Build, Launch, and Soar with Dronecode

The infrastructure ecosystem for the development of autonomous aerial robotics

Agenda

- About me
- What the hell is dronecode
- Timeline of our achievements
- Brief overview of the top level projects

📸 **Check me out later**

whoami

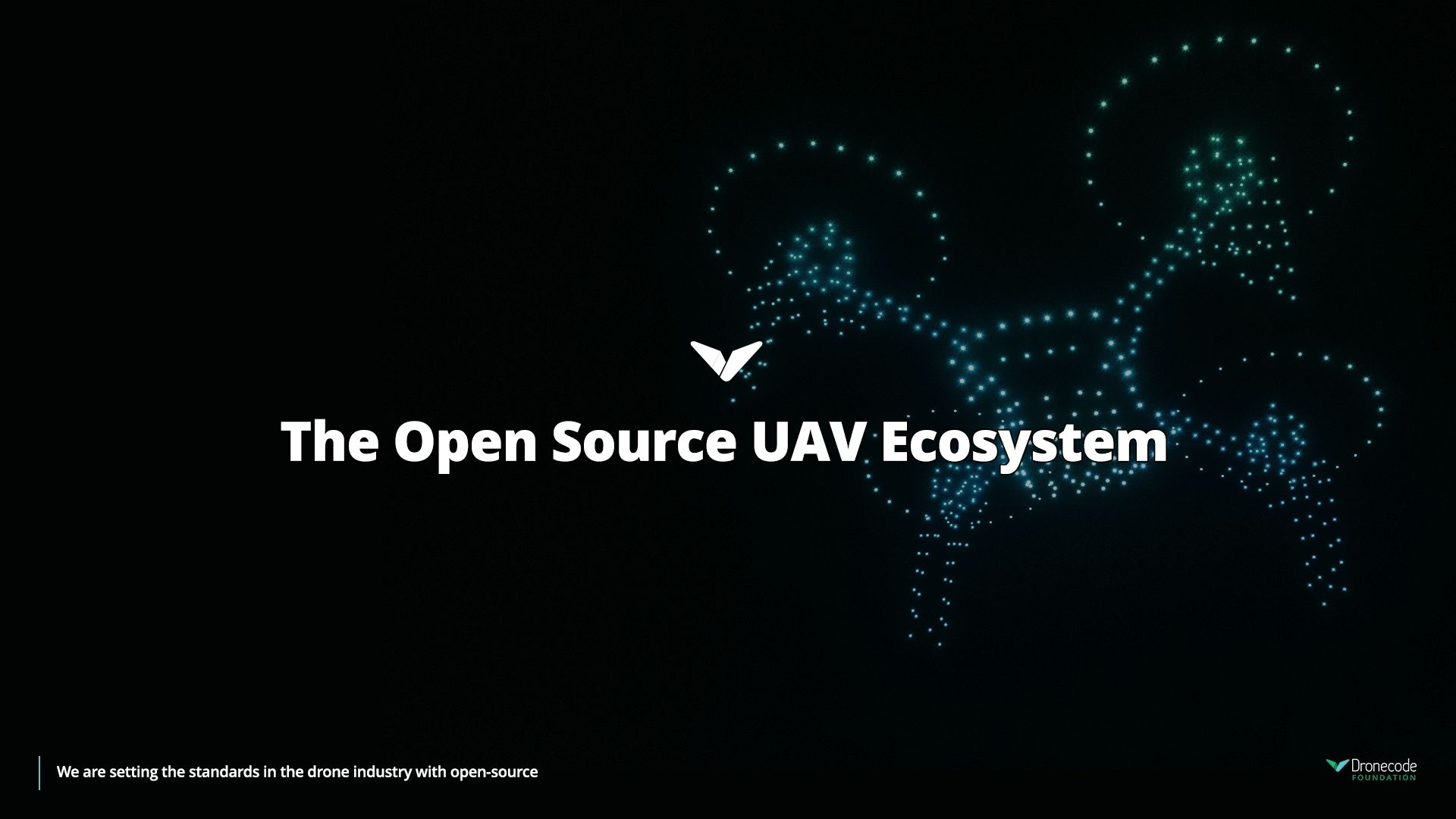
Ramón Roche
General Manager
Dronecode / Linux Foundation

