

James Isaac Kay

Perception & Edge-Autonomy Software Engineer

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Summary

Perception and edge-AI engineer who builds real-time detection, sensor-fusion and video-timing systems on embedded NVIDIA hardware. Part 107 pilot-in-command and co-author of the vision and UAV precision-landing systems for Embry-Riddle's Team Minion (1st of 20 international teams, 2022 Maritime RobotX Challenge; Best Technical Design Report, 2024). Founder of MOAT Safety; built its dashcam plate-recognition research prototype across 13 tagged prototype releases on a ~\$600 Jetson node. M.S. ECE candidate (Nov 2026).

Experience

Jul 2025 - Present **Founder & Lead Engineer, MOAT Safety**, Texas, registered 2026

- Architected and built a research-prototype edge license-plate-recognition system that checks dashcam video only against official public alert feeds (such as AMBER, Silver and Endangered Missing) on a ~\$600 NVIDIA Jetson Orin Nano node.
- Built a 9-service DeepStream/Savant pipeline - YOLOv8n → LPDNet → NvTracker → LPRNet (TensorRT FP16) - with ZeroMQ IPC, multi-camera routing, ± 2 s evidence-clip extraction (~2.8 s match-to-evidence) and opt-in training-data capture; 28-33 fps offline at 1080p.
- Cut duplicate reads $\sim 1000\times$ (2,286 raw plate reads → 1 event) with track-keyed deduplication; reconciled 358 raw state alerts into 200 canonical cases with an email-ingest + OCR pipeline (getmail6/IMAP, PyTesseract).
- Ran a disciplined release process: 13 tagged prototype releases in 17 days, each gated by automated ship tests (300+ pytest and bash smoke tests) with recorded evidence; 41 design/plan documents, 35 recorded design decisions, 31 plan errors caught by pre-build reconnaissance.
- Instrumented with OpenTelemetry → Loki/Tempo/Prometheus → Grafana; root-caused a ~ 10 fps live-throughput ceiling under multi-container load and scoped the optimization.
- In progress: building the opt-in civilian deployment path (dashcam + edge node over the driver's cellular hotspot; a human reviewer confirms every match before anyone is contacted, never automatic notification) and a serverless cloud tier (SQS → Lambda → PostgreSQL; API Gateway + S3 presigned URLs for evidence retrieval).

Jun 2025 - Present **Freelance Drone Operator & CV Engineer, Plantex Equipment**, remote

- Aerial photogrammetry and 3D modeling of industrial plants; orthomosaic stitching and image-based defect analysis for equipment audits; Part 107 flight operations.

Aug 2023 - Present **Graduate Researcher, AI & Autonomy, Embry-Riddle Aeronautical University**, Daytona Beach FL

Thesis: "Distributed Edge ALPR System Using Savant Framework: Low-Cost Architecture for AMBER Alert Detection via Wireless Dash Camera" (defense Nov 2026).

- Built ~ 13 K-image annotated driving datasets (Supervisely) and trained a custom YOLOv8 vehicle detector; evaluated it against NVIDIA's pretrained TAO models and adopted YOLOv8n + LPDNet/LPRNet (TensorRT FP16), redirecting effort to the edge-system architecture.
- Developed a hyperbola-based anisotropic undistortion method for wide-angle dashcam lenses; ChArUco calibration at ~ 0.5 px reprojection error.
- In progress: designing the distributed multi-node edge architecture, and modeling the projected camera-frustum geometry against the detection/recognition/identification pixel-density criteria of IEC/EN 62676-4:2025 (successor to DORI) to set resolution, mounting and range envelopes; Monte Carlo simulation of alert-to-response timelines.
- Teaching Assistant, Mechanical Engineering (Aug 2023 - Present): mentor 27+ seniors across six capstone robotics teams (RoboBoat, EcoCAR, VTOL UAV, quadruped, soft robot) on requirements (INCOSE), safety, design reviews and technical reporting.
- Graduate Research Assistant, Embry-Riddle Biomechanical Analysis Lab (Dr. Christine Walck) (Spring 2024): measured intraocular and blood pressure on human subjects during head-down-tilt and lower-body-negative-pressure trials in an IRB-approved spaceflight-analog study of Spaceflight-Associated Neuro-ocular Syndrome (SANS); the study was published in Aerospace Medicine and Human Performance (2026).

Sep 2022 - Sep 2025 **UAV/ASV Software Engineer & Pilot-in-Command, Team Minion, ERAU RobotX**
sponsors incl. ONR, Northrop Grumman, Yamaha

- Built GStreamer pipelines in C and Python (RTSP/RTP from the camera-enclosure Jetson) that stamp each frame's capture time into the H.264 stream (SEI NAL units + RTP header extensions) and publish it in ROS; field tests measured ~ 110 -120 ms video transport latency and a ~ 35 s inter-host clock offset, closed with chrony/NTP - replacing the constant-offset alignment that failed in rapid turns and enabling camera-LiDAR fusion at > 15 fps underway.
- Co-developed the Minion WAM-V vision system with the perception lead: 3× Livox LiDAR, 3× 4K cameras and a Sony IMX490 HDR camera on a Jetson AGX Xavier covering 160° of the bow; LiDAR-to-camera ROI projection with color classification.

