Pixhawk Standard 2019

https://pixhawk.org

Overview

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STANDARD DRAFT

1. Pixhawk Community Standardization process - bringing the industry together
2. Design approval process - what makes a design compatible?
3. Pixhawk Standard Set
   a. Connectors
   b. Autopilot Bus
   c. Payload Bus
4. Outlook: Pixhawk vision as the first generation of a full-system design

Community Process

Standardization Process

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STANDARD DRAFT

1. Weekly dev call: Vote open until June 1st, 2019
   https://doodle.com/poll/gy7pr5kbuzhdk3ec
2. Two releases per year (FMU revisions)
   a. FMUv{}, representing latest technology / latest SoC
   b. FMUv{}X, representing hardened version of last generation
3. Compatibility requirements:
   a. Binary compatible for autopilot software
   b. Pixhawk Connector Standard compatibe (PCS)
   c. Pixhawk Autopilot Bus compatible (PAB)
   d. Pixhawk Payload Bus (PPB)
4. HW Repo: https://github.com/pixhawk/hardware

Standard Process & Adoption

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1. Governance: Similar to SW open source projects (dev call, maintainer, development community and industry stakeholders)
2. Royalty-free license for trademark for any use
3. Conditions (**like USB mark**):
   a. Signed Pixhawk trademark agreement (correct use of standards trademark)
   b. Adherence to connector standards
   c. Adherence to autopilot bus standards
   d. Adherence to payload bus standards
   e. Manufacturing standards (e.g. temperature calibration and per-unit testing mandatory for industrial version)

Pixhawk Connector Standard (PCS)

Pixhawk Connector Standard: Well-established

- JST GH connectors
- Widely used in the industry
- Pinout: https://pixhawk.org/pixhawk-connector-standard/

Pixhawk Autopilot Bus (PAB)

Pixhawk Autopilot Bus (PAB-X1)

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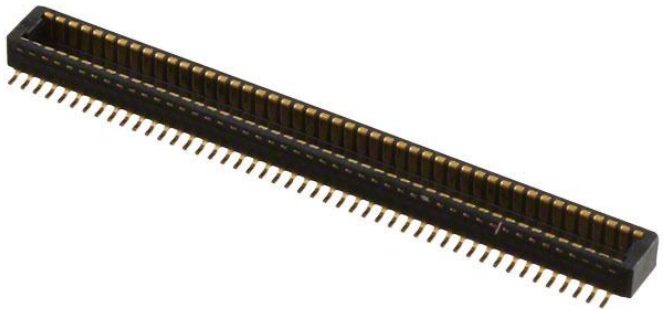
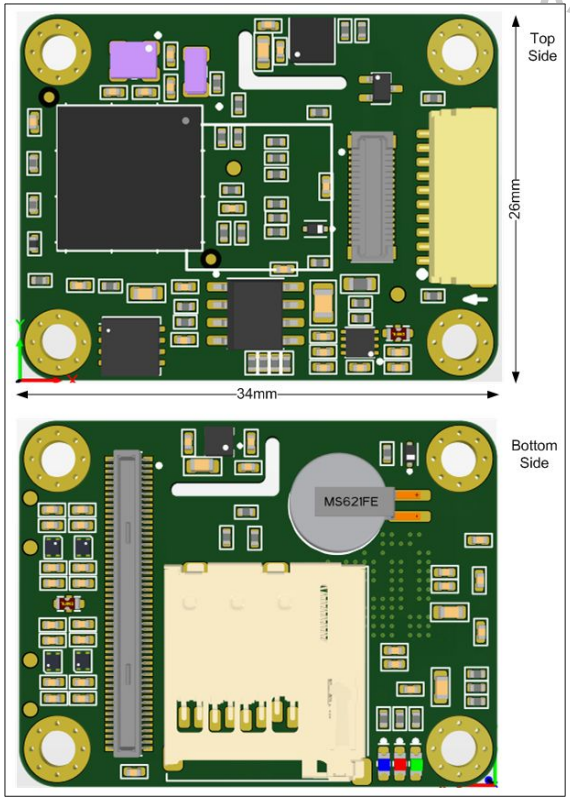
- Mechanical and electrical definition for Autopilot-on-Module (AoM)
- X1 connector: 100-pin connector
    - 34x26 mm core module
    - M2 screws





