Starshade Science and Industry Partnership
Telecon #10
NASA Exoplanet Exploration Program

Renyu Hu

October 29, 2020
Telecon Agenda

• Introduction - Renyu Hu

• Modeling Starshade Petal and Truss Deployment – Laura Hoffman & George Antoun, ATA Engineering

• Dark Coatings for Starshades – David A. Sheikh, ZeCoat Corporation

• Open Floor for Discussion
Motivation for Starshade Science and Industry Partnership

The purpose of the Starshade SIP is to maximize the technology readiness level of starshades to enable potential future exoplanet science missions.

- Starshades (or External Occulters) are one of the starlight suppression technologies for high contrast imaging of exoplanets and are baselined for large- and probe-class mission concept studies funded by the NASA Astrophysics Division for submission to the Astro2020 Decadal Survey.
- The Astrophysics Division authorized the Exoplanet Exploration Program (ExEP) to execute a directed technology development activity to advance starshades to Technology Readiness Level (TRL) 5.
- The Starshade Technology Development Activity to TRL5, or S5, follows an approved Technology Development Plan with technology milestones that respond to documented mission performance requirements.
- The ExEP recognizes that robust and impactful technology maturation requires ongoing consideration of new technology approaches and new mission concept drivers.
Starshade Technology Development

The Exoplanet Exploration Program Charter identifies one of the Program’s critical functions to be to “…manage exoplanet-related technology initiatives, including the management of specifically directed technology activities, facilitation of a coordinated NASA Astrophysics technology identification/prioritization process, oversight of competitively-selected technology activities, and certification of technology milestones and or Technology Readiness Levels (TRLs).”

A key method in the pursuit of these goals and objectives is the direct imaging of planets around other stars. Directly sampling the light from an exoplanet separately from that of its host star facilitates measurement of its size, orbit, albedo, and ground and atmospheric spectra, which provide clues to its habitability, and potentially could provide signatures of the presence of life itself. However, direct observation of small, rocky planets like Earth close enough to their host stars to harbor liquid water is very difficult due to the extreme faintness of the exoplanet relative to the very nearby star. The starlight must be suppressed, either interferometrically or by an occulter, to allow exoplanet detection. Occulters that are internal to the telescope are referred to as coronagraphs. Occulters that are external to the telescope are referred to as starshades.
S5 Technology Milestones Scorecard

Starlight Suppression
- Complete June 2020
  - Contrast NB 1A
  - Contrast BB 1B
  - Modeling 2

Scattered Sunlight
- Complete June 2020
  - Edges 3

Formation Flying
- Complete June 2020
  - Sensing 4

Critical Features
- Complete June 2020
  - Petal 5A
  - Truss Bay 7A
  - Inner Disk 7C

Shape Accuracy
- Complete June 2020
  - Petal 6A

Shape Stability
- Complete June 2020
  - Inner Disk 8A

All Features
- Complete June 2023
  - Petal 5B
  - Truss Bay 7B
  - Inner Disk 7D

- Complete June 2023
  - Petal 6B
  - Inner Disk 8B
### Starshade Science and Industry Partnership (SIP)

#### Tier 2 Schedule

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*Note: Dates and milestones are placeholders for demonstration purposes.*
SIP Activities

• SIP Forums #3 and #4 are replaced by a series of SIP telecons
  – Topics from TSWG recommendations and other SIP activities
  – 10am PT on the third or fourth Thursday of each month

• Agenda of SIP telecons
  – Aug: Stray light analyses. Starshade data challenge announcement
  – Sep: Mechanical milestones. Starshade data challenge Q&A
  – Oct: Presentations from ATA and Zecoat
  – Nov: Effects of binary companions and other astrophysical backgrounds
  – Dec: Presentations from Tendeg and Opterus
  – Feb, Mar: TBD
  – Will be keen on including student and postdoc presentations

• Starshade exoplanet data challenge
  – To validate requirements from science to key performance parameters based on synthetic images, and to quantify the accuracy of calibration of solar glint and exozodiacal light
  – Request For Proposals closed on October 16, 2020
  – Expect to announcement selections by the end of November
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Closing
Future telecon topics

• **Starshade SIP mailing list:** Follow instructions at https://exoplanets.nasa.gov/exep/technology/starshade/

• Suggest telecon topics and student & postdoc presentations to:
  – Gary Blackwood and Renyu Hu
  – Simone D’Amico, Chair of TSWG

• Open the floor for further discussion
Acknowledgements

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Science and Industry Partnership

- **Gary Blackwood**, NASA ExEP Manager, Starshade SIP Chair
- **Renyu Hu**, ExEP Scientist for Starshade Technology

Starshade Technology Development Activity (S5)

- **Phil Willems**, Manager of S5, LBTI Project Manager
NASA Headquarters Leadership

Astrophysics Division

- **Shahid Habib**, Program Executive for ExEP
- **Douglas Hudgins**, Program Scientist for ExEP
- **Mario Perez**, Division Technology Lead
- **Jeff Volosin**, Deputy Division Director
- **Paul Hertz**, Division Director