- FAA Part 107 pilot-in-command for all autonomous flight tests under Safety-Review-Board-approved SOPs; co-developed vision-based UAV precision landing (rule-based detection + PX4/MAVROS velocity control) at 16.23 cm average error. In 2022, built a 5 kg quadcopter (Tarot 680 Pro, Pixhawk) that took off from and landed autonomously on the WAM-V after an over-water task.
- Co-developed multi-mode PID and inverse-kinematic thrust allocation for the over-actuated WAM-V (azimuthing thrusters) and designed a custom PCB for the azimuthing motor-control pods; migrated Minion and the UAV from ROS 1 (Noetic) to ROS 2 in C++ and Python.
- Validated control and vision in SITL/HITL simulation (Gazebo VRX) and on-water tests; coordinated 2024 logistics (sponsor/vendor resources, hardware shipping) through vehicle inspection.

Jun 2019 - Jul 2021

Application Engineer / Junior Systems Architect (Mar 2020 - Jul 2021); Robotics Software Engineer Intern (Jun 2019 - Mar 2020), Unique Software Development, Dallas TX

- Project Lead for the MakerCause COVID-19 PPE program: led the company's print farm (116 FDM + 2 SLA printers) producing 30,000+ reusable masks - a Montana Mask variant with improved breathability and rigidity - donated to UT Southwestern, Medical City, Parkland and other DFW facilities through the company's MakerCause initiative (2020).
- Rapid-prototyped 160 PEEP valves in biocompatible resin for UT Dallas Bioengineering / UT Southwestern to return ventilators to service, plus nasopharyngeal swab prototypes.
- Built a prototype autonomous survey boat for SimpleUnmanned (sonar + down-imaging) that mapped lake beds and computed volumetrics without GPS.

Projects

2023 **RANGER - Vision-Guided Autonomous Coilgun Turret**, *Principal Engineer, graduate mechatronics project*

- Architected propulsion, perception and actuation subsystems; 350 V / 4,700 μ F capacitor bank (≈ 288 J) with SCR switching and high-voltage isolation.
- Python/OpenCV target tracking (HSV masking, morphology, circularity > 0.8 , moment centroids) driving dual-axis stepper control via multiprocessing; MATLAB GUI.
- Measured 16.8 ± 0.2 m/s muzzle velocity over 20 trials; hits within tolerance at 5, 15 and 20 ft; authored requirements, high-voltage safety SOP and operations manual.

Publications

- Nov 2024 • I. Kay (with D. Lane, E. Coyle), "Vision System," and I. Kay (with M. Abe, S. Sarkar, R. Vinnakota, E. Coyle), "UAV Precision Landing Using Image Recognition and Control," Apps. D-E in A. Lachguar et al., "Minion: Design and Competition Strategy for the 2024 Maritime RobotX Challenge," RoboNation Technical Design Report, 2024 - Best Technical Design Report.
- Nov 2022 • D. Holland, ..., J. Kay, ..., "Design of the Minion Research Platform for the 2022 Maritime RobotX Challenge," RoboNation Technical Design Report, 2022.

Education

expected Nov 2026 **M.S., Electrical & Computer Engineering**, Embry-Riddle Aeronautical University

May 2022 **B.S., Applied Mathematics**, Southern Methodist University

Certifications & Awards

- Jun 2025 • Passed NCEES FE - Electrical & Computer
- Nov 2024 • 2024 Maritime RobotX Challenge - 3rd place overall; Best Technical Design Report; 2nd, Design Documentation; Technical Innovation Award (team)
- Aug 2023 • SDI Open Water Scuba Diver (#1434296)
- Nov 2022 • 2022 Maritime RobotX Challenge - 1st place overall (20 international teams, Sydney)
- Oct 2022 • FAA Part 107 Remote Pilot
- Aug 2020 • Udacity Robotics Software Engineer Nanodegree

Skills

- Languages • Python, C/C++ (GStreamer, ROS 2), Bash, MATLAB, SQL
- Perception & ML • DeepStream, Savant, TensorRT (FP16), YOLOv8, NVIDIA TAO (LPDNet/LPRNet), OpenCV, PyTorch, camera calibration (fisheye, anisotropic), LiDAR-camera fusion, OCR
- Controls & Autonomy • PID / multi-mode PID, LQR / adaptive LQR, inverse-kinematic thrust allocation, ROS / ROS 2, PX4 / MAVROS / MAVLink, Gazebo (SITL/HITL)
- Systems • NVIDIA Jetson (Orin Nano, AGX Xavier), Linux, Docker / Compose, systemd, ZeroMQ, GStreamer (RTSP/RTP, SEI), chrony/NTP, OpenTelemetry, Prometheus / Loki / Grafana, Git