

Flying with Intel® SoC FPGA:

Smart Drones Enabled by Open Source Platform

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Agenda

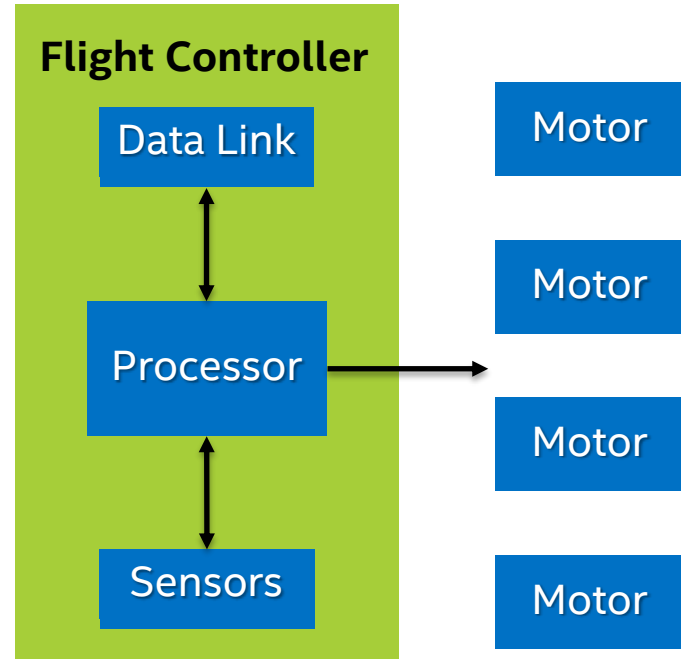
- Game of Drones
- The Path to Smart Drones
- Flying with OcPoC Open Source Platform
- Summary





Game of Drones

Game of Drones



Exciting combination of **electrical and aerospace engineering** and **computer science**, from theory to practice.

Current Hardware Option and Software Stack



Pixhawk with ARM* MCU



PX4 or APM Flight Code

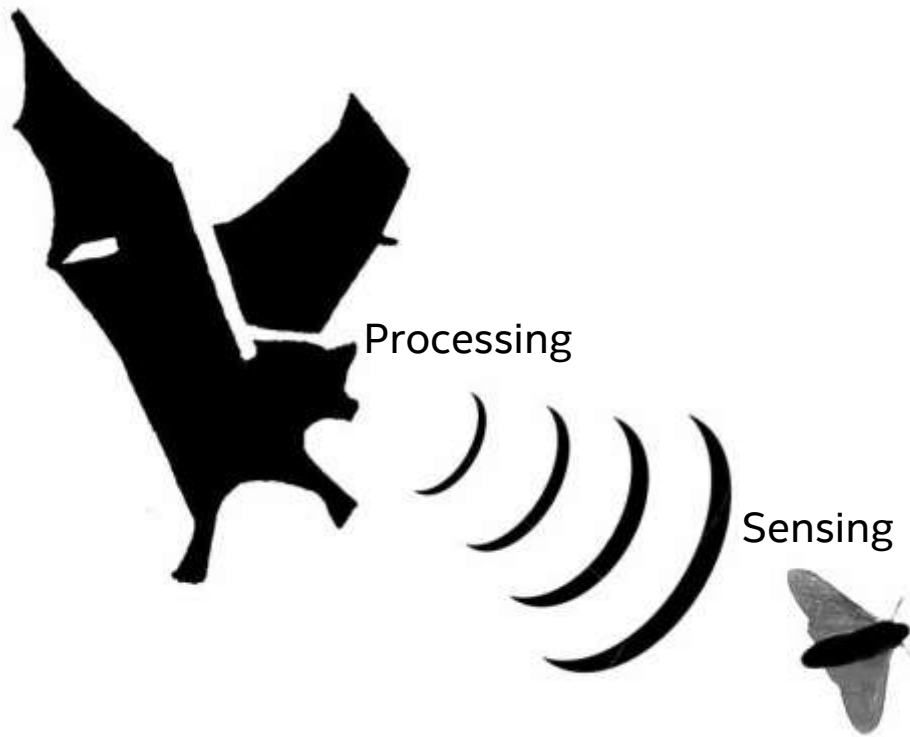
Embedded OS
(RT Linux*, NuttX, etc.)

Compatible Open Hardware
(Pixhawk, APM, etc.)



Evolution to Smart Drones

From Drones to Smart Drones



How to Achieve Safe and Reliable Autonomous Flying?

