JACK NAYLOR

Rose St Building (J04), The University of Sydney, Darlington, 2006, NSW, Australia

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RESEARCH INTERESTS

Robotic imaging, computational imaging, scene representation, physics-informed machine learning, computer vision, space engineering, remote sensing

EDUCATION

The University of Sydney March 2022 - June 2026
Doctor of Philosophy (Engineering) (*Under Examination*)
Advisor: Dr. Donald G. Dansereau
Thesis Title: *Sampling and Reconstruction of Visually Challenging Scenes with Radiance-Based Methods*

The University of Sydney 2017 - 2021
Bachelor of Engineering (Mechanical) (Hons. I)/Bachelor of Science (Advanced)
Majors: Space Engineering & Physics. Minor: Mathematics. Completed Advanced Engineering stream.
Thesis Title: *Targeted Extraction and 3D Reconstruction of Thin Linear Features*

RESEARCH EXPERIENCE

Computational Imaging Group/Robotics Institute, Carnegie Mellon University Aug 2025 - Feb 2026
Australian Fulbright Future Scholar

- Visiting Scholar under the Fulbright Foreign Student Program, hosted at the Light Transport Lab within the CMU Robotics Institute and supervised by Prof. Matthew O'Toole
- Work developing multi-modal radiance-based representations for persistent robotic mapping around complex appearances.

Australian Centre for Robotics (ACFR), University of Sydney Mar 2022 - Present
PhD Candidate/Graduate Research Student

- PhD candidate developing radiance-based methods to represent visually challenging scenes in robotics.
- Collaborator on NSW Space Research Network grant developing experimental simulation methods for event cameras applied to in-orbit docking.
- Notable project in construction of an optimisation framework for allocation of Junior Medical Officers (JMOs) during rotations in the NSW Health System. Deployed in Sydney's geographically largest local health district, allocating approximately 150 JMOs annually improving staff satisfaction and retention.

Australian Centre for Field Robotics (ACFR) Jan 2020 - Jan 2022
Undergraduate Research Student

- Research engineering position developing physics informed compression methods for hyperspectral imagery onboard autonomous systems.
- Selected as project member for vision and sensing capability on ACFR feasibility study of polar lunar rovers on behalf of Mitsubishi Heavy Industries (Dec 2020 - Mar 2021).
- Previous projects include the development of a framework for open source plenoptic cameras, and the development of a 3D hyperspectral camera for advanced next-generation autonomous sensing.

PROFESSIONAL EXPERIENCE

Nearmap July 2021 - Jan 2022
Computer Vision Research Student *Sydney, Australia*

- Scholarship position undertaking a six month full-time undergraduate thesis on machine learning methods for thin linear feature extraction in images, reconstructing 3D features from thin 2D representations.
- Major achievement in development of a learning-based extraction and multi-view optimisation pipeline for reconstructing features to sub-pixel accuracy.
- Co-supervised and based under the Vision Systems team at Nearmap and the Robotic Imaging research group at the Australian Centre for Field Robotics.

Abergeldie Complex Infrastructure Jan 2019 - Jan 2020
Trainee Engineer *Sydney, Australia*

- Scholarship internship incl. 3 week secondment to the Brisbane, QLD office.
- Developed and proposed a method for active acoustic monitoring of cutter-head performance in blind boring operations.

PwC Experience Centre Hong Kong Nov 2018 - Dec 2018
Emerging Technologies Project Intern *Hong Kong SAR*

- Month long project on disruptive innovation and emerging technologies; and their effects on start-up ecosystems around the world.

AWARDS & HONOURS

PhD

Scholarships and Honours

- Faculty of Engineering Career Advancement Award 2026
- Commonwealth of Australia Research Training Program (RTP) Stipend Scholarship 2022 - 2026
- Australian Academy of Technological Science & Engineering (ATSE) Emerging Leaders Network 2026
- Australian-American Fulbright Commission Fulbright Future Scholarship 2025 - 2026
- Faculty of Engineering Dean's Award for Enhancing Student Life 2024
- Faculty of Engineering HDR Conference Best Speaker Award 2022
- SPIE Optics and Photonics Education Scholarship 2022

