
Active NASA Investments in Starlight Suppression Technology

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Towards Starlight Suppression for the Habitable Worlds
Observatory Workshop
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How is NASA investing in starlight suppression technology?



Competed Grants

- Astrophysics Research and Analysis (APRA)
- Roman Community Coronagraph Participation
- Nancy Grace Roman Fellowships
- Strategic Astrophysics Technology (SAT)

SAT program is designed to mature technologies in the mid-TRL (3-5) range for strategic astrophysics missions such as HWO

Competed Contracts

- System-Level Segmented Telescope Design (SLSTD) / Segmented Mirror Technology Program (SMTP)
- Small Business Innovation Research (SBIR) Phases I and II

Directed and Competed Activities

- Internal Scientist Funding Model (NASA-only internal competition)
- ~~Starshade~~ (transition to SAT)

Infrastructure

- Coronagraph Vacuum Operational Testbeds (High Contrast Imaging Testbed Facility)

High Contrast Imaging Testbed (HCIT) Facility

An ExEP-managed resource available to SAT-funded investigators.

Coronagraph Testbed

§ Ultra-Low Noise Coronagraph Testbed 1

Ultra-Low Noise Coronagraph Testbed 2

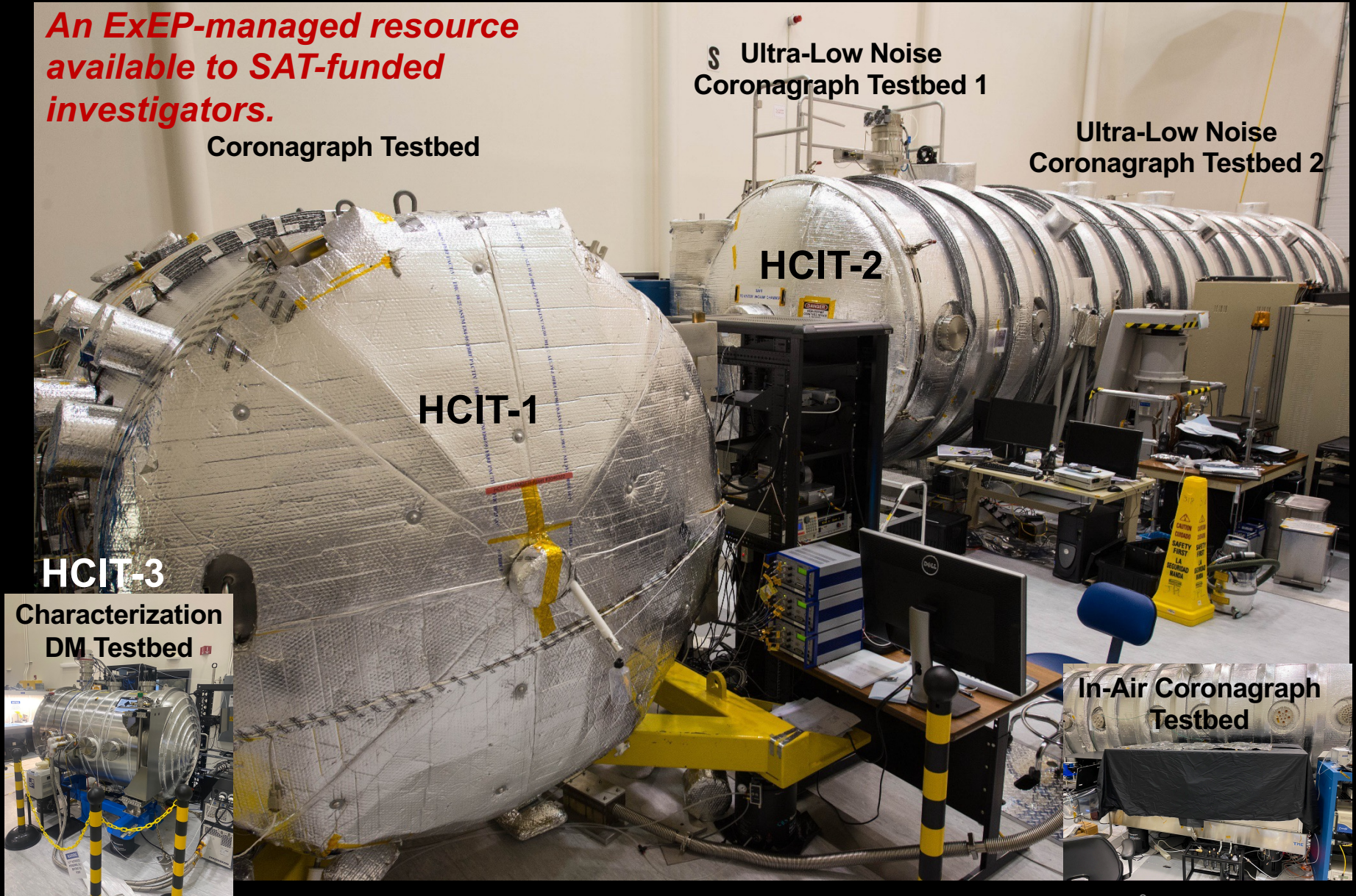
HCIT-1

HCIT-2

HCIT-3

Characterization DM Testbed

In-Air Coronagraph Testbed



Active SAT Awards Addressing Coronagraph Contrast and Contrast Stability Using the HCIT



