

The Client



AEROSPACE

KF Aerospace is the largest provider of maintenance, repair and overhaul for commercial aircraft in Canada!

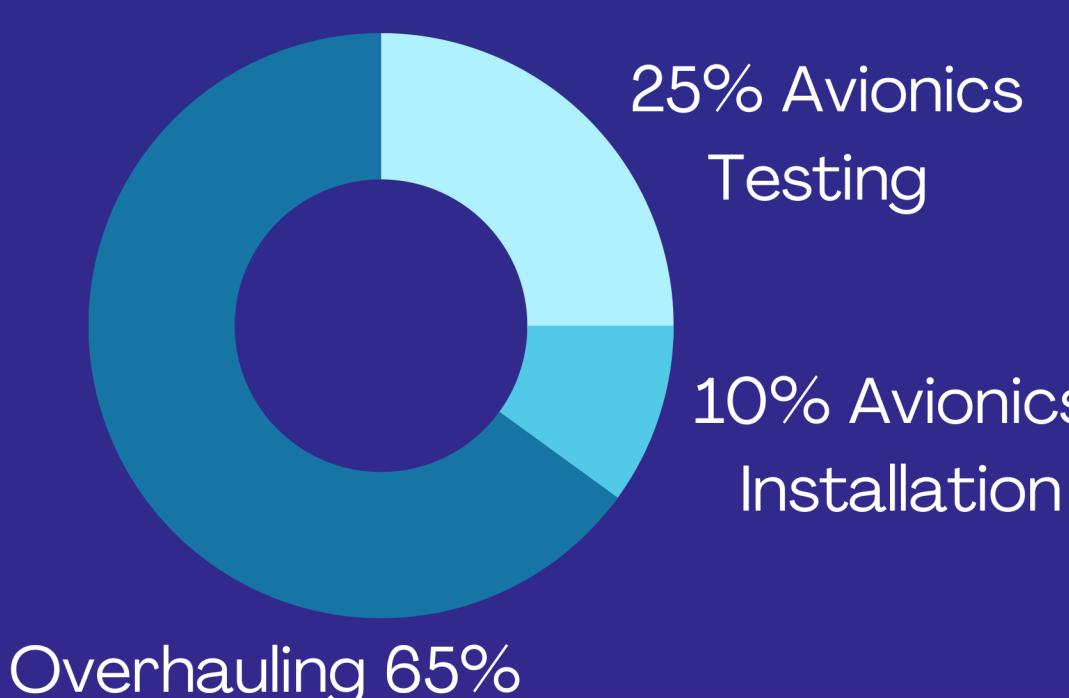
The Problem

- Verifying aircraft electronic systems following new equipment installation is **time consuming** for engineers
- Traditional integration methods lead to **costly rework** and **longer aircraft downtime** due to unforeseen compatibility issues



5 Days

Average Avionics Engineer Tasks



on an aircraft to validate avionics equipment

1+ Weeks

to fix incorrect equipment integration

Overhauling 65%

Why AeroSim?