(Still) an individual contributor

10+ years working in aerial robotics

Co-Lead ROS Aerial Robotics CWG

Co-Lead Space Grade Linux SIG



The Open Source UAV Ecosystem

We are setting the standards in the drone industry with open-source

Dronecode FOUNDATION

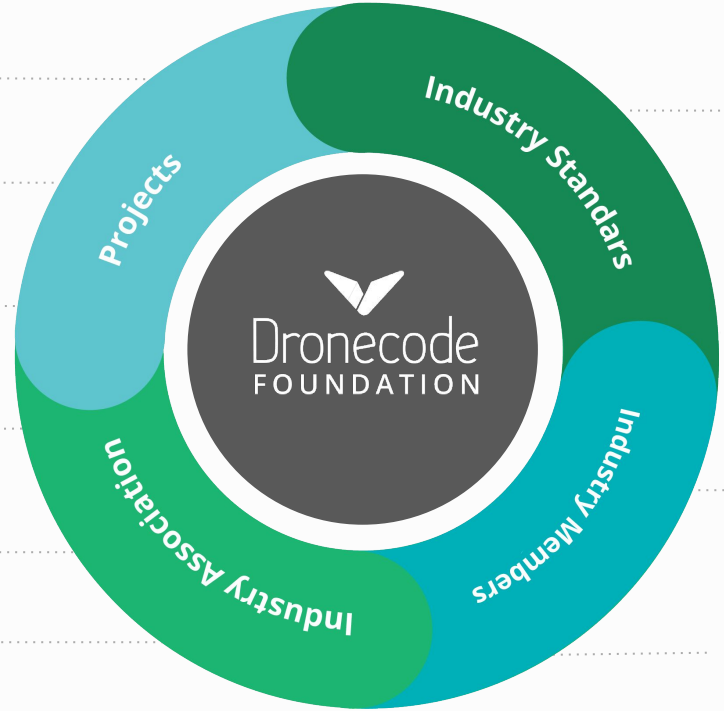
What the hell is Dronecode Foundation

The Dronecode Foundation, marked its 10th anniversary in 2024, we are part of the Linux Foundation.

In simple words, we are a non-profit formed to safeguard open source projects, promote collaboration, standardization, and support the commercial adoption of the open source projects.

- Neutral home for open source projects
- Promoting open collaboration
- Help set standards to accelerating innovation
- Supporting commercial and research use

The Dronecode Ecosystem



QGroundControl

MAVSDK

PX4 autopilot

OpenCV

THE LINUX FOUNDATION

open source robotics alliance

pixhawk

MAVLINK
MICRO AIR VEHICLE COMMUNICATION PROTOCOL

Auterion

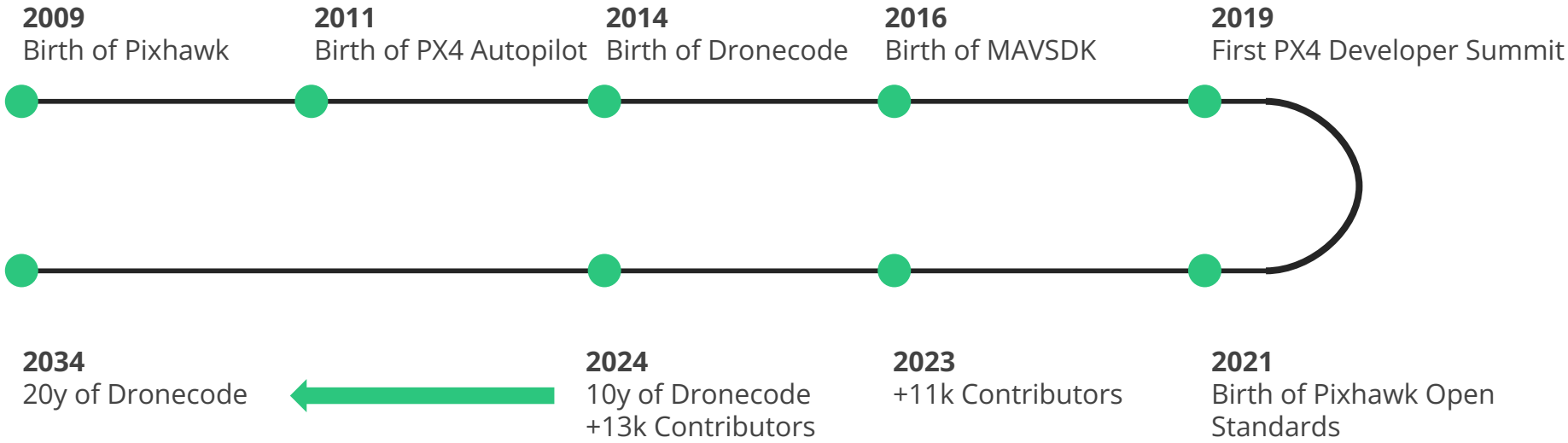
NXP

We are setting the standards in the drone industry with open-source

Member Community

These are the member companies that play an integral role in shaping the future of the industry.