Sensors and Sensor Fusion

- Ultrasonic, Microwave
- Optical (Infrared, Vision)

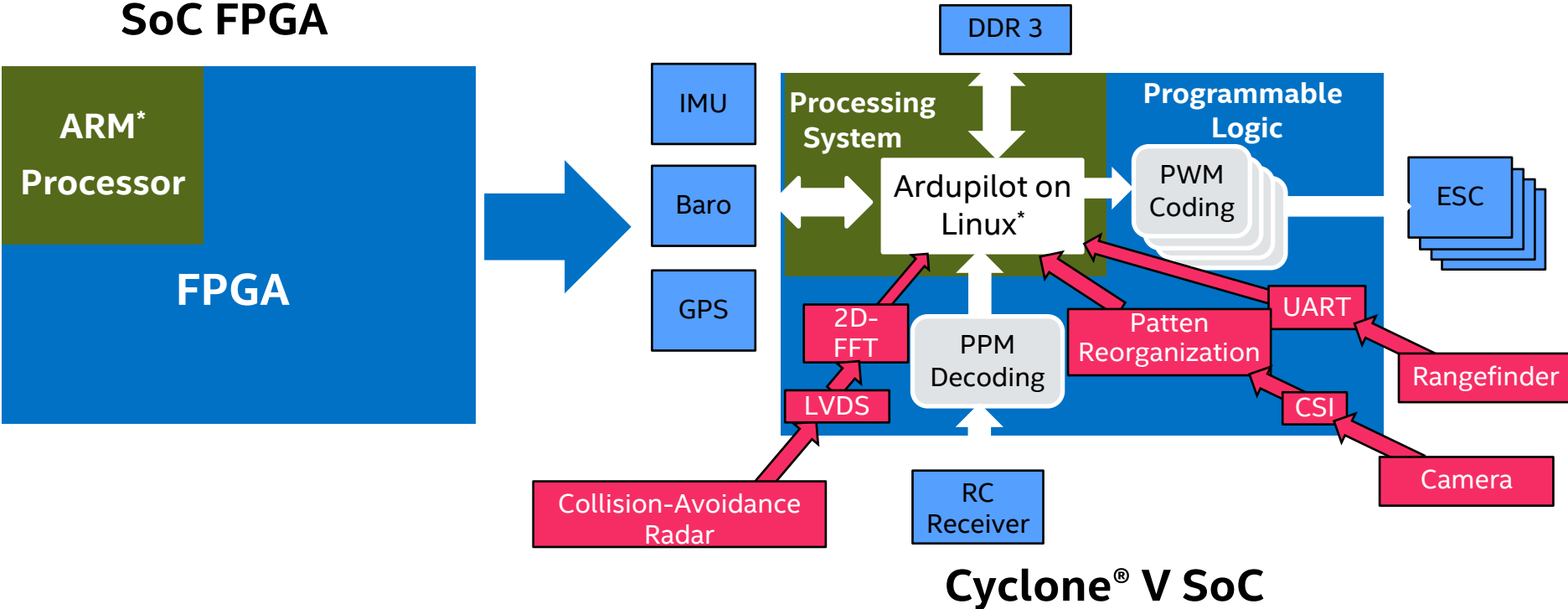
Onboard Real-time Processing and AI

- Remote processing is not feasible during flight due to time sensitivity

Designing the Brain of the Smart Drone

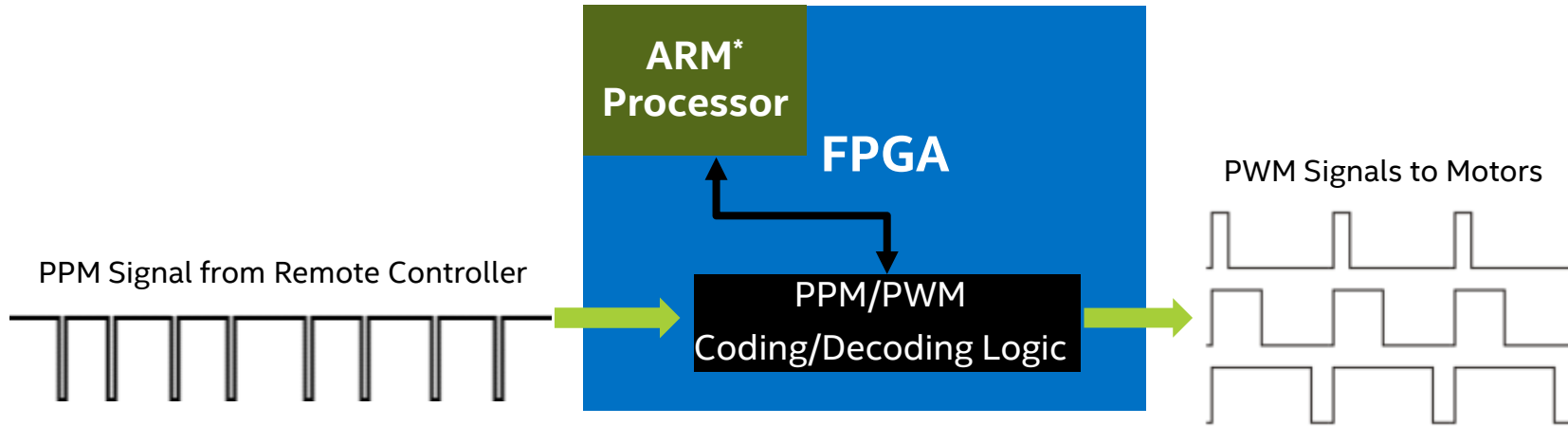
Demands in Smart Flight	Technical Features of SoC FPGA
Sensor Interface and Communication	I/O Throughput
Sensor Signal Processing and Sensor Fusion	FPGA
High-level Decision Making and Flight Control	Embedded ARM* Processor
Real-time AI and Deep Learning	FPGA-based Real-time Processing