Teaching Awards

- Faculty of Engineering Dean's Award for Casual Academic Excellence 2026
- Faculty of Engineering Dean's Award for Outstanding Tutoring 2024

Travel Awards

- Faculty of Engineering Charles Kolling Travelling Fund Scholarship 2023, 2024, 2026
- Faculty of Engineering Postgraduate Research Support Scheme Award 2022, 2025
- NSW Space Research Network International Astronautical Congress Sponsorship 2025
- NSW Space Research Network Australian Space Research Conference Sponsorship 2024
- iLAuNCH Trailblazer International Symposium on AI, Robotics and Automation in Space Sponsorship 2024
- NSW Space Research Network Travel Bursary Award 2024
- IEEE Robotics and Automation Society Travel Grant Award 2023

BE(Hons.)/BSc(Adv.)

- University of Sydney Academic Excellence Award (Top 600 Students University-Wide) 2021

- Engineering Sydney Industry Placement Scholarship 2021
- Faculty of Engineering Leadership Scholarship 2017 - 2020
- Dean's List of Excellence in Academic Performance 2020
- Slade Prize in Intermediate Physics 2020
- Faculty of Engineering Summer Research Scholarship 2020
- Faculty of Engineering Winter Research Scholarship 2020
- Pro-Vice Chancellors' Global Mobility Scholarship 2018

GRANTS

External Grants

- *Relightable 3D Gaussian Splatting for Robust Inspection Under Changing Lighting Conditions*, NVIDIA Academic Hardware Grant, Proposal Co-Lead and Investigator, A$ 60k, 2024
- *Physics-Based Simulation for Robotic Vision in Extreme Environments*, NVIDIA Academic Hardware Grant, Proposal Lead and Investigator, A$ 48k, 2024

Competitive Internal Grants

- *Capturing Reflective Scenes for 3D Reconstruction with Accurate Ground-truth Camera Poses*, Australian Robotic Inspection and Asset Management (ARIAM) Hub Demonstrator Seed Grant, Investigator, A$ 15k, 2025
- *Robotic Vision for Extreme Environments*, Sydney Informatics Hub High-Performance Computing Allocation Scheme - The University of Sydney, Investigator, A$ 6.5k, 2024

Hardware Grants

- *Intelligent Edge Data Curation for Remote Sensing* Inventing the Future Philanthropic Fund - The University of Sydney, CI, A$ 12k, 2022

PUBLICATIONS

* indicates joint authorship.

Journals

[J1] **J. Naylor**, R. Mishra, N. Barbara, and D. G. Dansereau, "∂LITE: Differentiable lighting-informed trajectory evaluation for on-orbit inspection," *Acta Astronautica*, 2026. (Selected for Special Issue).

Full Conference

[C1] **J. Naylor**, V. Ila, and D. G. Dansereau, "Surf-NeRF: Surface Regularised Neural Radiance Fields," *Proceedings of the IEEE/CVF Conference on Computer Vision and Pattern Recognition (CVPR) Workshops*, pp. 258–268, Jun. 2026.

[C2] C. Le Gentil, **J. Naylor**, N. Munasinghe, J. Mehami, B. Dai, M. Asavkin, D. G. Dansereau, and T. Vidal-Celleja, "Mixing data-driven and geometric models for satellite docking port state estimation using an RGB or event camera," *2025 IEEE International Conference on Robotics and Automation (ICRA)*, 2025.

[C3] R. Griffiths, **J. Naylor**, and D. G. Dansereau, "NOCaL: Calibration-Free Semi-Supervised Learning of Odometry and Camera Intrinsics," in *2023 IEEE International Conference on Robotics and Automation (ICRA)*, IEEE, 2023, pp. 4056–4062.

Peer-Reviewed Workshop

[W1] N. Munasinghe, C. Le Gentil, **J. Naylor**, M. Asavkin, D. G. Dansereau, and T. Vidal-Celleja, "Towards event-based satellite docking: A photometrically accurate low-earth orbit hardware simulation," *IEEE International Conference on Robotics and Automation Workshop on Heterogeneous Multi-Robot Cooperation for Exploration & Science in Extreme Environments (ICRA:HERMES)*, 2024. (Spotlight).

