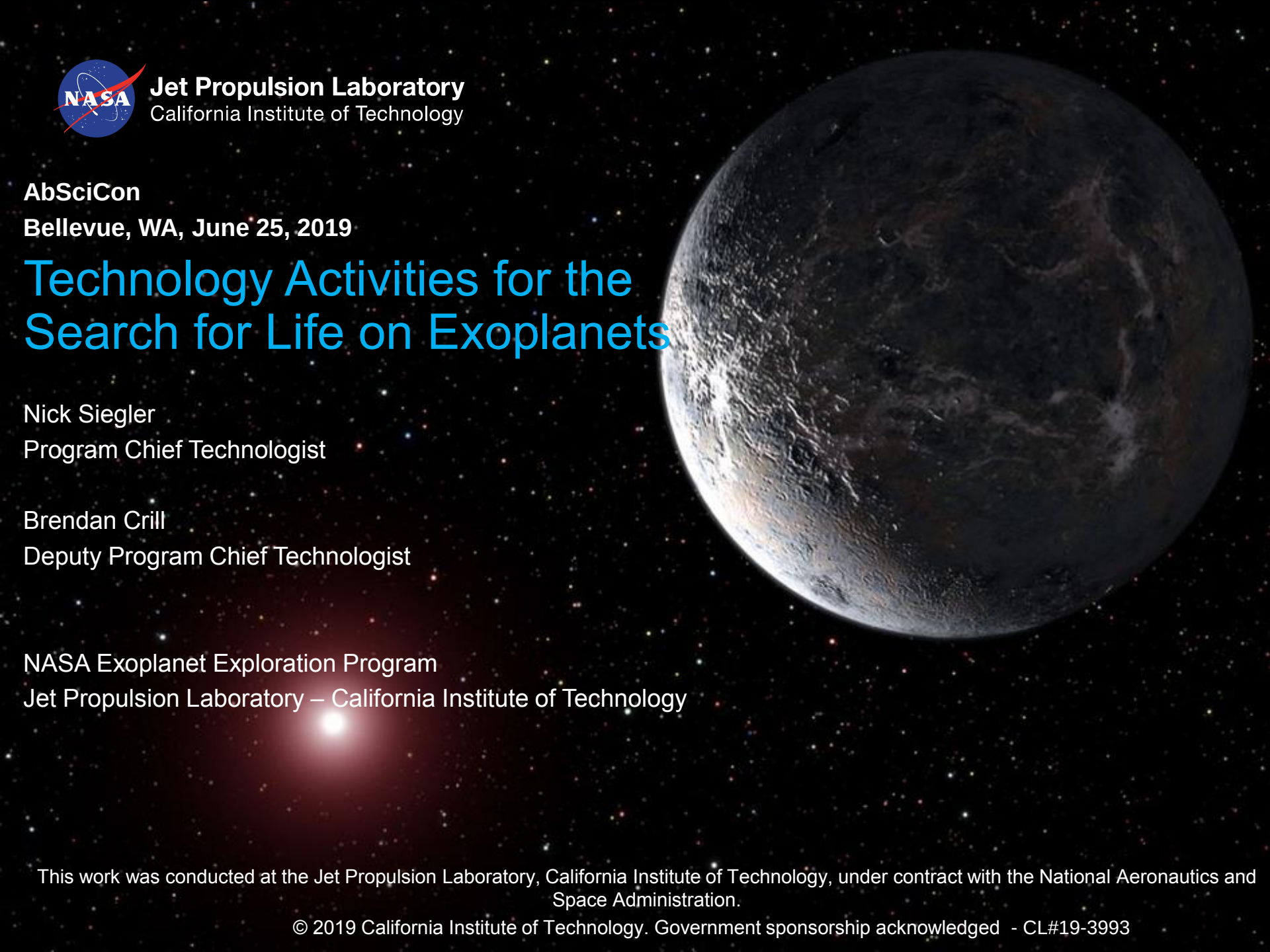


Jet Propulsion Laboratory
California Institute of Technology

AbSciCon

Bellevue, WA, June 25, 2019

Technology Activities for the Search for Life on Exoplanets

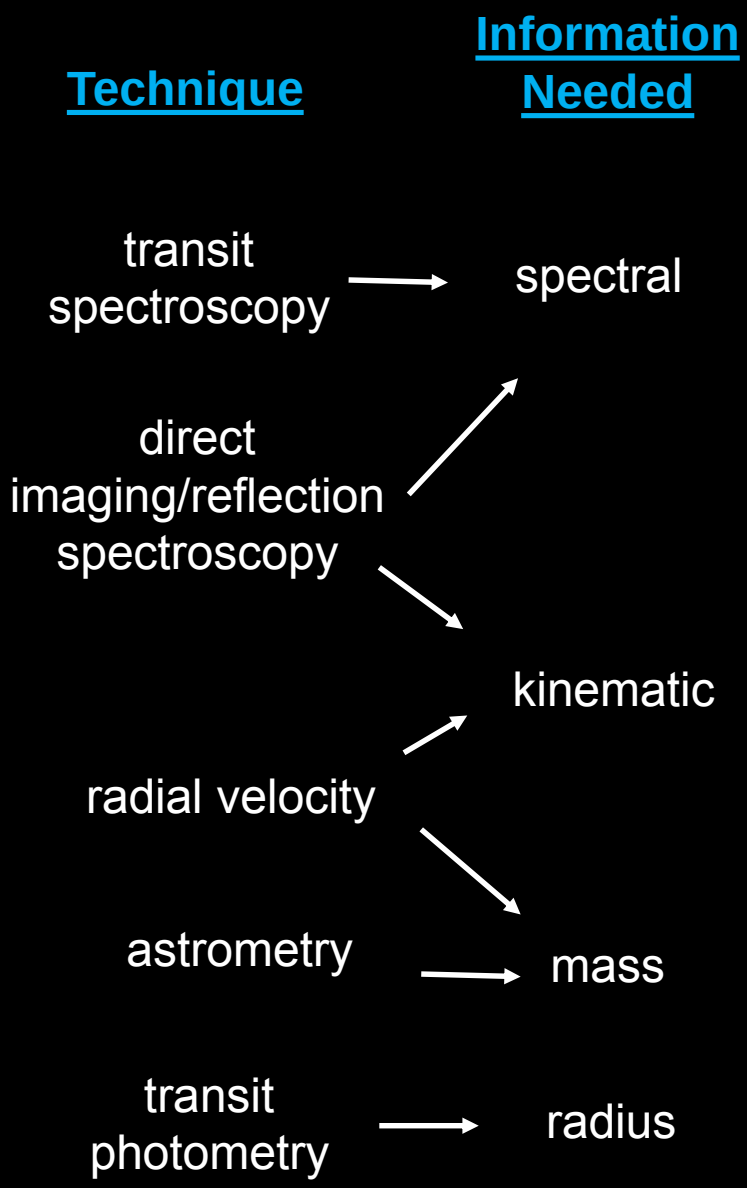