Reduces cost overruns & schedule delays



cheaper than similar off-the-shelf options

Full ownership and flexibility

Savings



\$10,000

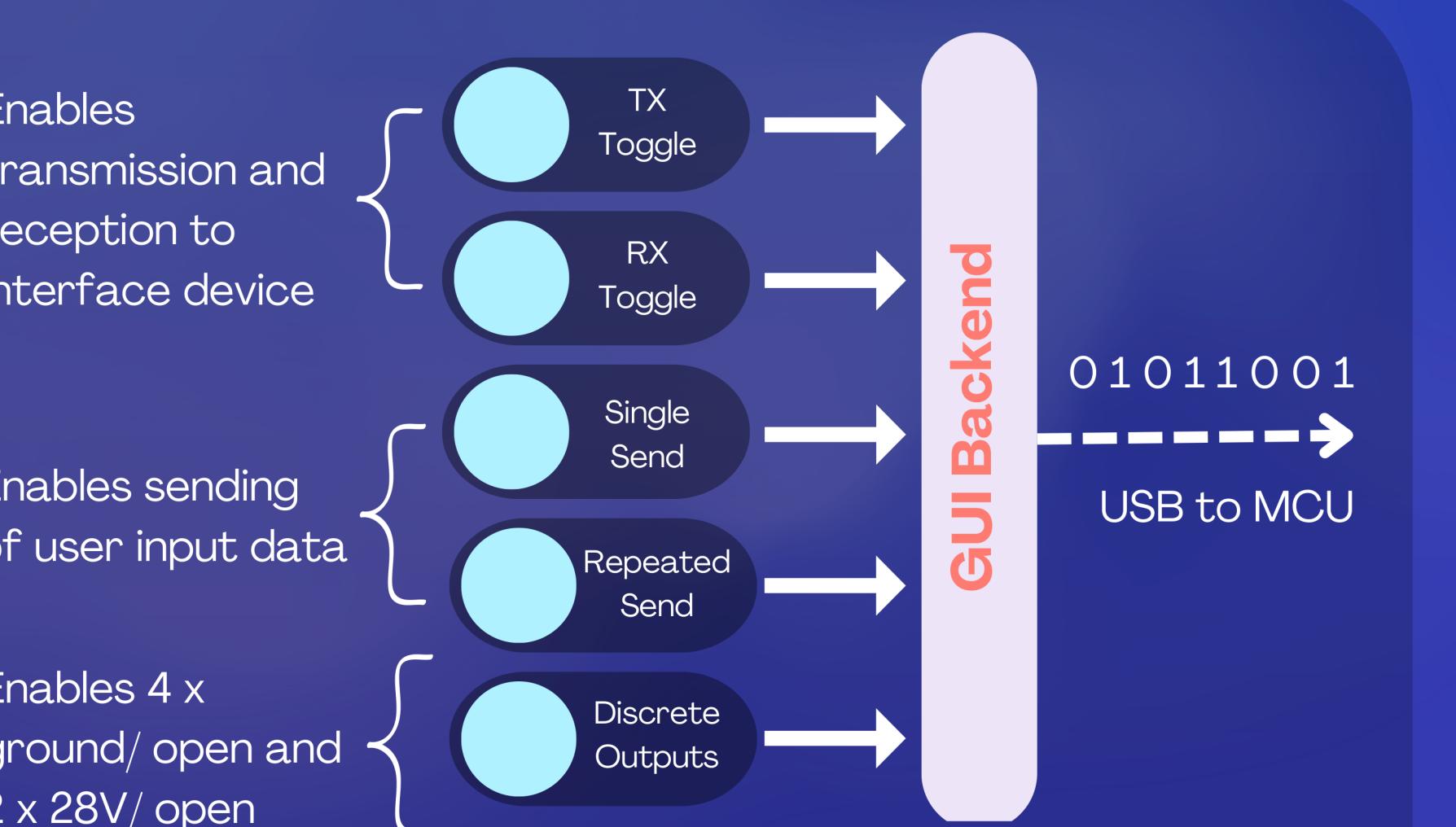
8 hours

Reported savings of **8 person-hours** and up to **\$10,000** per maintenance project

AeroSim

A portable flight instrument emulation system for troubleshooting avionics on a bench top

- Consists of an interface device and software package for encoding flight parameters from user input as ARINC 429 communication messages