[W2] J. Wilkinson, **J. Naylor**, R. Griffiths, and D. G. Dansereau, "Adaptive keyframe selection for online iterative NeRF construction," *IEEE International Conference on Robotics and Automation Workshop on Robotics and Neural Fields (ICRA:RoboNerF)*, 2024. (Spotlight).

Theses

[T1] **J. Naylor**, "Sampling and reconstruction of visually challenging scenes with radiance-based methods," Ph.D. dissertation, The University of Sydney - Under Examination, 2026.

[T2] **J. Naylor**, "Targeted Extraction and 3D Reconstruction of Thin Linear Features," Honours Thesis, School of Aerospace, Mechanical and Mechatronic Engineering, The University of Sydney, 2022.

Other and Abstract-Only

[O1] J. L. Gray, N. Goncharov, A. Cardaillac, R. Griffiths, **J. Naylor**, and D. G. Dansereau, "A 3D reconstruction benchmark for asset inspection," *arXiv preprint arXiv:2603.17358*, 2026.

[O2] **J. Naylor**, R. Mishra, N. H. Barbara, and D. G. Dansereau, "Task-aware trajectory optimisation for satellite inspection via differentiable simulation," *Australian Defence Science, Technology and Research (ADSTAR) Summit*, 2026.

[O3] R. Li, **J. Naylor**, M. Okunev, C. Richardt, M. O'Toole, and J. Tompkin, "Multi-frequency time of flight radiance fields," *IEEE/CVF Conference on Computer Vision and Pattern Recognition Workshops (CVPRW) - 15th IEEE International Workshop on Computational Cameras and Displays (CCD)*, 2026.

[O4] **J. Naylor**, R. Mishra, N. Barbara, and D. G. Dansereau, "∂LITE: Differentiable lighting-informed trajectory evaluation for on-orbit inspection," *IAF 76th International Astronautical Congress (IAC) Space Operations Symposium*, 2025.

[O5] R. Mishra, **J. Naylor**, N. H. Barbara, and D. G. Dansereau, "Appearance-aware trajectory optimisation for autonomous on-orbit inspection," *International Symposium on Artificial Intelligence, Robotics and Automation in Space (i-SAIRAS)*, 2024.

TALKS AND SEMINARS

Conference Plenary

- 75th International Astronautical Congress (IAC), Milan, Plenary Panellist - *Intelligent Space: Big Data, Advanced Algorithms, and Autonomous Robotics in Space*, Oct 2024

Invited Talks

- AI for Space Group, Australian Institute for Machine Learning (AIML), Adelaide University, *Hidden Signals: Applications of Plenoptic Cues*, July 2026
- Camera Culture, Massachusetts Institute of Technology (MIT) Media Lab, *Beyond Images: Plenoptic Fields for Robotics*, Feb 2026
- Visual Computing Group, Brown University, *Beyond Images: Plenoptic Fields for Robotics*, Feb 2026
- Computational Imaging Group Seminar, Carnegie Mellon University, *Beyond Images: Plenoptic Fields for Robotics*, Sep 2025
- Cross-Sector Applications for Remote Operations and Robotics, Australia in Space Magazine and Indo-Pacific Space & Earth Conference Lead-up Event, *Chasing Daylight: Operating under Visual Challenges in Space*, Oct 2024

- Unlocking Robotic Perception - Workshop, IEEE Intelligent Transport Systems Society (ITSS), *Losing Light: Perception in the Wild*, Sept 2023
- Computer Vision Group, Technische Universität München - TUM (Germany), *Through the Looking Glass - Neural Fields for Robotics*, June 2023
- Center for Sensor Systems (ZESS) Lecture Series hosted by DFG Research Unit Learning to Sense, Universität Siegen (Germany), *Through the Looking Glass - Neural Fields for Robotics*, June 2023
- Sydney Innovation Program, University of Sydney Law School, *Silicon Brains: A Field Guide to Machine Learning*, Feb 2023

TEACHING & SUPERVISION EXPERIENCE

Course Development:

- MECH5720: Sensors and Signals — 2026
  Developed materials, including hardware, for laboratory sessions.
- ENGG1810: Introduction to Engineering Computing — 2024 - 2025
  Part of course redesign team revitalising core first year programming unit for all engineering streams. Developed course material on applied optimisation for dynamics, planning and decision-making.