Nick Siegler
Program Chief Technologist

Brendan Crill
Deputy Program Chief Technologist

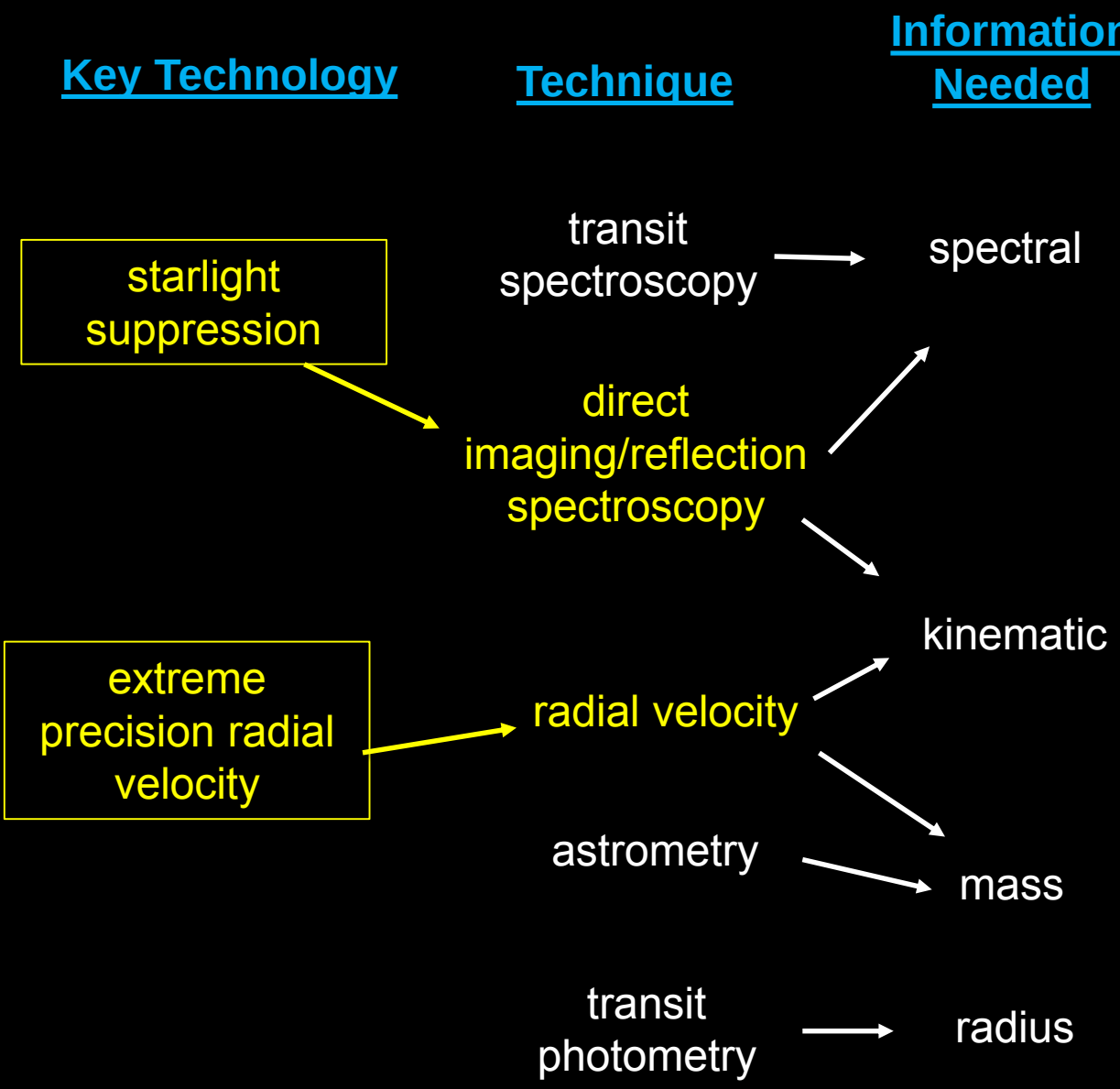
NASA Exoplanet Exploration Program
Jet Propulsion Laboratory – California Institute of Technology