PI	2023	2024	2025
Belikov (ARC)	PIAACMC		
Belikov (ARC) (*)	Multi-star Wavefront Control		
Serabyn (JPL)	Vector Vortex Coronagraph		
Trauger (JPL)	Super Lyot Coronagraph		
Guyon (UA)	Linear Dark Field Control		
Mawet (Caltech)	Coronagraph/ Spectrograph Architecture		
Wallace (JPL)	Dual-purpose Coronagraph		
Cahoy (MIT)	Dark Hole Maintenance		
Riggs (JPL)	High Contrast with Black Silicon Masks		
Guyon (UA)	Self-Calibrating Coronagraph Systems		

(*) funded through ISFM

Active SAT Awards Addressing Coronagraph Contrast and Contrast Stability



Coronagraphs: demonstration in other testbeds

PI		2023	2024	2025	
Soummer (STScI)	Systems Demo of Segmented Coronagraphy				
Trauger (JPL)			Low-order Hardware Wavefront Sense/Control		

Other Contrast Stability

PI		2023	2024	2025	
Tesch (JPL)			Advanced Wavefront Control for Segmented Aperture Telescopes		
Marresse-Reading (JPL)			Colloid Thruster Life Testing		

Active SAT Awards: Coronagraph Detectors



PI	2023	2024	2025
Nikzad (JPL)			UV Photon-counting detectors
Bottom (UH)	Infrared photon-counting detectors		
Figer (RIT)	Vis-band CMOS detectors		
Rauscher/ McElwain (GSFC) (*)	Vis-band Skipper detectors		

Managed by Cosmic Origins (COR) Program

Managed by Exoplanet Exploration Program (ExEP)

(*) funded through ISFM

APRA-2022 Awards Relevant to HWO



Title	PI	Institution
Chip-scale Astrocomb for High Precision Spectrograph Calibration	Bagheri	JPL
Low Thermal Coefficient of Resistance Microchannel Plates	Elam	ANL
Dark-hole maintenance with the Self Coherent Camera	Haffert	Arizona
Photonic High-Resolution Broadband Spectrographs for Space-Based Astrophysics Missions	Jewell	JPL
Demonstrating a megapixel array of UV superconducting-nanowire single-photon Detectors	McCaughan	NIST
Advanced metamaterial-based structures for optical applications in the Far Ultraviolet	Quijada	GSFC
Ultra-Sensitive Kinetic Inductance Detectors for Low-Background Space-Based Astronomy	Rostem	GSFC
Scaling of single-photon sensor arrays through monolithic semiconductor-superconductor integration	Shanline	NIST

APRA-funded technology projects are typically at a lower maturity than SAT-funded projects.

Conclusions

- **SAT Awards are currently the driving engine for maturing coronagraph technologies for HWO**
 - SAT 2023 currently open on NSPIRES, no due dates yet listed; likely December 14
- **Directed funds could be a strategy for future targeted efforts**

BACKUP

Strategic Astrophysics Technology – managed by ExEP



- Investigators write a Milestone Whitepaper and a Final Report at the end; each is reviewed by our ExoTAC (Exoplanet Technology Assessment Committee)



https://exoplanets.nasa.gov/exep/technology/TDEM-awards/

Strategic Astrophysics Technology (SAT) Awards

Exoplanet technology research is funded through the Strategic Astrophysics Technology (SAT) component of NASA ROSES - information can be found on the [NASA NSPIRES website](#). Prior to the 2018 SAT solicitation, a sub-component of SAT was called Technology Development for Exoplanet Missions (TDEM). Beginning with the 2018 solicitation, there is a single SAT program but exoplanet technology development SAT awards are managed by the ExEP as before. Awards from solicitations from 2009 through 2017 are listed below, including links to the abstracts of the original proposals, to Milestone Whitepapers, and Final Reports, where available.

Please refer here for information on [ExEP Resources Available to Proposers](#) to SAT, including access to the High Contrast Imaging Testbed laboratory for coronagraph demonstrations.

Download templates: [Whitepaper](#) | [Final Report](#)

Download milestone process: [Milestone Process](#)

Year	PI	Institution	Proposal Title
CORONAGRAPH STARLIGHT SUPPRESSION DEMONSTRATIONS			
2009	John Trauger	JPL/Caltech	Advanced Hybrid Lyot Coronagraph Technology for Exoplanet Missions Abstract Whitepaper Final Report
2009	Olivier Guyon	Univ. of Arizona	Phase-Induced Amplitude Apodization Coronagraphy Development and

NASA Astrophysics Strategic Technology Portfolio

[Searchable NASA APD technology investment database](#)

State of the Art of Starlight Suppression Technology – April 2023

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Decadal Survey Testbed Roadmap April 2019

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