Pixhawk Payload Bus (PAB)

Pixhawk Payload Bus (PPB-A1)

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- **Design GOAL: Build an interface that supports most payload applications and is configurable with an onboard SDK**

- Mechanical and electrical definition for gimbals and other payloads
- A1 connector: 20-pin connector
    - Connector: TBD
    - Pinout: TBD
    - Mechanical interface design: TBD

FMUv5X: Industrial

Motivation: Next level of integration via Ethernet

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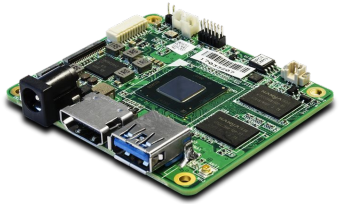
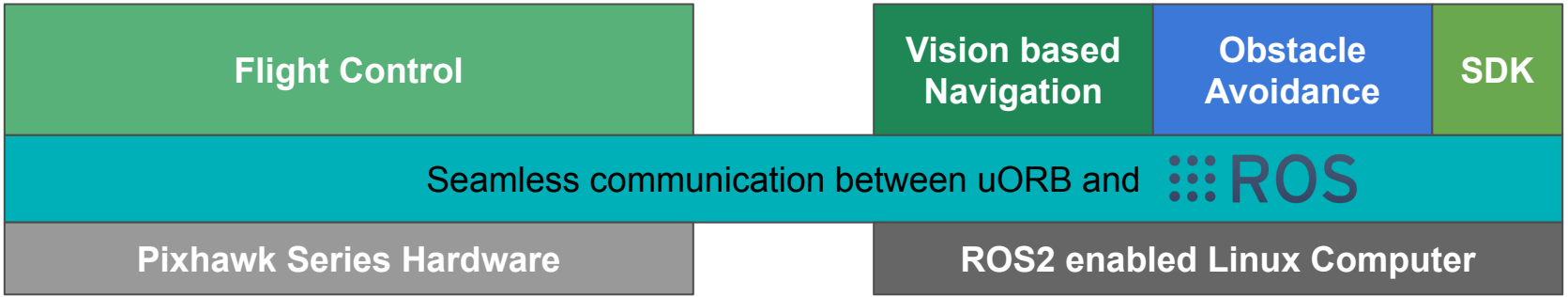
PX4 supports native communication with ROS2 via FastRTPS. This enables integration of a companion computer using industry-standard middleware with safety-critical implementations available. ROS nodes can communicate **today** natively with PX4 without the need for a translation layer like MAVROS.





https://dev.px4.io/en/middleware/micrortps.html

FMUv5X Preview

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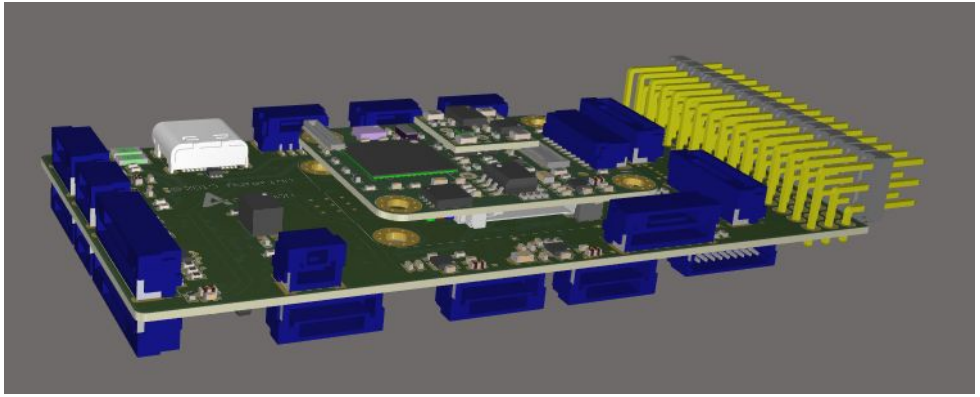
- Targeting industrial applications: Compact build size, hardened electronics, industrial buses (Ethernet and CAN)
- Retains backwards-compatibility (PWM and I2C)
- Provides standardized Autopilot-on-Module architecture (AoM)

