Calvin Joyce

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Objective

Medical robotics R&D / New Product Development internship, **available Jan–Sep 2027**. Graduate researcher under **Prof. Michael C. Yip** (UCSD ARCLab); *Nature* co-author and 5× first author (ICRA, ISRR). Focusing on autonomy, controls, and learning for patient-contact robots, grounded in years of building the hardware myself, deploying on and improving real systems.

Education

University of California, San Diego · B.S. & M.S. Mechanical Engineering, GPA 3.8/4.0 *B.S. 2024 · M.S. expected June 2027*

Relevant coursework: Robotics, Haptics, Soft Robotics, Linear Control, Mechanical Design, Experimental Techniques

Skills

- **Medical Robotics & pHRI:** haptics & bilateral teleoperation, catheter/continuum robots, clinical safety thresholds, OptiTrack
- **Software & Control:** Python, C++, MATLAB, PyTorch, ROS 2; imitation learning (ACT), PPO, MPPI; NVIDIA Warp/Newton
- **Hardware:** SolidWorks + FEA, Fusion 360, DFMA, resin/FDM printing, laser cutting; design requirements & acceptance criteria, verification testing, test fixtures, capstan drives, motor drivers, sensors

Research & Work Experience

Advanced Robotics and Controls Lab (ARCLab), UC San Diego *June 2021 – Present*

R&D Engineer / Graduate Student Researcher, previously Undergraduate Researcher · Advisor: Prof. Michael C. Yip La Jolla, CA

- **PHABS (Portable Haptic Assisted Bimanual System)** **Project lead; first author, ICRA 2027 submission**
  - Attacking the force-blindness of video, simulation, and position-only teleoperation data, by capturing force-annotated bimanual demonstrations that anchor imitation-learning corpora.
  - Invented the first handheld bimanual device to render the internal force between two hands on a shared object, the signal that decides crushing, slipping, or tearing, by pairing capstan-driven pinch actuators with a gimbal-motor squeeze stage.
  - Closed the bilateral teleoperation loop on an Anvil OpenArm dual-arm robot, by mapping gravity-compensated joint effort through the manipulator Jacobian into per-hand pinch and signed inter-hand force channels.
  - Now training ACT policies on matched haptic vs. no-haptic demonstrations across three contact-rich bimanual tasks; verified force-rendering fidelity against a reference load cell.
- **RIC (Robotic Infant Care)** — *first framework for direct robotic infant handling* **Project lead; first author, ICRA 2027 submission**
  - Defining safe robotic care for the NICU's most frequent physical interventions: bimanual infant pickup and CPAP nasal-mask repositioning, contact-rich tasks no robotic system has performed on a physical infant.
  - Formalized the safety bar, by deriving continuously measurable clinical thresholds with four NICU clinicians: cervical pitch and head acceleration for pickup; contact pressure, eye/mouth exclusion zones, and a PEEP-interruption time budget for CPAP.
  - Benchmarking direct-human, teleoperated, and autonomous (ACT) execution on a Unitree G1 humanoid, by building a manikin OptiTrack pipeline and a pressure-sensing molded CPAP mask, with every trial verified against the clinical thresholds.
- **Humanoid Surgery** *(video)* · *in vivo feasibility of humanoid robots in laparoscopic surgery* **Co-author, *Nature* 2026**
  - Enabled humanoid robots to operate standard medical tools in dry-lab and in vivo porcine surgeries, by designing the tool-mount system (optimized mass/CoM, bench- and sim-validated rigidity) and running mechanical setup for every surgical session.
  - Coordinated a 10-person robot–clinician team through live surgeries, turning surgeon feedback into hardware revisions.
- **Autonomous Catheter Navigation** — *early-stage ARPA-H & DARPA project; RL for endovascular robotics* **Jul 2026 – Present**
  - Developing autonomous catheter steering in simulation, by training PPO policies with domain randomization in GPU-physics models of patient-derived vasculature; early policies outperform the project's prior baseline.
  - Made sampling-based MPC tractable in simulation, by building state snapshot/restore for the GPU catheter-physics solver.
  - Built three catheter simulation demos for Newton, an open-source physics engine from NVIDIA, DeepMind, and Disney.
- **Mentorship:** 16+ students across lab projects, through CAD/FEA design reviews, DFMA, fixture design, and test plans.

ArtemisAI Labs · *Mechanical Engineer, La Jolla, CA* *Jan 2026 – Present*

- Made a NICU bedside camera mount clinically deployable, by writing its load, retention, and cleanability requirements (rough-handling loads benchmarked against the IEC 60601-1 instability test; no-disassembly hydrogen-peroxide wipe-down) and redesigning it against them with low-cost, manufacturable, and COTS components.
- Reached the bedside: the mount fields the cameras for NOVA, ArtemisAI's Phase II trial of computer-vision neurological monitoring of newborns at Mount Sinai; lining up assembly partners to kit and ship units to purchasing hospitals.

Triton Robotics, UC San Diego · *Team President / Advisor* *June 2020 – June 2023*

- Scaled the team 20→80+ members and diversity 15%→35%+, by formalizing onboarding, DEI partnerships, and targeted recruiting.
- Ran a 17-lead organization with OKRs, roadmaps, and stand-ups, by founding business, marketing, and project-development teams; obtained national nonprofit status, $3K in funding, and permanent lab space.

Selected Research Projects

- **Haptic Shoulder** (paper) — *pHRI phantom; co-first author, ICRA 2025; provisional patent* Jan 2024 – June 2024
  Invented a biomechanically accurate shoulder phantom for safe pHRI testing, by dedicating one motor-encoder module to each anatomical DOF to reproduce joint center, coupled kinematics, and configuration-dependent range of motion.
- **ARCSnake V2** (paper) — *amphibious screw-propelled snake robot, w/ NASA JPL; IROS 2026* June 2021 – Sep 2025
  Increased screw output torque 40% by raising the torque ratio, aligning the belt drive, and cutting friction (shorter drive stack, relieved rubbing surfaces); engineered the mobile testbed that characterized screw performance across media (co-first author, ICRA 2023); designed NASU, the first Archimedes screw with reconfigurable angle of attack (first author, ISRR 2024).

Publications (Google Scholar)

- ***Nature* 2026 (co-author):** "In vivo feasibility study of humanoid robots in surgery"
- **ICRA 2027 submission (first author):** "PHABS (Portable Haptic Assisted Bimanual System) for Force-Annotated Bimanual Teleoperated Data"
- **ICRA 2027 submission (first author):** "How Safe Is Robotic Infant Handling? Benchmarking Learning from Demonstration Against Clinical Thresholds for Neonatal Pickup and CPAP Mask Repositioning"
- **ICRA 2025 (co-first author):** "Haptic Shoulder for Rendering Biomechanically Accurate Joint Limits for Human-Robot Physical Interactions"
- **ISRR 2024 (first author):** "NASU — Novel Actuating Screw Unit: Origami-Inspired Screw-Based Propulsion on Mobile Ground Robots"
- **ICRA 2023 (co-first author):** "Mobility Analysis of Screw-Based Locomotion and Propulsion in Various Media"
- **Additional:** "Humanoids in Hospitals" (arXiv 2025, co-2nd author); "LapSurgie" (ICRA 2026); "ARCSnake V2" (IROS 2026)