Lecturing:

- MECH5720: Sensors and Signals, Guest Lecturer, Sem 2 — 2026
  Lecture on coded aperture imaging and guest lecture on radiance-based methods for scene representation.
- MTRX5700: Experimental Robotics, Guest Lecturer, Sem 1 — 2023
  Lecture on robot arm kinematics and the DH convention to senior undergraduate and masters level students.

Tutoring (US TA equiv.):

- MECH5720: Sensors and Signals, Tutor, Sem 2 — 2026
  Tutor for newly developed course on computational imaging and sensing.
- AMME3500: System Dynamics and Control, Tutor, Sem 1 — 2022 - 2026
  Taught state-space and frequency based control system design, system identification.
  Rating: 4.6/5.0 2025, 4.4/5.0 2024, 4.5/5.0 2023, 4.4/5.0 2022
- ENGG1810: Introduction to Engineering Computing, Teaching Lead in Tutorial Activities, Sem 1 — 2025
  Senior tutor coordinating teaching team of 26 staff during first iteration after redesign.
- AERO3760: Space Engineering 2, Tutor, Sem 2 — 2023 - 2024
  Assisted course redesign with focus on remote sensing.
  Rating: 4.4/5.0 2024, 4.3/5.0 2023
- MTRX5700: Experimental Robotics, Tutor & Guest Lecturer, Sem 1 — 2022 - 2024
  Developed assignments on real robotic subsystems and presented lectures on Kinematics & Dynamics.
  Rating: 4.7/5.0 2024, 4.5/5.0 2023, 4.6/5.0 2022
- AERO2705: Space Engineering 1, Tutor, Sem 2 — 2023
  Half semester teaching basic orbital mechanics.
- MTRX3760: Mechatronic System Design, Tutor, Sem 2 — 2022
  Redesigned student/hardware interfacing and taught C++/ROS applied to mechatronic systems.
  Rating: 4.2/5.0 2022
- MTRX1701: Introduction to Mechatronics Engineering, Lab Demonstrator, Sem 1 — 2022
  Conducted introductory soldering and electronics laboratories.
- AMME2262: Thermal Engineering 1, Tutor/Lab Demonstrator, Sem 2 — 2020
  Taught introductory thermal engineering and conducted refrigeration cycle laboratories.
  Rating: 4.5/5.0 2020

- ENGD1000: Building a Sustainable World, Tutor/Head Tutor, Sem 1 — 2019 - 2020
  Developed assignments and taught sustainable engineering practices in a multi-disciplinary class.
  Rating: 4.6/5.0 2020, 4.6/5.0 2019

Supervision:

- Co-supervisor to undergraduate vacation research interns — 2025 - Present
- Co-supervisor to mechatronics engineering honours project in computer vision — 2025 - 2026
- Co-supervisor to Stanford Cardinal Quarter Fellowship Student — July - Sept 2025
- Aux. supervisor to undergraduate vacation research interns — 2023 - 2025
- Aux. supervisor to 2 mechatronics engineering honours projects on Neural Radiance Fields — 2023

Professional and Leadership Development:

- Emerging Leaders Network, Australian Academy of Technological Sciences & Engineering (ATSE) — 2026
- Future Faculty Program, Eberly Centre, Carnegie Mellon University — 2025
- Faculty of Engineering Tutor Training, The University of Sydney — 2019

ACADEMIC SERVICE, OUTREACH & MEMBERSHIPS

Review

- IEEE/CVF Winter Applications of Computer Vision (WACV) — 2025, 2026
- IEEE Robotics and Automation Letters (RA-L) — 2025
- ACM SIGGRAPH — 2024
- IEEE International Conference on Robotics and Automation (ICRA) — 2023, 2024
- RoboNerF, IEEE ICRA Workshop — 2024
- Neural Fields across Fields, ICLR Workshop — 2023

Conference

- Organiser, Emerging Tech for Autonomous On-Orbit Servicing, 76th Int. Astro. Congress (IAC) — 2025
- Session Chair, University of Sydney Engineering HDR Student Conference — 2024
- Organiser, University of Sydney Engineering HDR Student Conference — 2022, 2023

