Accommodation of Starshade Readiness on WFIRST

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NASA / HQ

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Starshade Development for Direct Imaging of Exoplanets
Grapevine, TX

Artist concept of Kepler-16b

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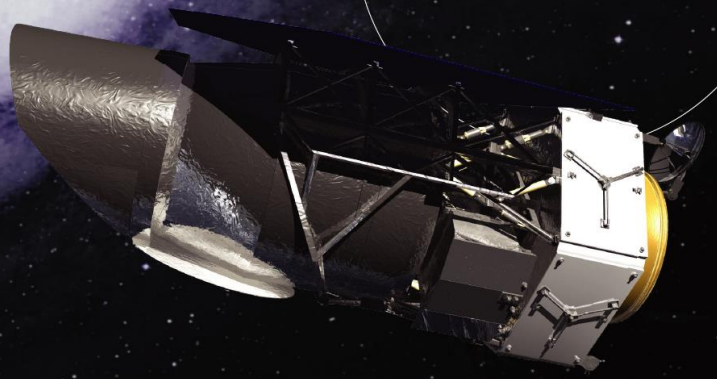
NASA's core astrophysics mission of the late 2020s, building on the amazing discoveries of Hubble and the James Webb Space Telescope.



A panoramic view of the universe 100x wider than Hubble.

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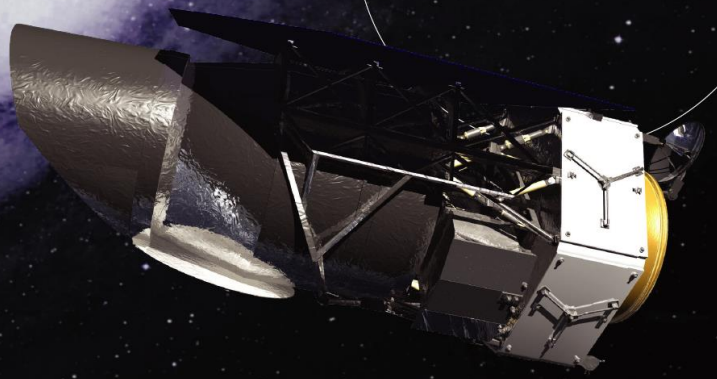

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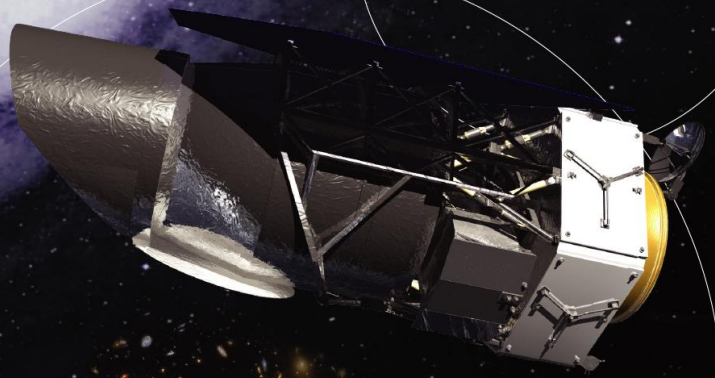

Survey billions of galaxies to reveal the biggest unsolved mystery in the universe: dark energy, what it is and what it does.

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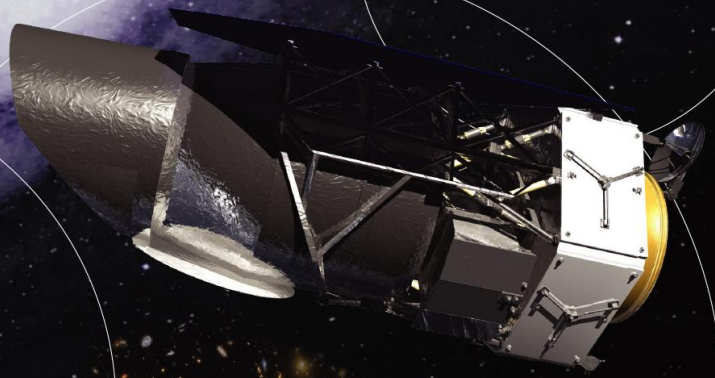

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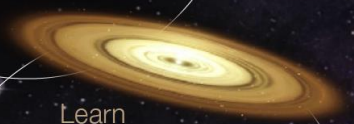

Learn how these distant worlds formed — and whether they may be hospitable for life.

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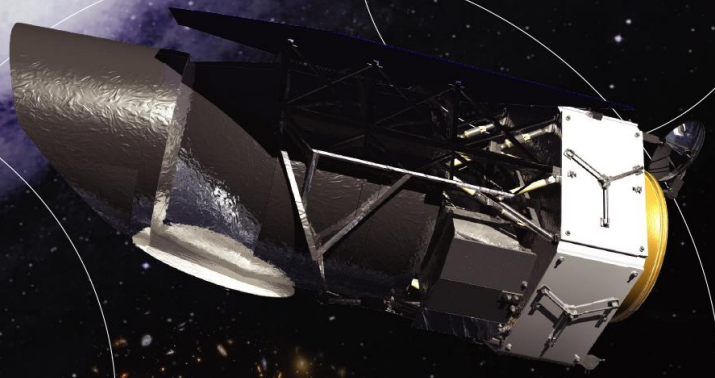

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Simple WFIRST – Starshade Situation

There is no starshade for WFIRST.

We’re studying the accommodation for one.