Brief Timeline



Putting things into perspective

- $1B Project Value
- 59.72M Total Lines of Code
- 13,307 Total Unique Contributors

- 1,900 Contributors in 2024
- 100+ Git Repositories
- 20 Dronecode Members
- 5 Top-Level Open Source Projects


DroneUp
FAA
CERTIFIED
OPERATION
STAND CLEAR


wingtra

How are these varied applications possible?

PX4 Autopilot - ✅ The Answer

Autonomy Stack originally developed for Aerial Robotics, primarily Multi Rotors, over time extended to support Fixed-Wing, VTOL, and Over & Under Surface Vehicles.

Main Characteristics:

- Runs **realtime** on top of Apache NuttX RTOS
- **Modular** architecture with a **DDS-compatible middleware** (uORB)
- Modules are fully **parallelized**, and **thread safe**
- Great hardware support
- Support for custom builds, **trim what you don't need**
- More than **1M** vehicles using PX4
- More than **13k** developers

- **Flight Modes** provide a set of helpers to control autonomy
- **Flight Tasks** allowing developers to extend flight modes
- **Parameter** database exposing functionality back to users
- **Events interface** giving developers a system-wide API for notifications
- **Control allocation** translates thrust and torque commands into actuator commands which control motors and servos
  - Controllers do not require special handling for airframe geometry
- Native **ROS 2 Support** through DDS

PX4 Autopilot - Hardware Support

- Support for more than 80 boards from 30+ manufacturers
- Drivers for more than 100+ sensors
  - IMU, Baro, Actuators, GPS, INS, CAN, UWB... etc.
- Main Architectures Supported
  - STM32 - STMicro
  - iMX - NXP Semiconductors
  - RISCV-V

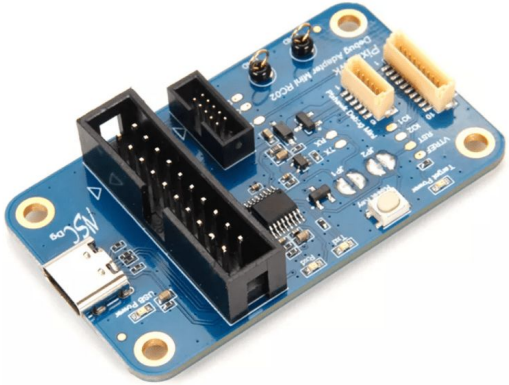
Pixhawk Hardware

Open Hardware & Open Standards

Started as a flight controller open hardware project with the first versions of Pixhawk’s

Evolved into an Open Standard for

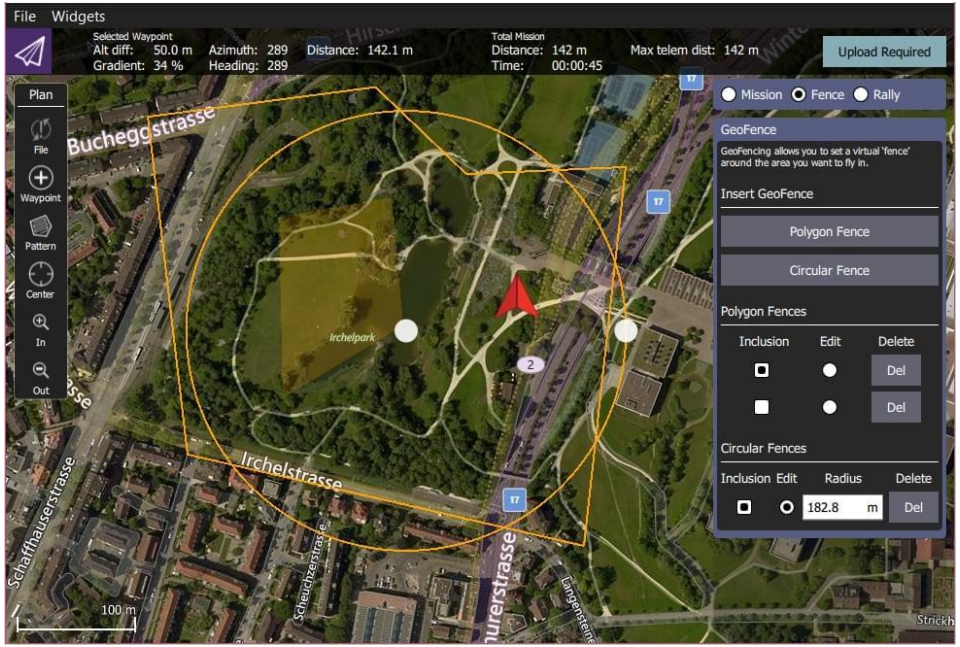
- Flight controllers
- Payloads (Gimbals)
- Smart Batteries
- Connectors
- Debuggers



