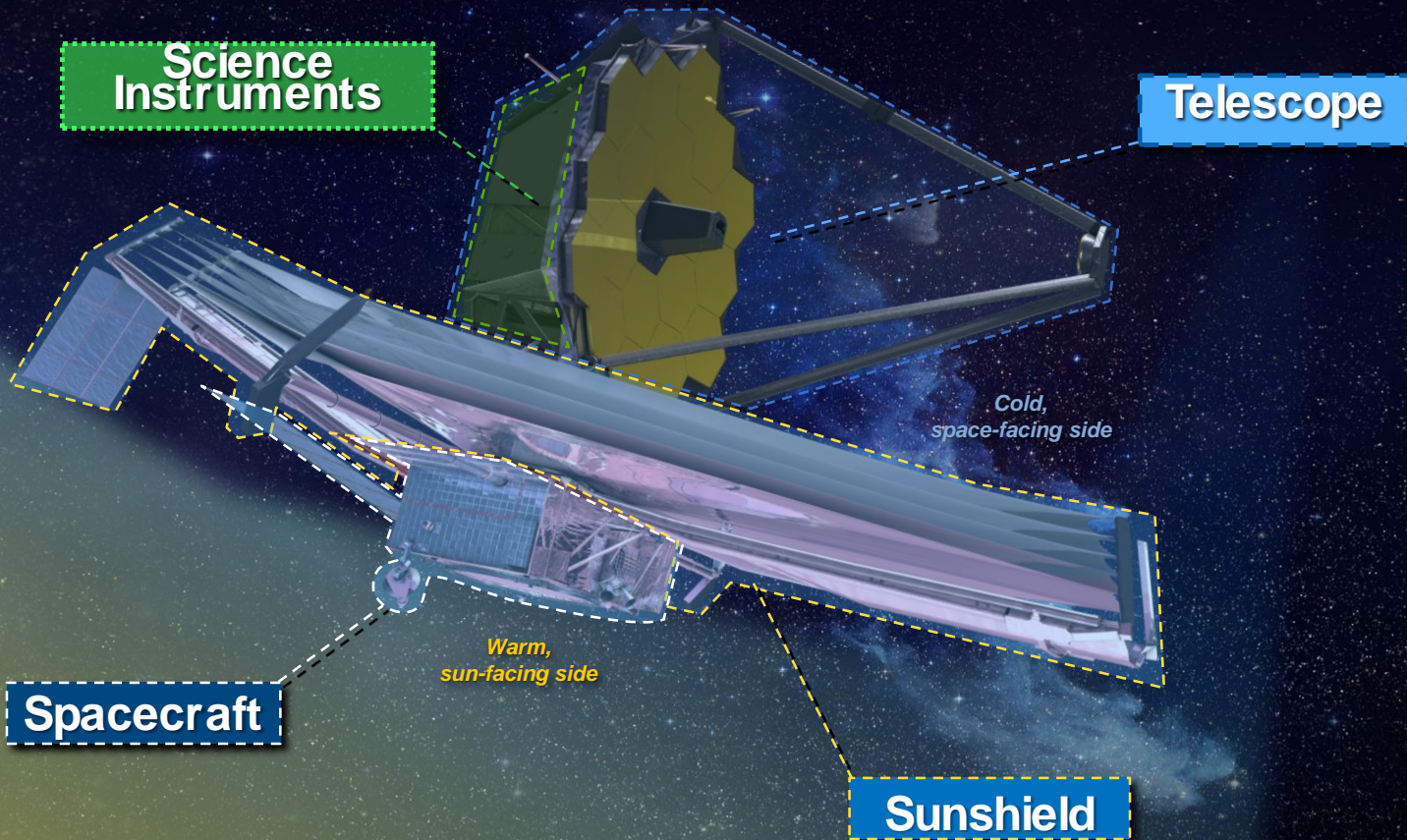
Targets are anywhere in the sky

- Very far away = faint = high sensitivity
- Very far away = small = high resolution
- Infrared objects = cool telescope



Even with 25 m², JWST will only collect 1 photon/s from prime targets
For reference, stray light from solar system (dust) = 3 photons/s

Major JWST Observatory Elements



Extensive Analysis, Test Planning, and Modeling



- Identify and quantify all major contributors and form a detailed error budget
 - Perform analysis to quantify the items in the error budget
 - E.g. tolerance analysis, the mechanical design
 - E.g. finite element analysis of the parts: deflection, thermal distortion, outgassing
 - E.g. deployment mechanisms, deployed position, repeatability
- Plan a test program to verify everything
 - Define the tests, major analysis, models, we need
 - Define the inputs to test, analysis, models
 - What measurements are needed? How do we measure such precision? What are the references? How do we ensure they remain stable? What are the measurement uncertainties?
 - Fight gravity every step of the way
- A team of four experienced engineers took two years to perform the analysis, detail out the test program and complete the planning



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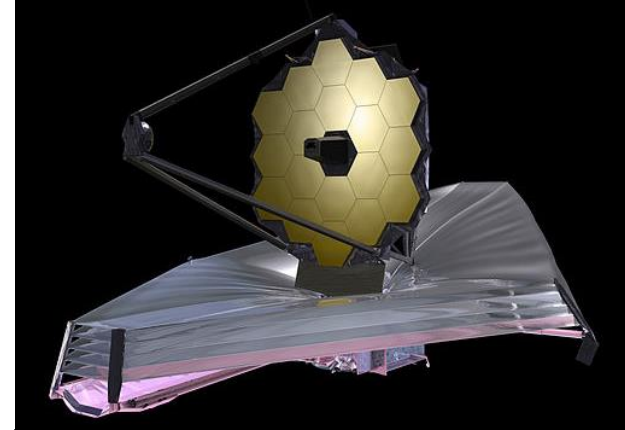
Steps to JWST Launch

2018

- Telescope & Instruments completed testing at JSC
- Spacecraft and Sunshield structure undergo environmental testing
- Telescope & Instrument integrate onto the Spacecraft & Sunshield
- Entire Observatory undergo environment testing

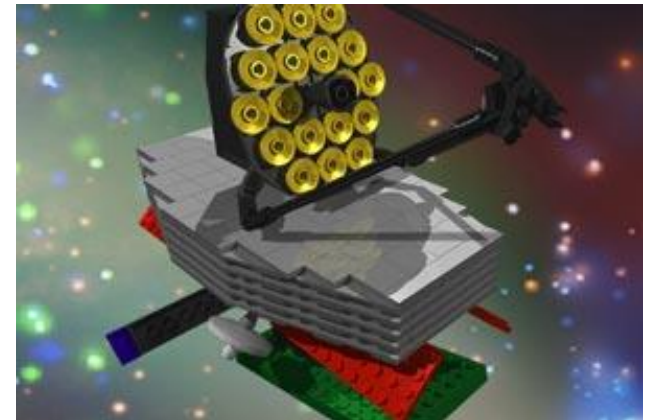
2019

- Final Deployment & Check Out
- Ship to Ariane Launch Site
- 2019 Launch



Further Resources

- Monthly updates of accomplishments: <https://jwst.nasa.gov/recentaccomplish.html>
- Live webcam: <https://jwst.nasa.gov/index.html>
- JWST documentary, Into the Unknown: <http://www.northropgrumman.com/CorporateResponsibility/CorporateCitizenship/Education/IntoTheUnknown/Pages/default.aspx>
- JWST lego model instruction: http://www.northropgrumman.com/CorporateResponsibility/CorporateCitizenship/Education/Documents/pdfs/jwst_lego_assembly_instructions.pdf



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