Going back to open hardware to deal with market fragmentation: Complete Altium reference design



FMUv5X Architecture - Full Detail

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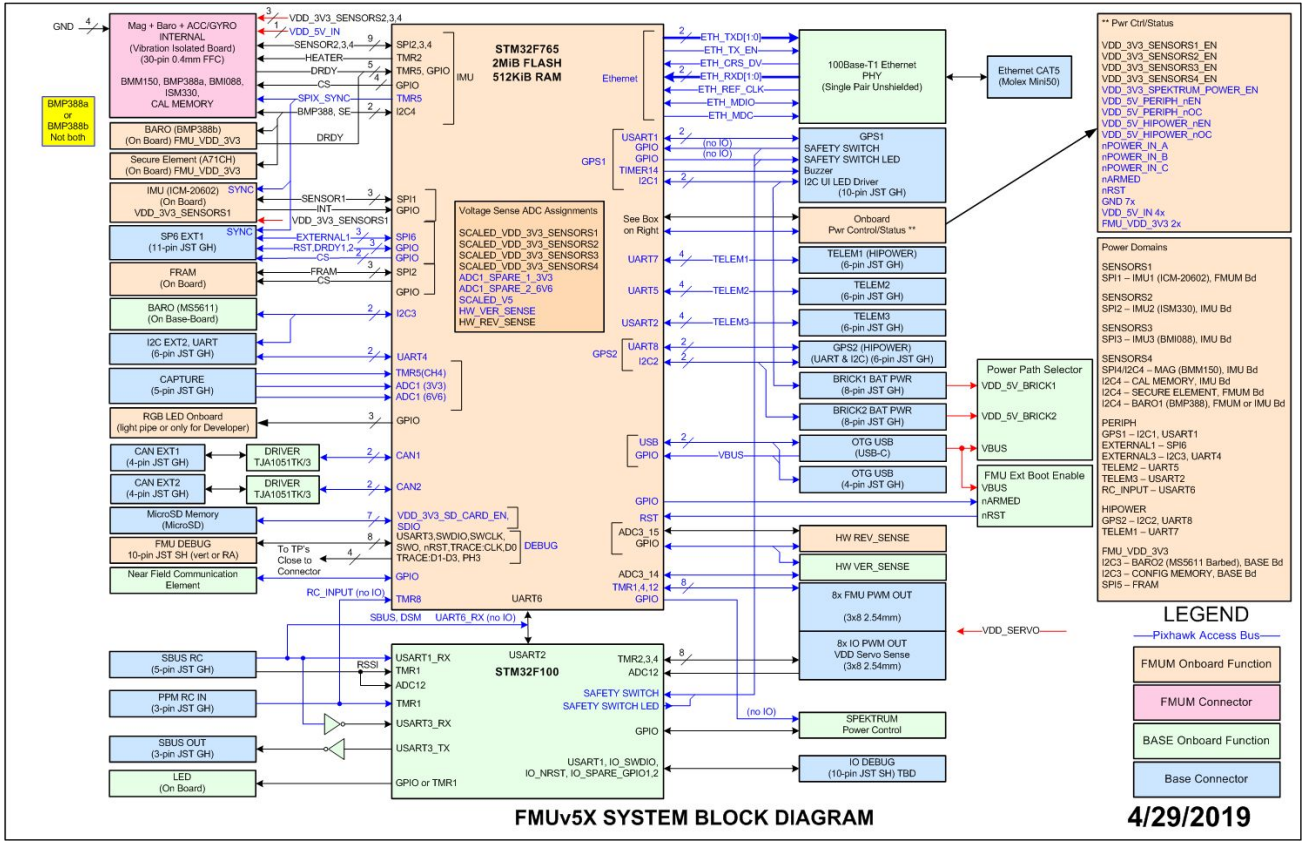
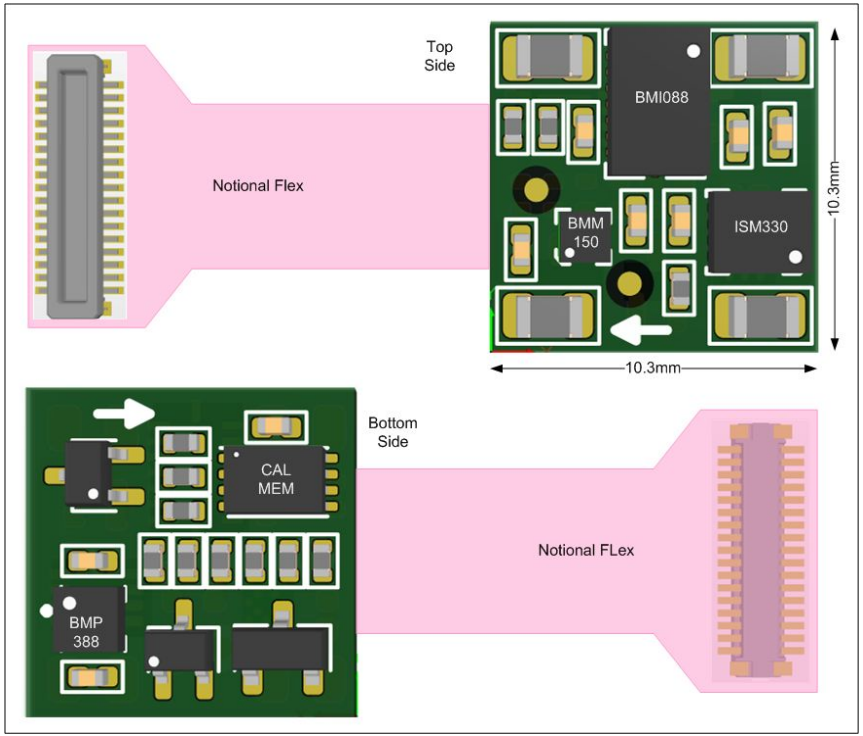