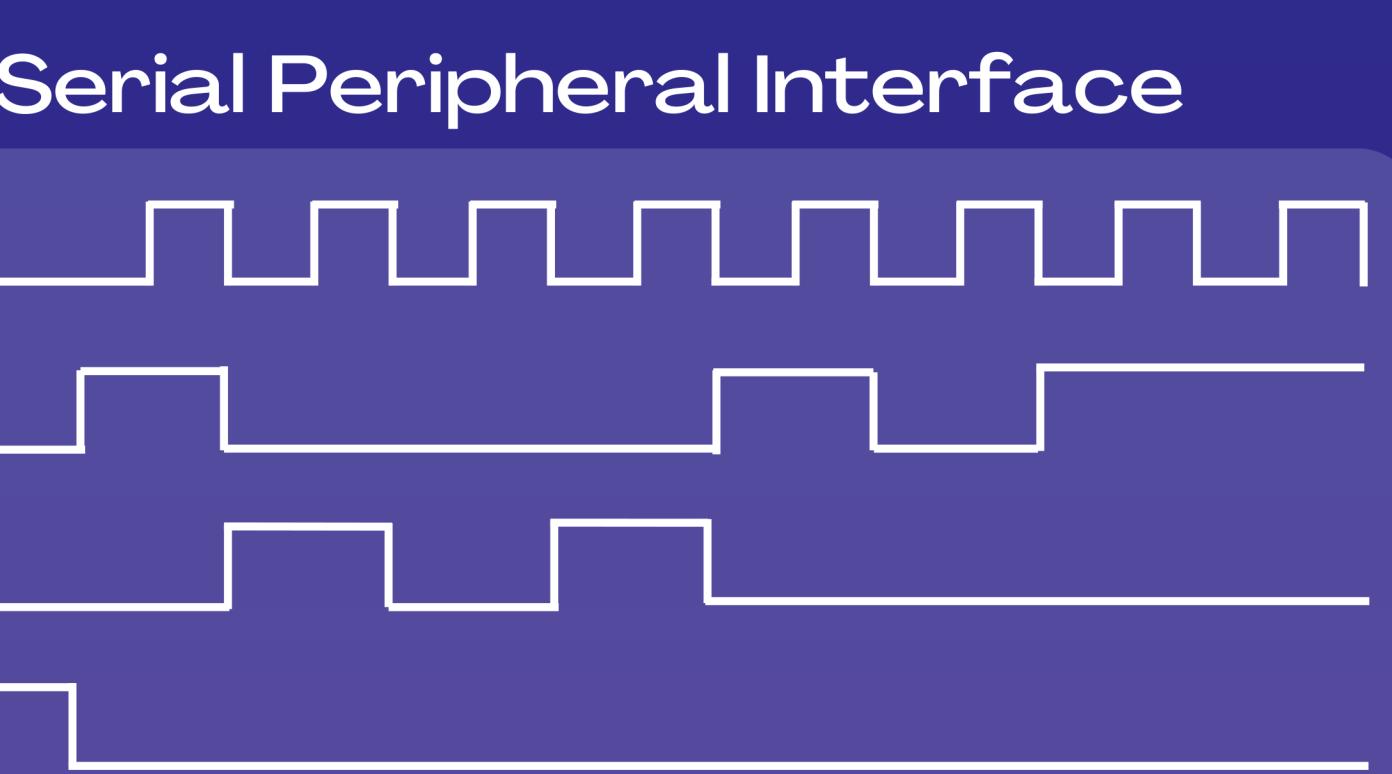
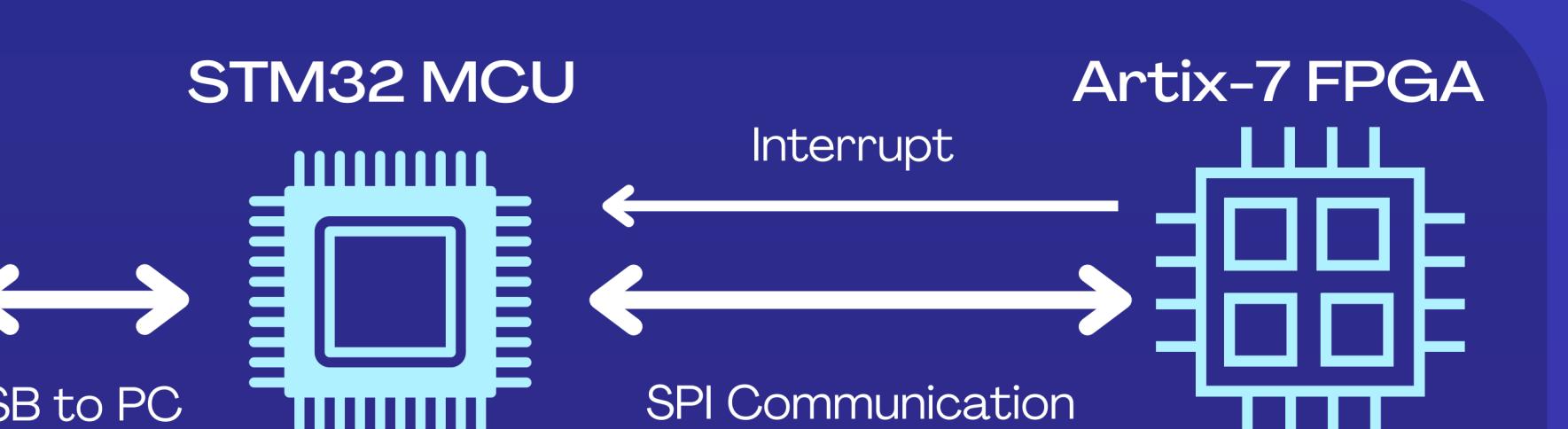


