



NASA EPSCoR
Research Performance Progress Report
Template Example

II. Accomplishments:

A. The major goals of this project are to construct a new machine learning training set, to develop machine learning classification algorithm for brown dwarfs, and to develop recommendations and a

science case for ultracool subdwarf classification with Roman. The goals also include working closely with the NASA Backyard Worlds Citizen Science team to expand the training set.

B. We have completed a training set, incorporating observations of previously known brown dwarfs, simulated extragalactic sources from the literature, simulated brown dwarf model spectra, and a large set of previously unpublished brown dwarf observations including subdwarfs. We have classified the new (previously unpublished discoveries) sources from the NASA Backyard Worlds Team. We have also created synthetic photometry in all the Roman Telescope passbands. We have developed a Galactic model of brown dwarfs using more realistic star formation models in order to set up the classification problem and evaluate simulated Roman surveys. We have tested a large number of machine learning algorithms for our problem. We have identified the most useful features that Roman will measure and recommend specific regression algorithms over discrete classification algorithms. We also show that the incorporation of Rubin Observatory photometry improves the performance. We have used the early data preview releases from Rubin Observatory and Euclid to demonstrate our methods. We have developed classification relations for ultracool dwarfs and subdwarfs in the Roman system. The graduate student made significant contributions to a white paper on a possible all-sky survey with Roman. The graduate student has been able to present this work at conferences including the American Astronomical Society, the Cool Stars 23 conference, and the Brown Dwarfs to Exoplanet Connection conference.

C. The project has enabled our participation in a major NASA project. The graduate student has been training in machine learning and AI methodology. He has also become an expert in photometric measurements and analysis of large astronomical datasets. He has been able to do one-on-one work with a UD faculty member and to be mentored by the leaders of the Backyard Worlds NASA collaboration.

D. The work has been published in professional journals. One more paper will be submitted in July 2026. The work has been presented at major conferences, including the American Astronomical Society, the Cool Stars 23 conference, and the Brown Dwarfs to Exoplanet Connection conference. Both Gizis and the graduate student will present work at the upcoming Shifting Landscapes in Astrophysics: New Frontiers to Explore with *Roman* in July 2026. We met with the Technical Monitor via Zoom often. The graduate student gave public outreach talks at the Mt Cuba Astronomical Observatory in Delaware, USA.

E. Most of the work is completed but the review of the final paper, planned to be submitted in late July 2026, may stretch beyond this reporting period. Accordingly, we will respond to referee comments and review the manuscript in the next period.

III. Products:

- A. List Journal publications – Please only list papers that have been published. **Please do not remove the table; or alter columns, add additional rows as required.**

Date Published	Published Paper (APA format)
2026	Honaker, E. et al. “Searching for Ultracool Dwarfs in. Early LSST Data Products”, 2026, ApJ, 1004, 214
2026	Schneider, A.C., et al. “Three Thousand Motion-confirmed L and T Dwarf Candidates from the Backyard Worlds: Planet 9 Citizen Science Project.” 2026, ApJ, 171, 341
2026	Han, et al., “A Path to an All-Sky Survey with Roman”, 2026, arXiv, 2602.21280
2025	Honaker, E. J. & Gizis, J.E. “Simulating Solar Neighborhood Brown Dwarfs”, 2025, ApJ, 985, 48

- B. List Conference Papers – Please only list papers that are included in conference proceeding. **Please do not remove the table; or alter columns, add additional rows as required.**

Conference Date	Conference Paper (APA format)

- C. List Conference Presentation – Please list conference presentation. **Please do not remove the table; or alter columns, add additional rows as required.**

Conference	Presentation Topic (APA format)
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Date	
2026	Honaker et al., “Roman color-spectral type relations for ultracool dwarfs.” Cool Stars 23.
2026	Honaker. “Searching for Ultracool Dwarfs in Early LSST Data Products”. Brown Dwarf to Exoplanet Connection 2026.
2026	Honaker. “Ultracool Dwarfs.” 20 th Annual Delaware Space Grant Symposium
2025	Honaker & Gizis. “Simulating Solar Neighborhood Brown Dwarfs: A Guide for Upcoming Surveys.” AAS Annual Winter Meeting.

