Toby Luke Anderson

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RESEARCH & ENGINEERING INTERESTS

- Autonomous systems and long-horizon autonomy
- Constraint-based planning and optimisation
- Modular system architecture and engineering design
- Space and extreme-environment systems
- Embedded systems and robotics

EDUCATION

Monash University, Clayton, VIC
Bachelor of Engineering (Honours) / Bachelor of Science
Specialisation: **Robotics & Mechatronics Engineering (AI)** and **Physics (Astrophysics focus)**
March 2025 – March 2030 *(ongoing)*

RESEARCH & ENGINEERING EXPERIENCE

Autonomous Systems Team Member — Monash Nova Rover

September 2025 – Present

Developing and testing autonomous navigation and perception systems for a competitive planetary rover platform.

- Designed and evaluated autonomous navigation pipelines including sensor fusion using LiDAR, stereo cameras (ZED), and IMU data
- Implemented path planning and obstacle avoidance algorithms under real-time constraints
- Developed computer vision modules for object detection, classification, and localisation
- Integrated C++ and Python software modules within the ROS2 framework for deployment on physical rover hardware
- Collaborated within a multidisciplinary engineering team to debug and validate system-level behaviour under competition constraints

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Independent Research Engineer — Standard Template Construct (STC)

January 2025 – Present

Designing a modular research framework for autonomous infrastructure planning and long-horizon system reasoning in resource-constrained and extreme environments.

- Developed abstractions for missions, environments, agents, and modules to support constraint-based planning and validation
- Designed simulation, planning, and verification tools to evaluate system feasibility under environmental and resource constraints
- Investigated trade-offs between human labour, robotic systems, and automation within autonomous infrastructure models
- Applied robotics, AI, and physics-based reasoning to planetary and remote infrastructure scenarios
- Conducted research-driven system design prioritising correctness, modularity, and maintainability over deployment or scale

This project serves as a unifying framework for multiple autonomous systems subprojects, including planetary surface analysis and autonomous construction planning.

Research Team Member (Medical Device Feasibility) — Melbourne Bio Innovation Student Initiative (MBSI)

August 2025 – October 2025

Member of a multidisciplinary student research team conducting early-stage concept development and technical feasibility analysis for a proposed chronic kidney disease (CKD) diagnostic system.

- Conducted technical research into embedded systems, AI-based analysis, and spectroscopy as candidate technologies for early-stage CKD detection
- Contributed to system-level concept design and feasibility evaluation rather than prototype development
- Performed literature review, technical validation checks, and integration analysis to support competition readiness
- Collaborated with students from medicine, biotechnology, and engineering to align technical concepts with clinical and regulatory constraints

The project culminated in a formal technical and business presentation delivered to industry professionals in the biotechnology and medical technology sectors.

TECHNICAL SKILLS

Programming & Software

- Python, C++
- ROS2
- Git, Linux
- Machine learning frameworks (introductory)

Robotics & Embedded Systems

- Arduino, Raspberry Pi
- Sensors and actuators
- Control systems
- Embedded system integration

Modelling & Analysis

- Constraint modelling
- Simulation environments
- System architecture design
- Data analysis

PROJECTS

Standard Template Construct (STC)

Independent Research Project — Autonomous Systems & Infrastructure Planning

A long-term research project investigating how autonomous systems can reason about **missions, environments, constraints, resources, and objectives** to synthesise viable infrastructure and operational plans in extreme or uncertain environments.

The project focuses on architectural and theoretical questions rather than deployment, including:

- Formal representation of missions, environments, agents, and modules
- Separation of planning, validation, and optimisation layers
- Constraint-based reasoning under uncertainty
- Trade-offs between human labour, robotic systems, and automation
- Long-lived system design, maintainability, and failure tolerance
- Modularity and extensibility of system components

Current work emphasises simulation, abstraction design, and system correctness over performance or scale.

PRESENTATIONS & COMPETITIONS

Melbourne Biodesign Competition — Research Team Member

Medical Device Feasibility Study (CKD Diagnostics)

Contributed to early-stage technical and system-level feasibility analysis for a proposed CKD diagnostic approach.

- Developed and presented a system concept addressing limitations in current CKD screening methods
- Explored the use of AI and machine learning to analyse data from paper microfluidic assays
- Participated in a final presentation to industry professionals from biotechnology and medical technology sectors

Selected presentation slides available upon request.

AFFILIATIONS & ACTIVITIES

- Monash Nova Rover
- Monash Engineering Students Society
- Engineers Australia

REFERENCES

Available upon request