This work was conducted at the Jet Propulsion Laboratory, California Institute of Technology, under contract with the National Aeronautics and Space Administration.

The Key Evidence for Life on Earth-Size Planets

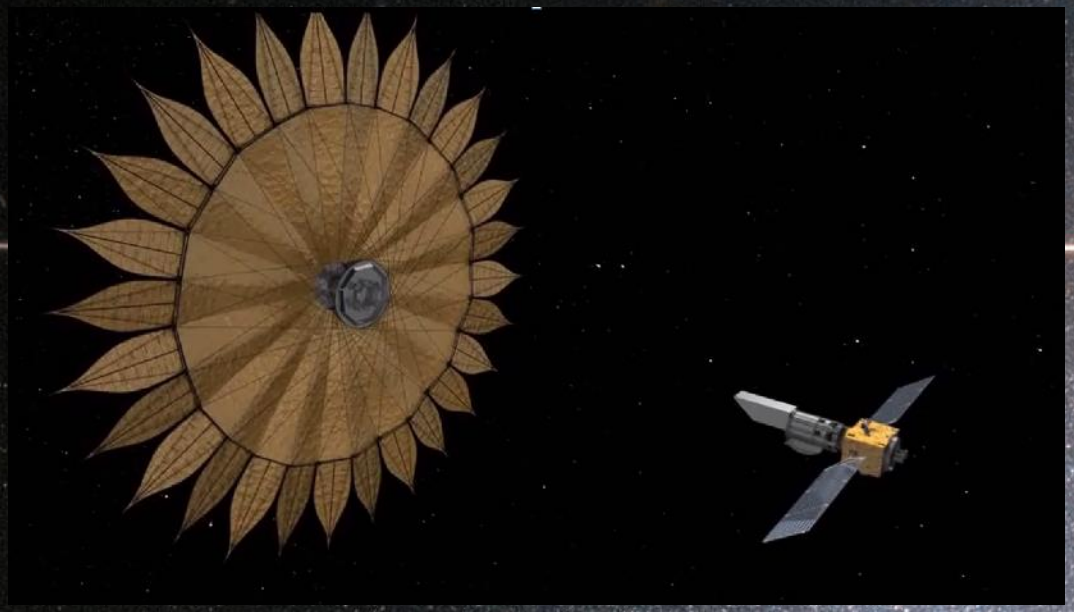


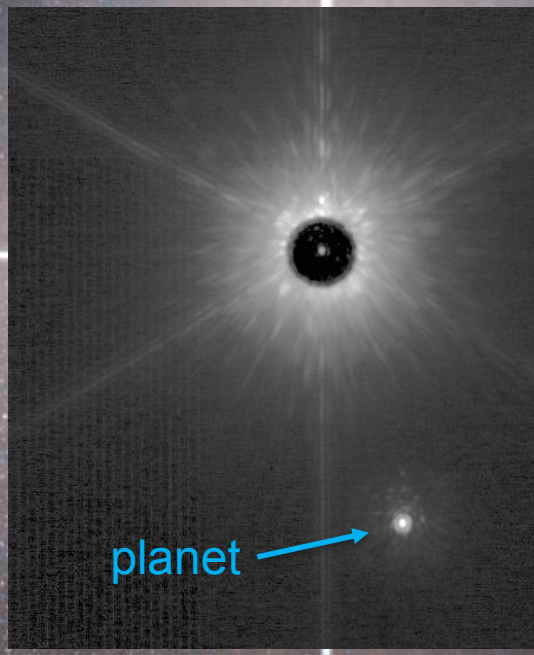