PX4 Autopilot + QGroundControl - Autonomous Missions

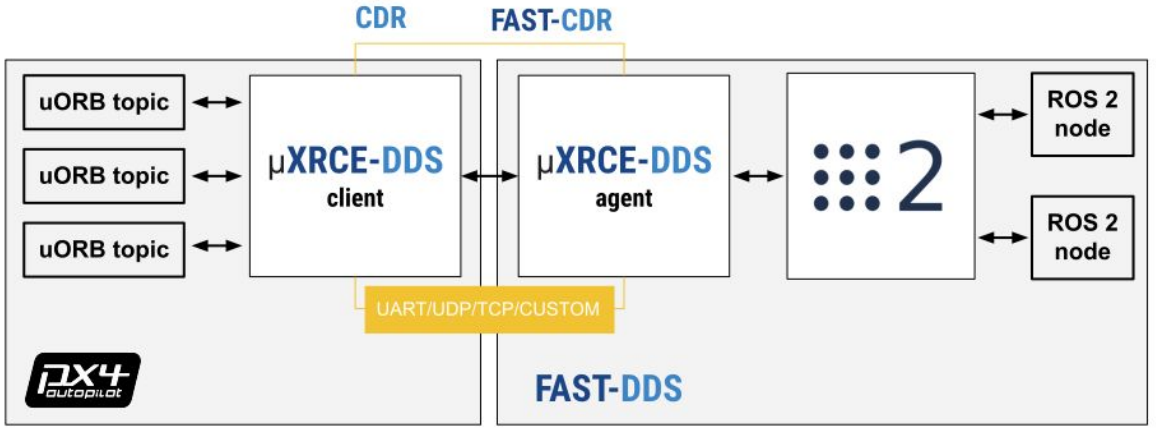
Define waypoints with customizable actions that allow you to control the behavior of vehicles.

Standardized mission protocol trough MAVLink



PX4 Autopilot - ROS 2 Support

- Thanks to uORB middleware we can communicate directly with the ROS 2 middleware (XRCE-DDS based)
- PX4 internal modules can share data with ROS 2 nodes
- Agent / Client approach
- Ethernet and Serial support
- ROS 2 QoS Supported
- We are ready for the switch to Zenoh!

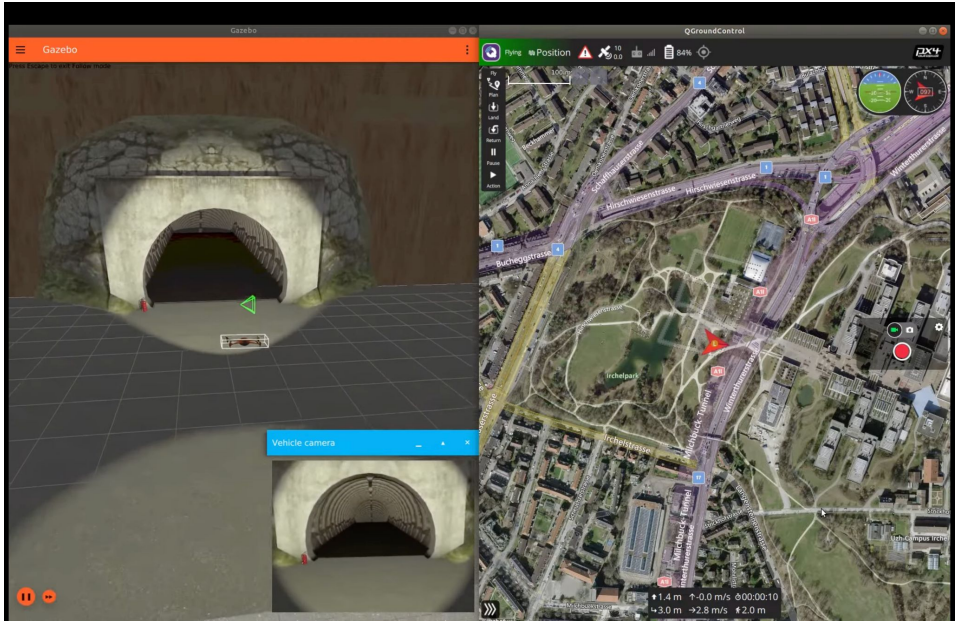


PX4 Autopilot - Simulation

Gazebo is our default simulation agent, we support both classic and modern gazebo, with multiple worlds and models to choose from.

Other Simulation Engines Supported

- Gazebo Classic
- AirSim
- Flight Gear
- jMAVSim



Gazebo Simulation Docs

Learn More & Get involved

GitHub / Forums / Discord / Weekly Calls

- Github: PX4, Pixhawk, MAVLink, MAVSDK, QGroundControl
- Forums
- Discord
- Calendar

Enjoy Brussels

Thank You