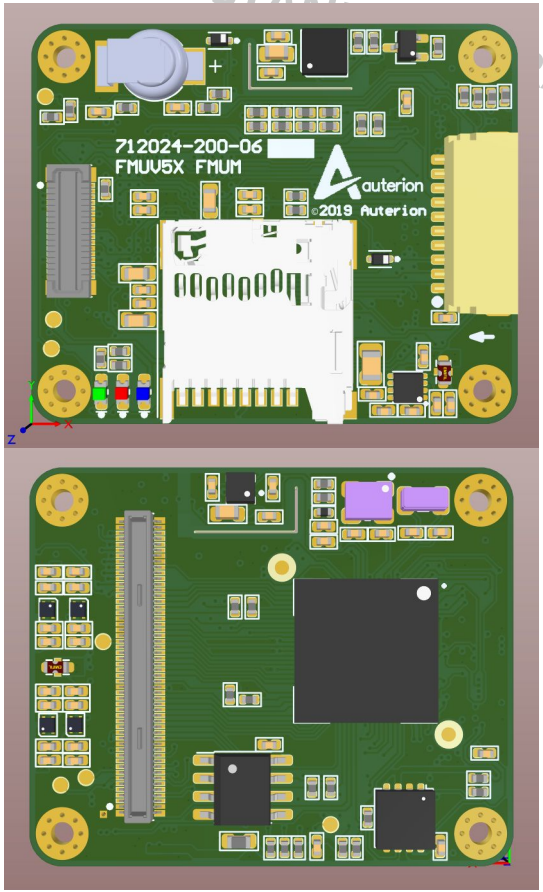
FMUv5X Preview: IMU Board

- Combines all temperature-calibrated sensors onto single board
- Board is vibration-isolated through rubber mounting kit
- Sensor selection can be upgraded independently
- Mass loading