The Key Evidence for Life on Earth-Size Planets Around Sun-Like Stars



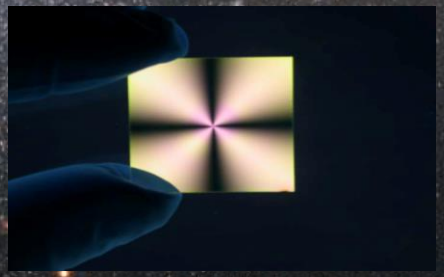
Starlight Suppression
(at visible wavelengths)

External Occulters (Starshades)



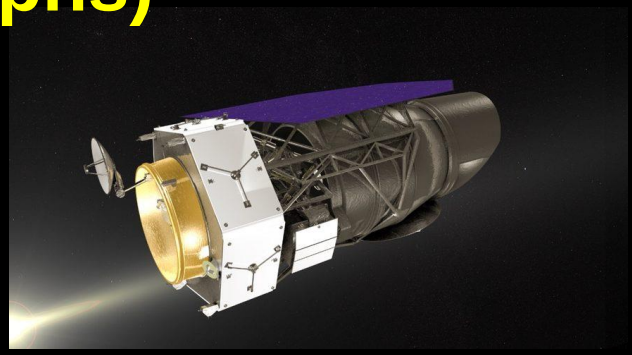


Internal Occulters (Coronagraphs)



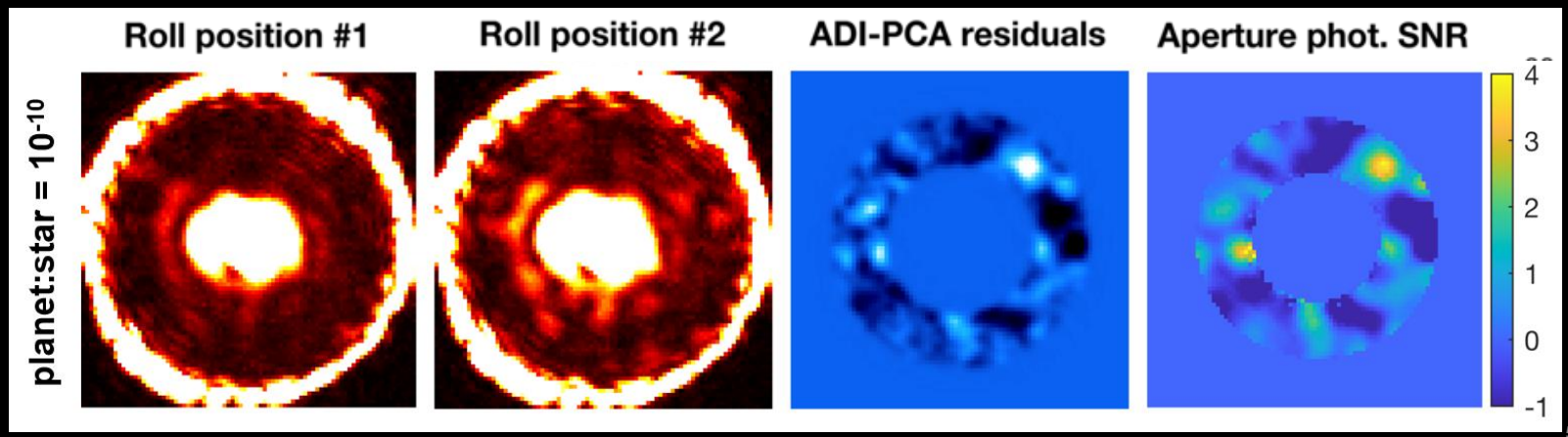
Internal Occulters (Coronagraphs)