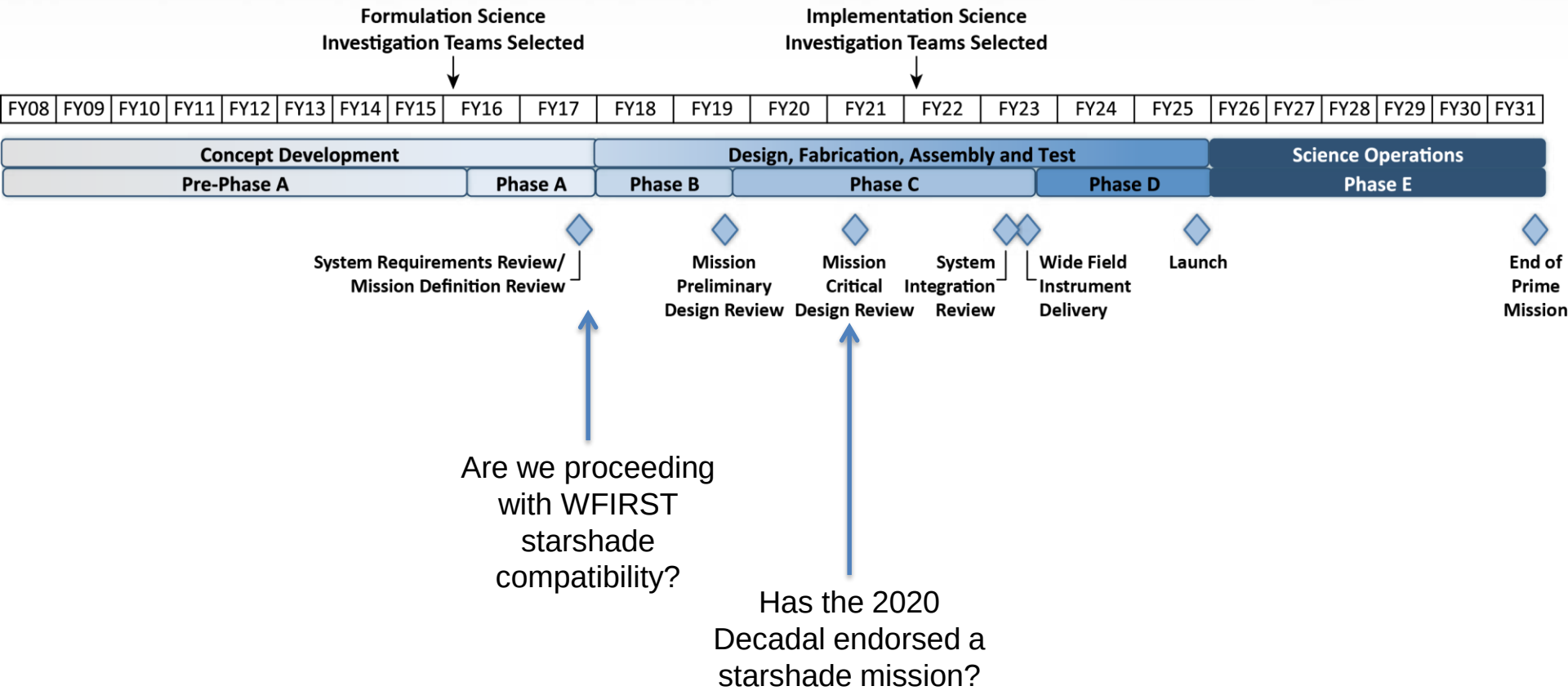
WFIRST Starshade Policy from HQ

- Incorporate design features into WFIRST to ensure compatibility with current starshade design
- Quantify additional cost + risk that WFIRST incurs
- Around Fall 2017, we expect to make a final decision on WFIRST starshade compatibility; scientific benefits versus additional cost & risk

- Whether to develop an *actual* starshade mission?
  - Same process as other strategic science projects
  - Factor recommendations of 2020 Decadal Survey into any decision on a starshade mission

WFIRST Timeline

Timeline for WFIRST with major events; dates are for illustration purposes only



Scenario

- Wherever possible, required functionality is allocated to the notional starshade system rather than to WFIRST. Modification to the core WFIRST mission minimized.
- The WFIRST baseline mission lifetime of 6 years + 3 mo. does not change. No modifications made to the baseline WFIRST to elevate reliability after WFIRST prime mission.
- WFIRST Coronagraph is instrument used with starshade
- Starshade will perform all translational maneuvers for science target acquisition and formation flying; WFIRST maneuvers remain momentum unloads + station-keeping

Impacts to WFIRST

- Coronagraph:
  - Add filters (dichroics for tracking, wider bandpasses)
  - Algorithms for starshade sensing
  - Starshade optical simulator for ground testing
- Spacecraft:
  - Starshade acquisition camera
  - Communication system for WFIRST-Starshade ranging & comm
  - (Optional) on-board orbit determination – celestial navigation
- Science Center:
  - Different planning & scheduling, data processing & archiving
- Schedule: no change to launch date
- Risk: Starshade requirements not well known

Take-Home Message

- WFIRST does not have a starshade;
  studying this for next Decadal Survey's consideration.
- Starshade compatibility being studied during Formulation;
  mandated minimum impact on WFIRST. Now assessed.
- Science benefit: starshade permits detection and characterization of HZ Earths and super-Earths, plus whole-system imaging – extending reach of WFIRST exoplanet discoveries
- WFIRST starshade accommodation is feasible.
- NASA will decide in Fall 2017 whether to maintain starshade compatibility.