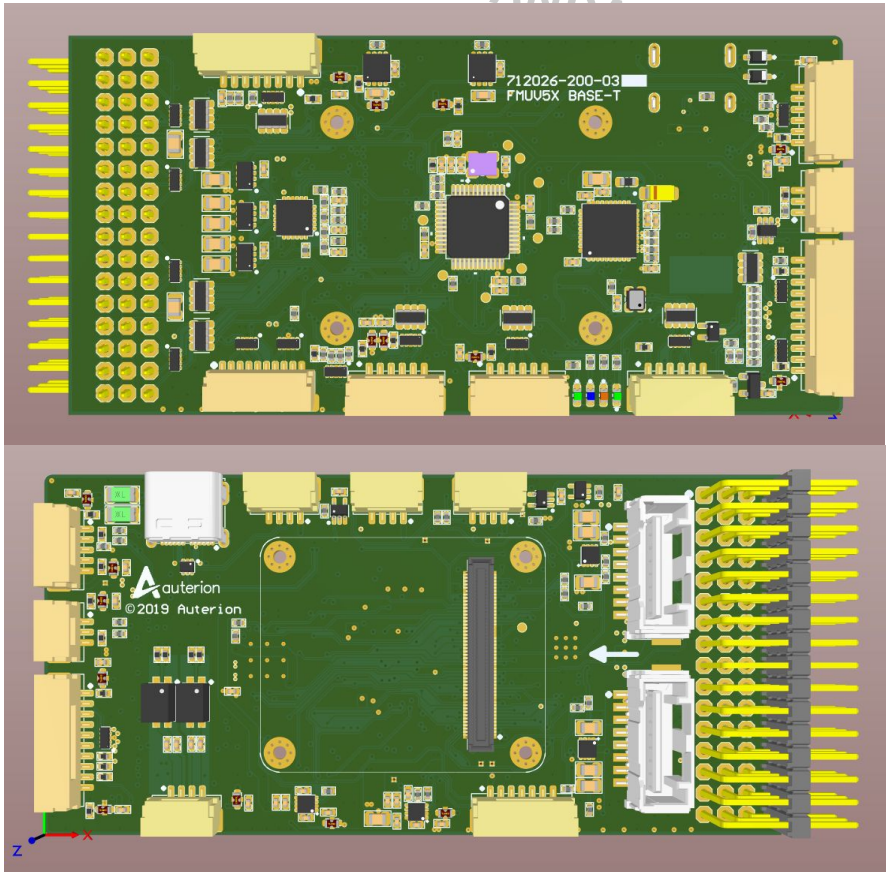
FMUv5X Preview: Autopilot-on-Module

- Miniature form factor addressing the industry need for smaller total volume
- Core functionality bundled on one board: IMU, autopilot, storage
- Includes secure element for authentication and drone remote-ID
- Hard-mounted failsafe sensor suite ensures system can revert to safe operation even if IMU board fails
- IMU and core UARTs all connected via DMA



FMUv5X Preview: Baseboard

- 43 x 88 mm (board)
- Improves over all previous Pixhawk generations: More PWM, more UARTs
- Adds USB-C
- Adds 100Base-T Ethernet
- Switches power sensing to I2C power modules
- Allows to build compact designs using only UAVCAN and dropping PWM