Brain of the Smart Drone



- Basic peripheral devices for drones
- Additional external sensors for smart drones

Advantages of SoC FPGA Structure



ARM

500+ lines of C/C++

1000+ CPU cycles

VS

VS

ARM + FPGA

20 lines of VHDL/Verilog + 6 lines of C/C++

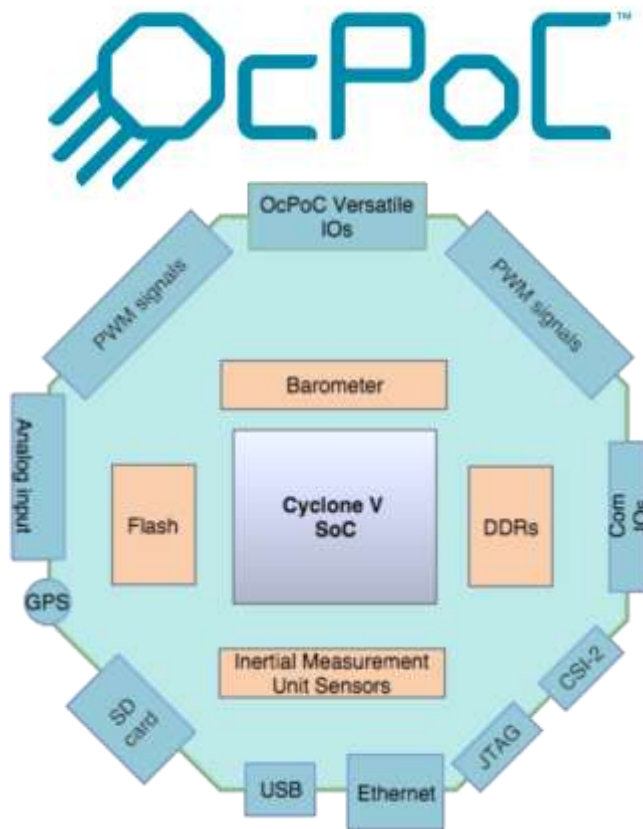
<5 clock cycles of pipeline delay

Free up CPU load for high-level *“thinking”*



Flying with OcPoC* Open Source Platform

Introducing OcPoC* – “Octagonal Pilot on Chip”



Highlights

- First Intel® SoC FPGA-based flight controller
- Utilizes Enpirion® power modules
- >100 I/Os for sensor integration
- Video streaming and processing
- Enhanced GPS and IMU sensor packages
- APM compatible (dronecode.org)
- Open source platform (hardware, software)

Flying with OcPoC



OcPoC's Sensor Options

Flight Control Platform



Aerotenna's Microwave Sensors



μLanding*
Compact Altimeter



μSharp*
360° Sense-and-Avoid Radar

OcPoC* Compatible Sensors



Courtesy of Human+ Tech

Dual-Camera Module

Aerotenna's Microwave Sensors for OcPoC*



Compact Altimeter for All Drones

- < 60 grams in weight
- < 1.5 watts in power
- < 4 cm in range accuracy
- Up to 120 m in sensing range