Workshops

- Student Social Convener, Australian School of Robotic Systems (AuSRoS) — July 2024
- Tutor, Robotic Vision Summer School (RVSS) — Feb 2024

Professional Memberships

- Graduate Member, Institute of Engineers Australia (GradIEAust) — 2017 - Present
- Member, Australian Institute of Physics (MAIP) — 2020 - Present
- Student Member, SPIE — 2022 - Present
- Student Member, IEEE & IEEE Robotics and Automation Society — 2022 - Present
- Member, ACM SIGGRAPH — 2023 - Present
- Student Member, OPTICA & ANZOS — 2025 - Present

Community and Outreach

- Volunteer, 19th Australian Space Forum — July 2026
- Lab Tour Presenter, Robotics: Science & Systems (RSS) — July 2026
- HDR Rep., Centre Life and Research Education Committee, Australian Centre for Robotics — 2022 - 2025

- HDR Rep., Work, Health and Safety Committee, Australian Centre for Robotics 2023 - 2025
- ACFR/AMME Representative, Faculty of Engineering HDR Research Education Committee 2023 - 2025
- Speaker, Australian Virtual Astronaut (AVA) Challenge Apr 2025
- Keynote Speaker, High Achiever's Lunch, University of Sydney Info Day Dec 2024
- Mentor, NSW Higher School Certificate (HSC) Science Extension 2024
- President/Treasurer, Postgraduate Research in Engineering Student Society (PRESS) 2022 - 2024
- Microteaching Workshop Facilitator, Faculty of Engineering Tutor Training 2022 - 2024
- Houseparent & Mentor, Indigenous Australian Engineering Summer School (IAES) and Winter Workshop 2018 - 2024
- Student Volunteer, SIGGRAPH Asia Dec 2023
- Panel Member, Advance.org NextGen Program May 2023
- Ambassador, NSW Department of Education Computing Technologies Syllabi 2023
- TurtleBot3 Fleet Upgrade Lead, deployed to fleet of 35 teaching robots Nov 2022 - Feb 2023
- Invited to demonstrate remote sensing prototype at Vice-Chancellor's Reception, USYD Nov 2022
- Contributer, KPMG and AmCham Australia report series: *A Prosperous Future* 2022
- Engineering Outreach Facilitator, Designed/led activities at Eng. Aus. Programs, NSW schools 2018 - 2025
- USyd STEM Outreach Trip to Cambodia and Vietnam Nov - Dec 2019
- President/Treasurer, USyd Mechanical Undergraduate Society (MUGS) 2018 - 2019
- Vice-President/Treasurer, USyd Physics Society (PhySoc) 2018 - 2019

VISITS

- Carnegie Mellon University Computational Imaging Group/Robotics Institute, PA, USA July 2025 - Feb 2026
- Universität Siegen Computational Imaging Group, NRW, Germany June 2023

FIELDWORK

- MV Cape Don, July 2025: Deployment of Boston Dynamics Spot for asset management; imaging for 3D reconstruction, robot operation and support

MEDIA COVERAGE

- *SpaceNews*, Big data, advanced algorithms and new approaches for space missions, Oct 2024
- *Australia in Space TV*, "Intelligent Space: Big Data, Advanced Algorithms, and Autonomous Robotics in Space", Oct 2024

SKILLS

Computer Skills C++, MATLAB, SimuLink, LaTeX and Python proficiency. Intermediate ROS skills. Experienced in Computer Vision (OpenCV, Open3D, COLMAP), Machine/Deep Learning (JAX, Pytorch) and Optimisation (Ceres Solver, Eigen, OR-Tools). Basic CUDA skills.

Engineering Skills	High DS Solidworks, Autodesk Inventor and ANSYS skills. Extensive manufacturing and rapid prototyping experience. Experience in optomechanical and optical system design, mechanical system design and analysis (thermal, vibration and structural), space system design & analysis.
Courses	RPA Operator Accreditation - Civil Aviation Safety Authority (CASA), TV Presenting Techniques - National Institute of Dramatic Art (NIDA), NextGen Program (Global Australians), First Aid Certificate
Languages	English - Native Speaker, German - Limited Working Proficiency, French - Basic

REFEREES

Available on request.