Pixhawk Vision

Need for full drone reference design for vision

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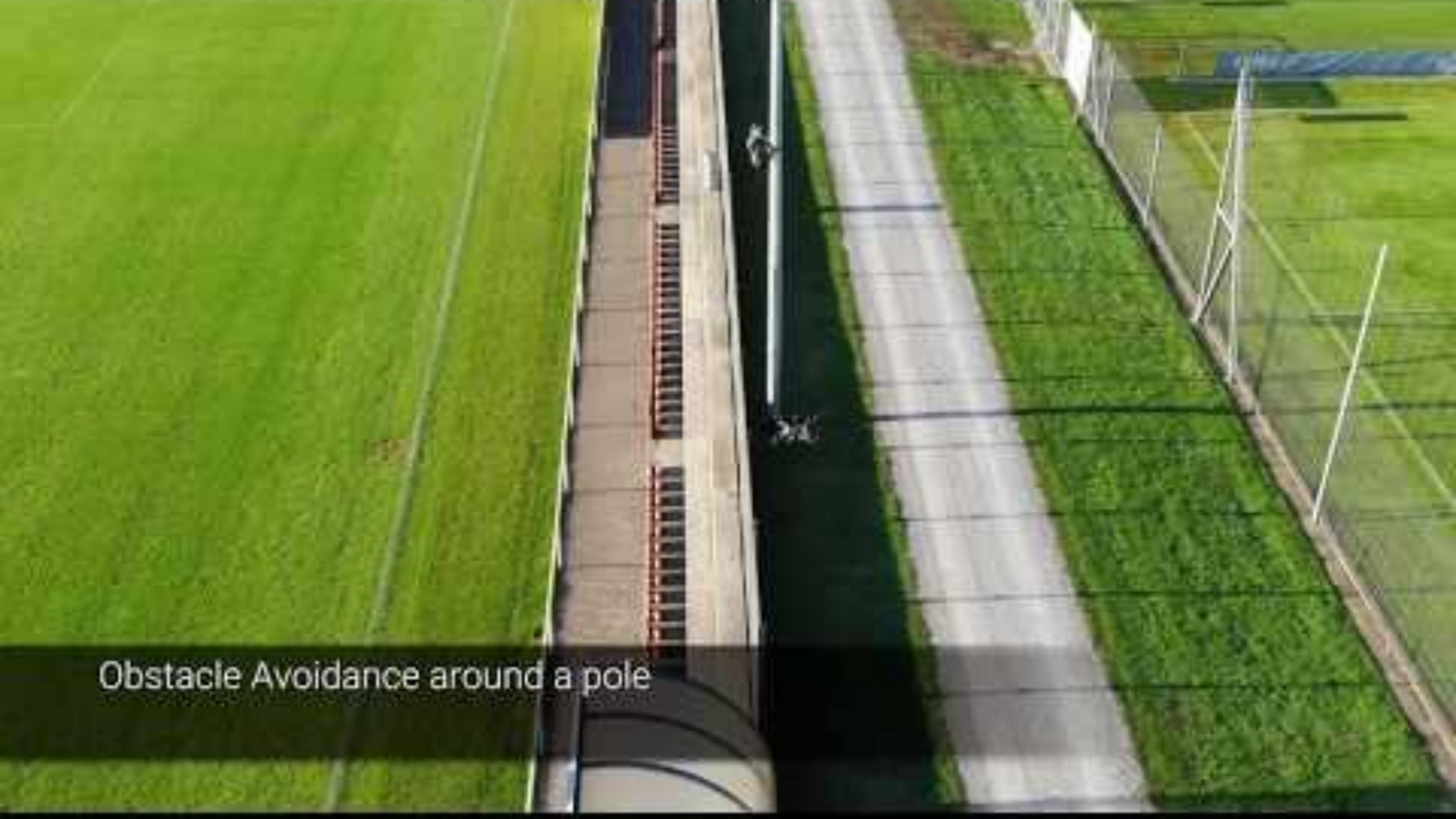
- First full-system Pixhawk design
- Geared towards robotics developers
- Pixhawk + Intel Up Core board + Structure Core on racing frame
- Available as RTF
- Runs Linux distribution
- Capabilities:
  - Obstacle avoidance
  - GPS denied navigation


Obstacle Avoidance around a pole

Thanks!