- WFIRST's Coronagraph Instrument

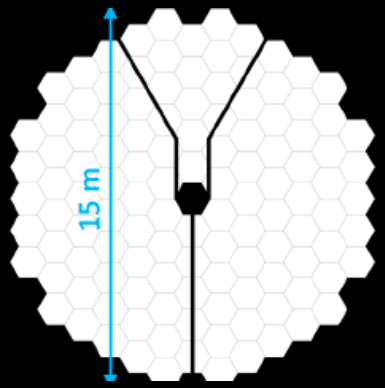


- NASA's competitive grant programs
  - Strategic Astrophysics Program (9 active)
  - Astrophysics Research and Analysis (8 active)

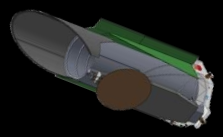
- New ExEP coronagraph testbeds
  - 3.8×10^{-10} contrast at 550 nm, 10% bandpass



Internal Occulters (Coronagraphs)

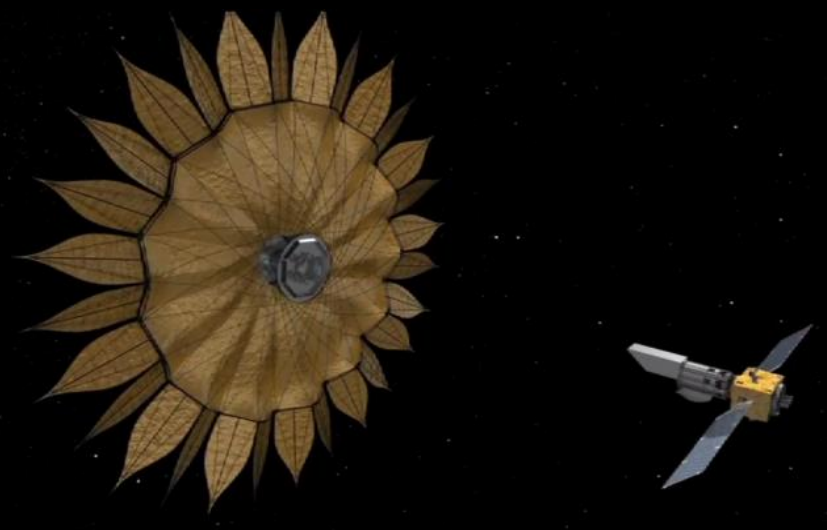


- Design study for segmented telescopes
  - Three candidate coronagraph designs
  - New result: 10-20 pm rms wavefront error stability required for segment-segment errors
- Systems-level segmented telescope design studies
  - Competitive industry grants
- Mission concept studies (HabEx and LUVOIR)