- D. List Books and/or other Publications – Please include explanations, help us to learn about your accomplishments. **Please do not remove the table; or alter columns, add additional rows as required.**

Date	Explanations (APA format -Book, Newspaper Op-Ed, ...)

- E. List talk/presentation/event/outreach activity – Please include explanations, help us to learn about your accomplishments. **Please do not remove the table; or alter columns, add additional rows as required.**

Date	List talk/presentation/event/outreach activity (APA format if applicable)
2025-2026	Public Outreach talks at Mt Cuba Astronomical Observatory

- F. List of new or updated Website(s) or other Internet site(s). **Please do not remove the table; or alter columns, add additional rows as required.**

URL	Short description of purpose of site

- G. Technology/Technique – **Please do not remove the table; or alter columns, add additional rows as required.**

Technology/Technique	Short description of technologies or techniques
Machine Learning	We have selected the optimum methods and features to identify and classify brown dwarfs and ultracool subdwarfs with Roman Space Telescope. The code will be posted at the completion at the project,

- H. List patent – Please include Patent Number/Patent Title/ Patent Abstract (or link to it). **Please do not remove the table; or alter columns, add additional rows as required.**

Date Patent Issued	Patent Number/Patent Title/ Patent Abstract (or link to it)

- I. List Inventions – Please include Invention Title, List of Inventor(s) and Description. **Please do not remove the table; or alter columns, add additional rows as required.**

Invention Title	List Inventor(s)	Invention Description

- J. List Licenses – Please include license issued, Invention Title, List of Inventor(s) and Description. **Please do not remove the table; or alter columns, add additional rows as required.**

Date License Issued	License Assignees	License Title

- K. List New/Revised Courses – Please include new/revised courses. **Please do not remove the table; or alter columns, add additional rows as required.**

Course Number	Course Name/Title	Offering Institution

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- L. Others: List Databases, Physical collections, Audio or video products, Software or NetWare, Models, Instruments or equipment, Data & Research Material (e.g., cell lines, DNA probes, animal models) related to your EPSCoR research. **Please do not remove the table; or alter columns, add additional rows as required.**

Accomplishments title	Short Description of accomplishments

IV. Participants & Other Collaborating Organizations:

- A. University Research Team Members (do not include names of minors). **Please do not remove the table; or alter columns, add additional rows as required.**

Name	Project Role	Nearest person month worked	Contribution to Project	Funding Support
Easton Honaker	Student	18	Major Work	This grant
John Gizis	Researcher, Co-I	1	Supervision of student	Delaware
Federica Bianco	Researcher, Co-I	0.1	Machine learning expertise	Delaware
W. Matthaeus	PI	0.01	ESPCoR PI	Delaware

- B. NASA Collaborators. **Please do not remove the table; or alter columns, add additional rows as required.**

Name	Title	NASA Center	Nature of the Collaboration
Marc J. Kuchner	Citizen Science Officer	NASA HQ	Leader of Backyard Worlds

- C. Industry Collaborators. **Please do not remove the table; or alter columns, add additional rows as required.**

Name	Title	Industry/Company Name	Nature of the Collaboration

- D. New non-EPSCoR grants. **Please do not remove the table; or alter columns, add additional rows as required.**

Funding Entity	Award Name	Value of New Grant

- E. Other Organizations Involved as Partners. **Please do not remove the table; or alter the columns, add additional rows as required.**

Organization	Nature of the Collaboration	Benefit of Collaboration	Additional Information
NOIRLab	Backyard Worlds co-leader, provided models	Essential for training set and collaboration with Backyard Worlds.	No funding from this grant.
American Museum of Natural History	Provided Backyard Worlds spectra	New spectra essential for training set.	No funding from this grant.

V. Changes/Problems

- A. No major changes in approach.
- B. No major delays, but a no cost extension is requested to complete publication.
- C. No major changes to expenditures.
- D. Not applicable: No significant changes in use or care of human subjects, vertebrate animals, and/or biohazards.
- E. No change of primary performance site location from that originally proposed.

VI. Impact: Stimuli article, attach a high-resolution photo and a one line caption. Obtain permission to publish photo from any recognizable person. **Do not** include photos of minors.

Caption: Graduate student Easton Honaker classified brown dwarfs from their spectra and developed the machine learning models.

