MATTHEW MANGANO
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EXPERIENCE

Aerospace Control Dynamics, Cincinnati, OH

Simulation, Controls, and Software Engineer | August 2012 - Present

- Developed 6-DOF simulations in the Simulink environment for multiple aircraft companies.
- Control design of multi-rotor EVTOL craft.
- Developed control algorithm for an autonomous R44 helicopter.
- Construction of fully functional 6-DOF simulations using dSPACE and Speedgoat/MathWorks platforms.
- Developed tools for DO-178 certification testing and test case development.
- Designed linear and nonlinear closed-loop systems for rotary and fixed-wing aircraft.
- Conducted margin analysis, performance prediction, and handling qualities estimation.
- Integrated hardware using ARINC-429, RS-422/485, AFDX, and TCP/IP.
- Built real-time hardware-in-the-loop labs with DSpace, FlightLab, ADI, and custom software.
- Developed and documented simulation standards, user interfaces, and recording systems.
- Consulting for Gulfstream, Moog, Embrear, Cessna, Honda Aircraft, and more.
- Expert in multi-axis 6DOF system modeling, sensor fusion, and simulation automation.
- Created a graphical control law tool for rapid prototyping.
- Created a graphical flight dynamics analysis tool.

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- Development of control law algorithms for an electric short takeoff and landing aircraft.
- Large scale VLM aerodynamic modeling via cloud computing.
- Requirements development and control law algorithm design.
- Developed a 6-DOF simulation in the Simulink environment.
- Developed a full aircraft simulation including the 6-DOF model, control laws, and sensor models.

- Introduced an agentic dev loop that generated Simulink/MATLAB scaffolds and Python glue from natural-language specs, cutting boilerplate and rework; integrated with MATLAB Engine to auto-sanity-check models before PRs.
- Implemented an LLM-assisted test authoring flow that converted requirements into parameterized test vectors and assertions for DO-178-style verification, stored as versioned artifacts in CI.

BELCAN CORPORATION, Cincinnati, OH

Controls Engineer | March 2008 - 2012

- Developed and certified software for General Electric Aircraft Engines.
- Managed DOORS database for requirements traceability.
- Led upgrade of engine monitoring systems to new MATLAB/Simulink versions.
- Built verification tools and monitoring/control algorithms to meet DO-178 standards.

GULFSTREAM AEROSPACE, Savannah, GA

Flight Control Engineer II | May 2006 – March 2008

- Designed and tested full-feedback flight control laws and 6-DOF simulation models.
- Built a seamless Simulink simulator for desktop and lab environments with real-time capabilities.

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- Conducted pilot-in-the-loop simulation with visual displays and control loaders.
- Developed reusable flight quality analysis tools and participated in advanced flight control research.

NATIONAL AIR AND SPACE INTELLIGENCE CENTER, Dayton, OH

Aerospace Engineering Co-op | June 2004 - Sept. 2005

Created threat simulators and integrated component models with the FLAMES architecture.

- Contributed to a Combat Effectiveness Intelligence report.

AIR FORCE RESEARCH LABORATORY, Dayton, OH Aerospace

Engineering Co-op | Jan. 2003 - Mar. 2004

- Conducted CFD simulations on hypersonic vehicles.
- Studied vibration mitigation on F-18 vertical tails using piezo-electric actuators.

TECHNICAL SKILLS

- **Operating Systems**: Proxmox, Arch Linux, Debian, Ubuntu, Gentoo, NixOS, Talos Linux
- **Cloud & Virtualization**: Kubernetes, Docker, OpenStack, Proxmox, VMware, Incus, AWS, GCP, Oracle Cloud
- **Networking & Security**: Open vSwitch (OVS), OVN, WireGuard, BGP, VLANs, Ceph networking
- **Infrastructure & Storage**: Ceph, ZFS, Btrfs, RAID, LVM, PXE boot, NAS/SAN, iSCSI
- **Automation & DevOps**: Terraform, Ansible, systemd, GitLab CI/CD, Bash, Python
- **Kernel & Performance**: eBPF, Kernel tuning, Real-time Linux, RSTP loop setups

- **Programming & Scripting**: Python, Rust, Zig, Go, C, C++, Bash, Perl, MATLAB
- **Software Development**: Embedded systems, real-time applications, control systems, infrastructure automation
- **Monitoring & Logging**: Prometheus, Grafana, Wireshark
- **Simulation & Control**: MATLAB, Simulink, Stateflow, FlightLab, dSPACE, Speedgoat, ACD FLIGHTControl/Dynamics

  Tools: DOORS, Visual Studio, MS Office, Tecplot, Gridgen, Mathematica, AutoCAD, Catia
- **Real-Time Systems & Integration**: ARINC-429, AFDX, RS-422/485, TCP/IP, ADI Real-Time
- **Certifications**: Private Pilot License

AI & Agentic Coding

- Integrated LLMs into daily dev workflow to automate requirements → code → tests loops using OpenAI's tool-calling and structured outputs; enforced schema validation (pydantic), safe retries, and deterministic prompts to keep changes reviewable in Git.
- Built an "agentic" copilot for control-law tooling that plans multi-step tasks (retrieve context, generate MATLAB/Python stubs, create unit tests, and write docs), invokes MATLAB Engine from Python when needed, and opens PRs with CI checks.
- Created a lightweight code-aware RAG pipeline over internal repos (chunking, embeddings, semantic search with source citations) to ground generations for specs, migration notes, and API examples.
- Added LLM assistants to the toolchain: code review bot, doc summarizer, test-case generator, and migration helper (MATLAB UI → PySide6/QML), wired into GitHub/GitLab CI so outputs are validated before merge.

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Selected technologies: OpenAI API (Responses w/ tool-calling & structured outputs), Python, MATLAB Engine, PySide6/QML, FastAPI, pydantic, Typer CLIs, GitHub Actions/GitLab CI, Docker, Kubernetes, ArgoCD, vector search/RAG

ADDITIONAL TECHNICAL EXPERIENCE – HOME LAB

- Built and manage a private home lab data center with rack-mounted Dell R640/R730 servers.
- Deployed Kubernetes (including Talos Linux) and Proxmox clusters with automated provisioning via PXE boot.
- Configured real-time Linux environments and Ceph-based distributed storage with ZFS/NVMe tiers.
- Developed infrastructure-as-code with Ansible, Terraform, and Bash scripts.
- Built internal observability stacks using Prometheus, Grafana, and Wireshark.
- Integrated DNS management (Bind9, dnsmasq), WireGuard VPN, and VLAN-based networking with Open vSwitch.
- Created virtualized networks and lab environments for control simulation and remote access.
- Employed cloud resources (AWS, GCP, Oracle) for aerodynamic model computation and storage.