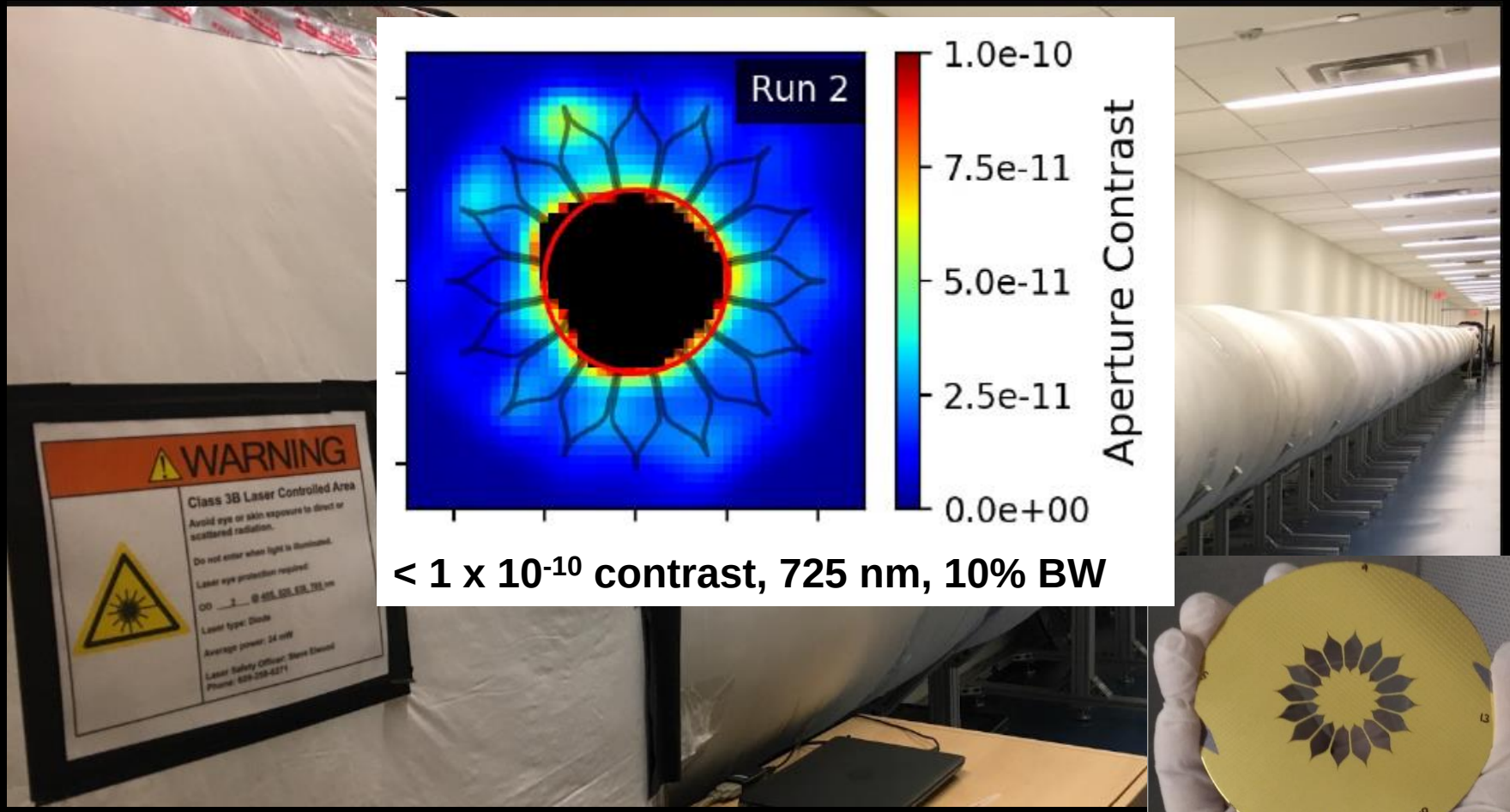
External Occulters (Starshades)

- Mission concept studies (HabEx and WFIRST Rendezvous)
- NASA's technology development activity (S5)
  - Progress on formation flying
  - Progress on optical demonstration
  - Progress on mechanical deployment and stability



External Occulters (Starshades)