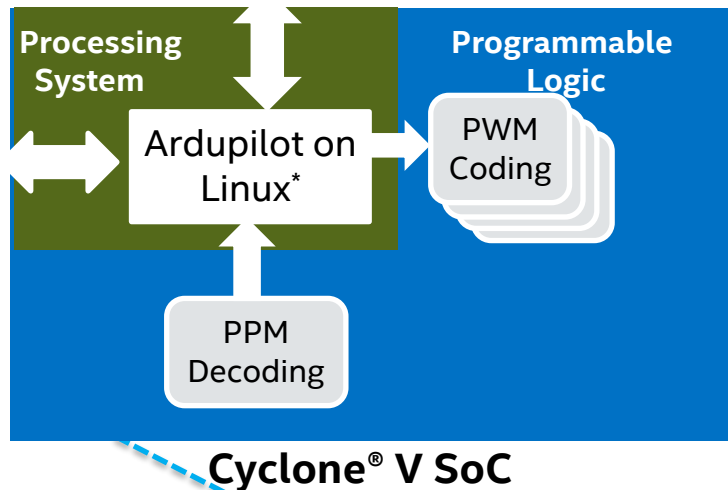


360° Sense-and-Avoid Radar

- < 150 grams in weight
- < 2.5 watts in power
- < 4 cm in range accuracy
- Up to 60 m in sensing range

OcPoC Onboard Processing

IP Library for OcPoC*



Cyclone[®] V SoC

Interface
IPs

Available

PPM
Decoding

PWM
Coding

S.BUS
Decoding

Under Development

CSI-bus

Sensor
IPs

μLanding*
Interface

μSharp*
Range
Processing

Dual Camera
Depth
Retrieving

Dronecode in the Game of Drones

Dronecode Project Members

Platinum



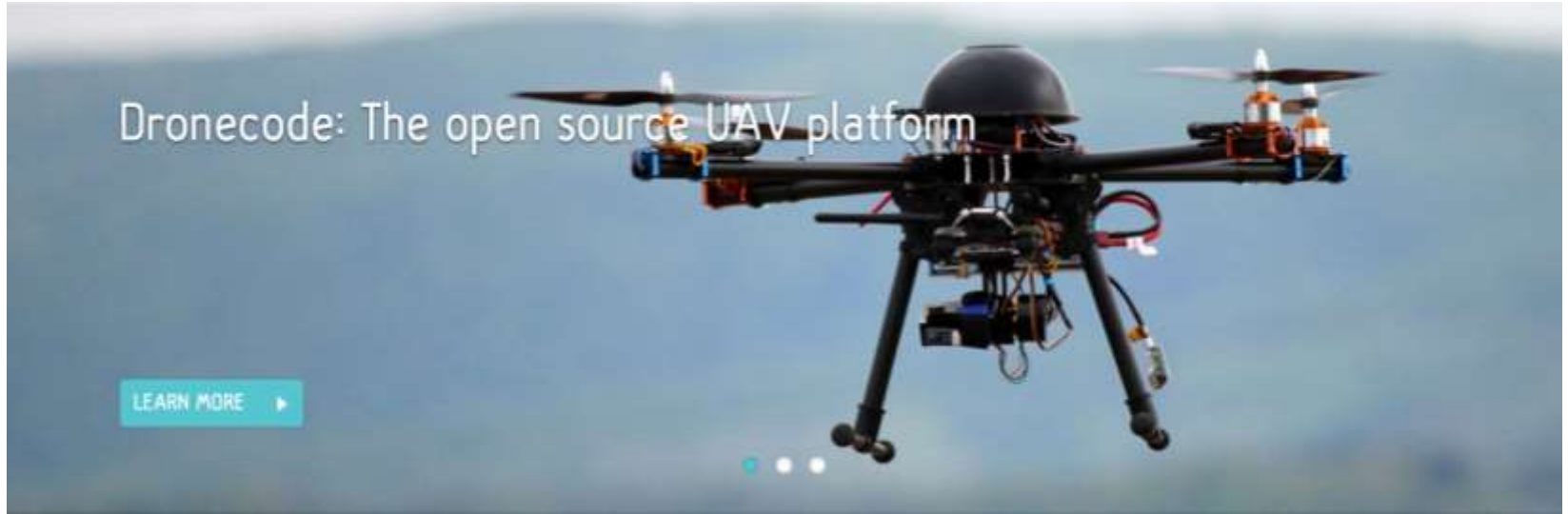
Gold



Silver



Dronecode.org



Open Source

Open Culture

Open Skies

Open to Exploring New Tech!



Summary

- Drones are evolving into smart drones
- Intel® SoC FPGAs fit perfectly as the brain of the smart drone
- OcPoC* is available as an open-source platform supporting drones
- OcPoC enables the development of:
 - Sensor fusion
 - Real-time processing
 - Vision-based flying assistance
 - Deep learning and environmental sensing
 - and more...

Are You Ready for Smart Drones?

Additional Sources of Information

More web based info: www.aerotenna.com