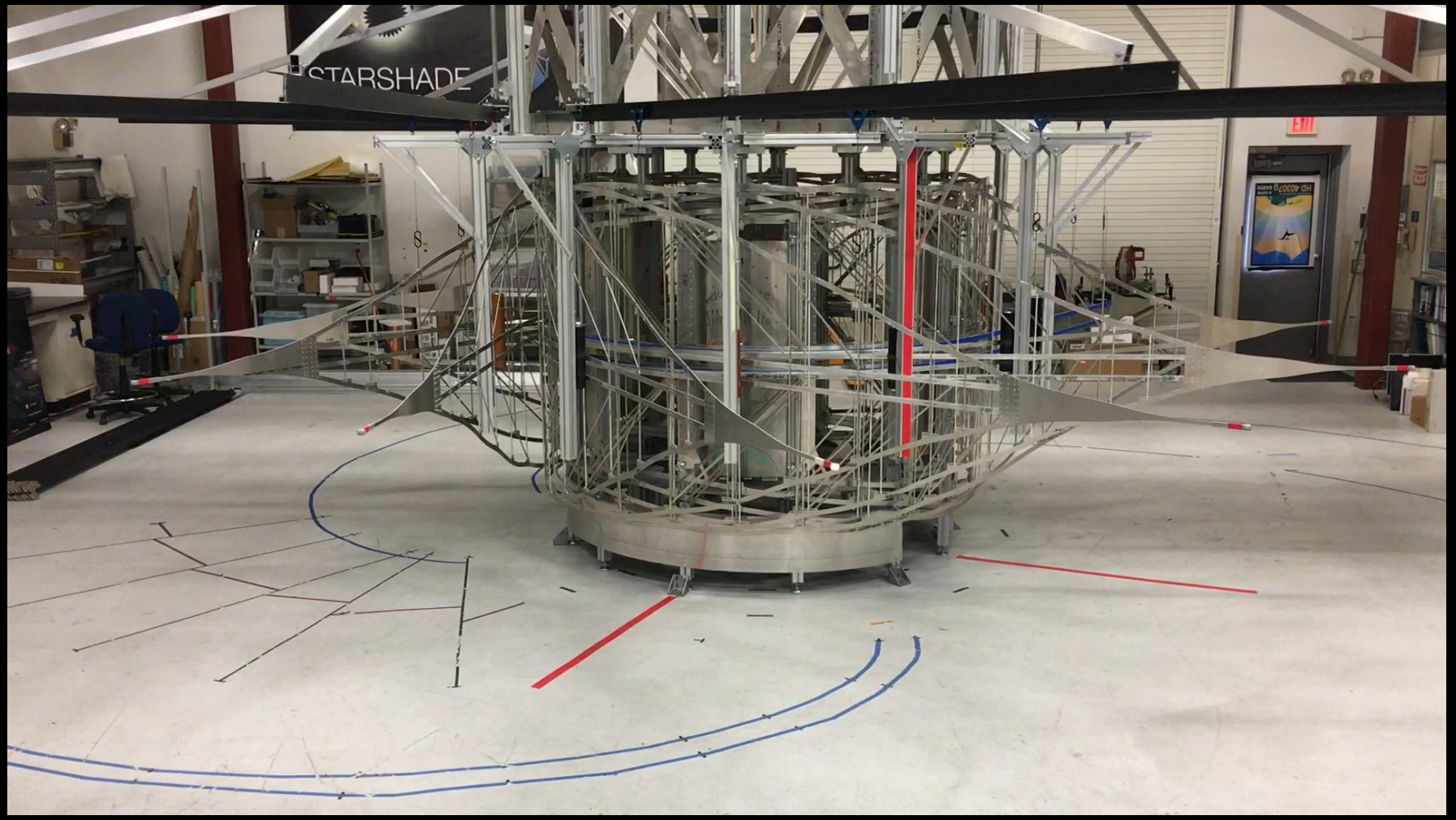
Progress on optical demonstration



Frick Testbed, Princeton University
Lead: Anthony Harness

Petal Unfurling

10 m prototype



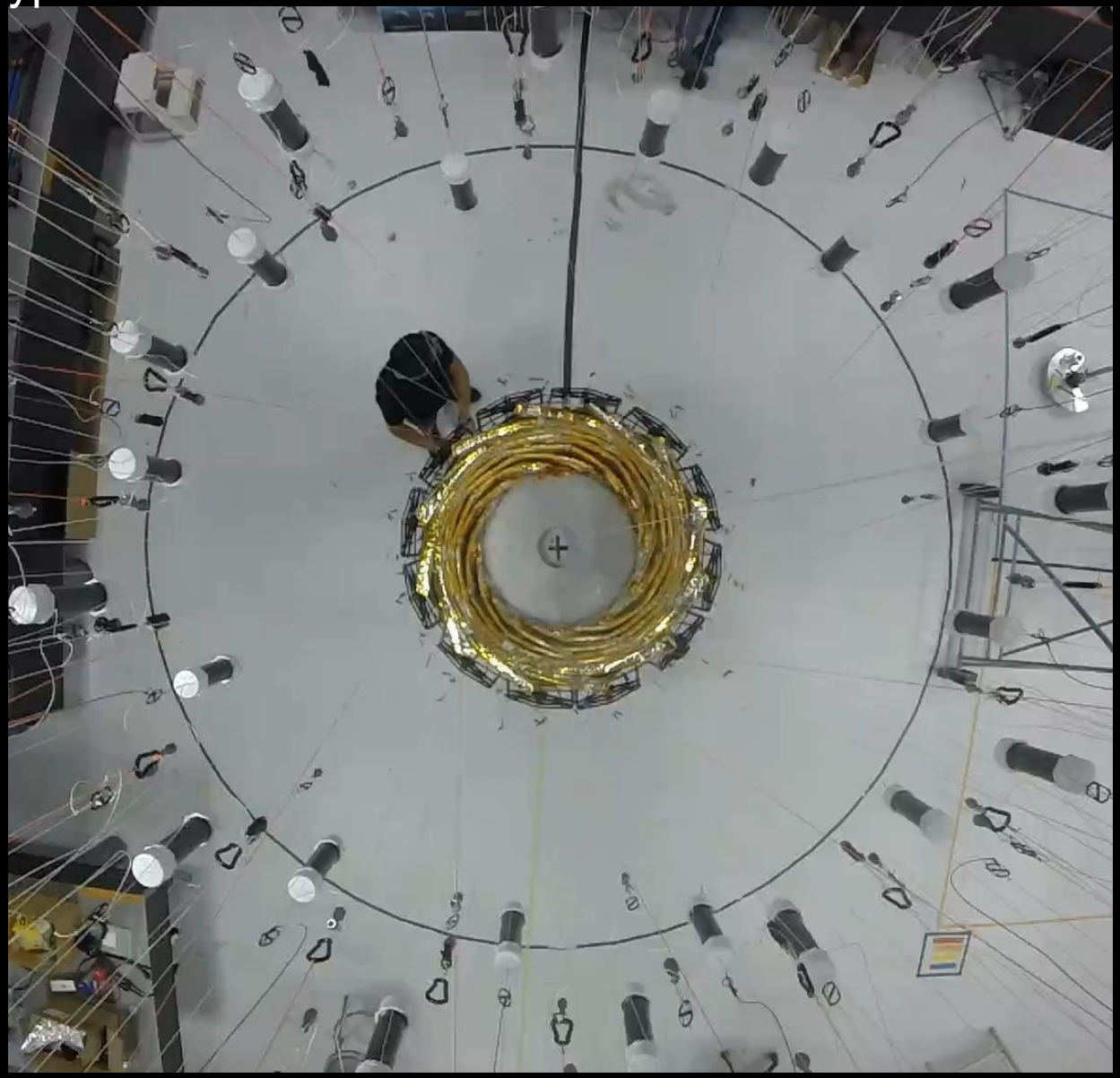
Tendeg/NASA/JPL-Caltech

Inner Disk Deploying

10 m prototype

Optical Shield Deployment

5 m prototype



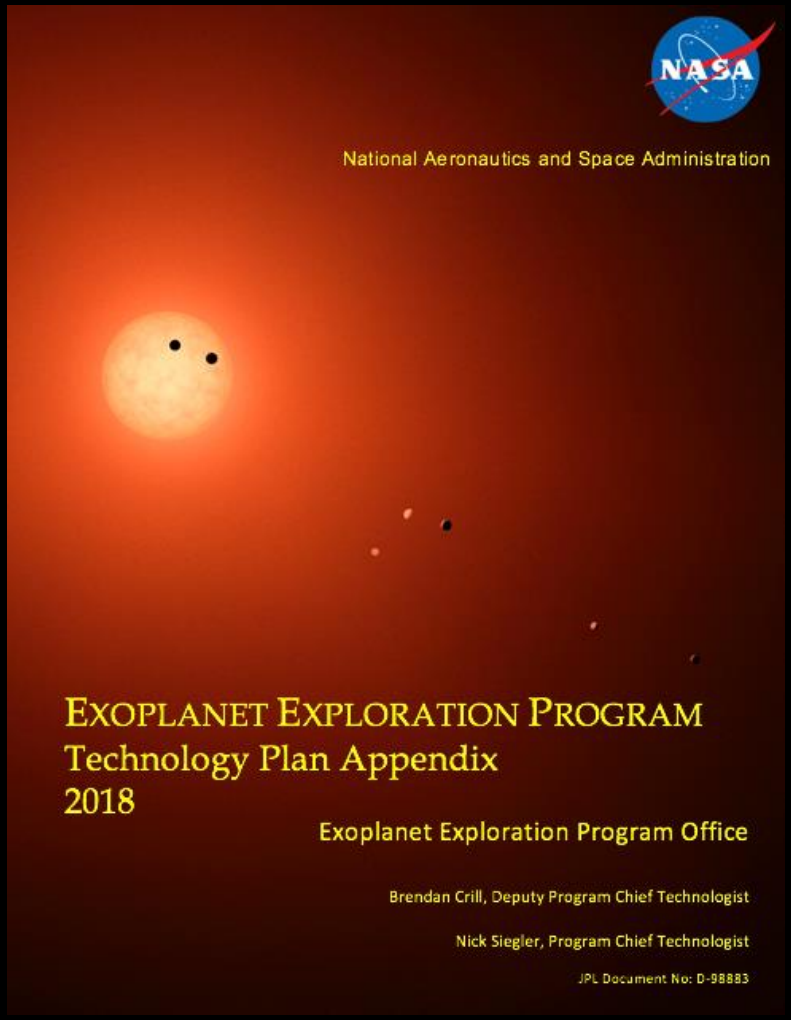
NASA/JPL-Caltech

Extreme Precision Radial Velocity (EPRV)

Measuring exoplanet masses

- For Earth-sized planets around Sun-like stars, need sensitivity to ~ 10 cm/s
  - State of Art is currently ~ 100 cm/s
  - NEID instrument at the WYNN telescope < 50 cm/s (commissioning expected in 2019)
- Many natural challenges that exceed the 10 cm/s goal
  - Star's activity and telluric contamination
- New EPRV initiative to develop a plan to reach the 10 cm/s goal.
  - Recommendations in Spring 2020

Please visit the NASA ExEP website for more details



https://exoplanets.nasa.gov/exep/