User Interface (GUI)

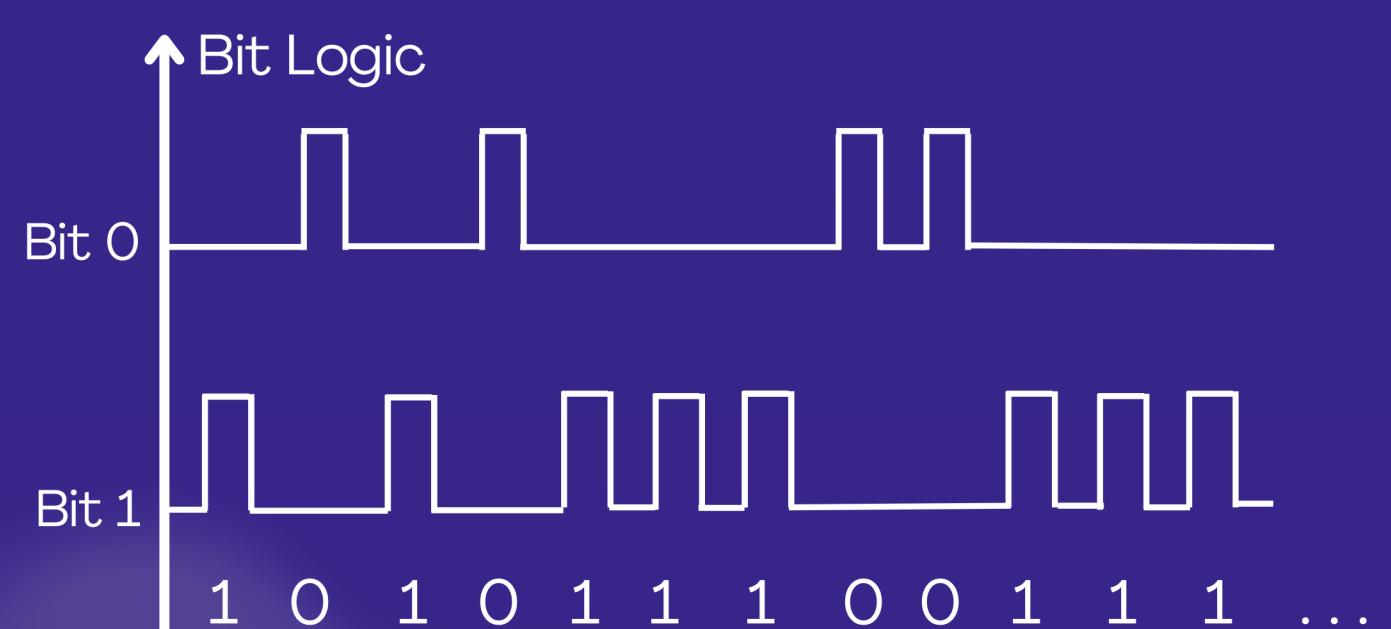
- Developed using open source Python libraries
- Scalable architecture
- Handles user input processing and ARINC 429 message conversion

Microcontroller (MCU)

- Link between USB communication with PC & ARINC 429 protocol encoding hardware
- Fast interrupt-based architecture
- Controls discrete outputs via MOSFETs



FPGA TX & RX Bus



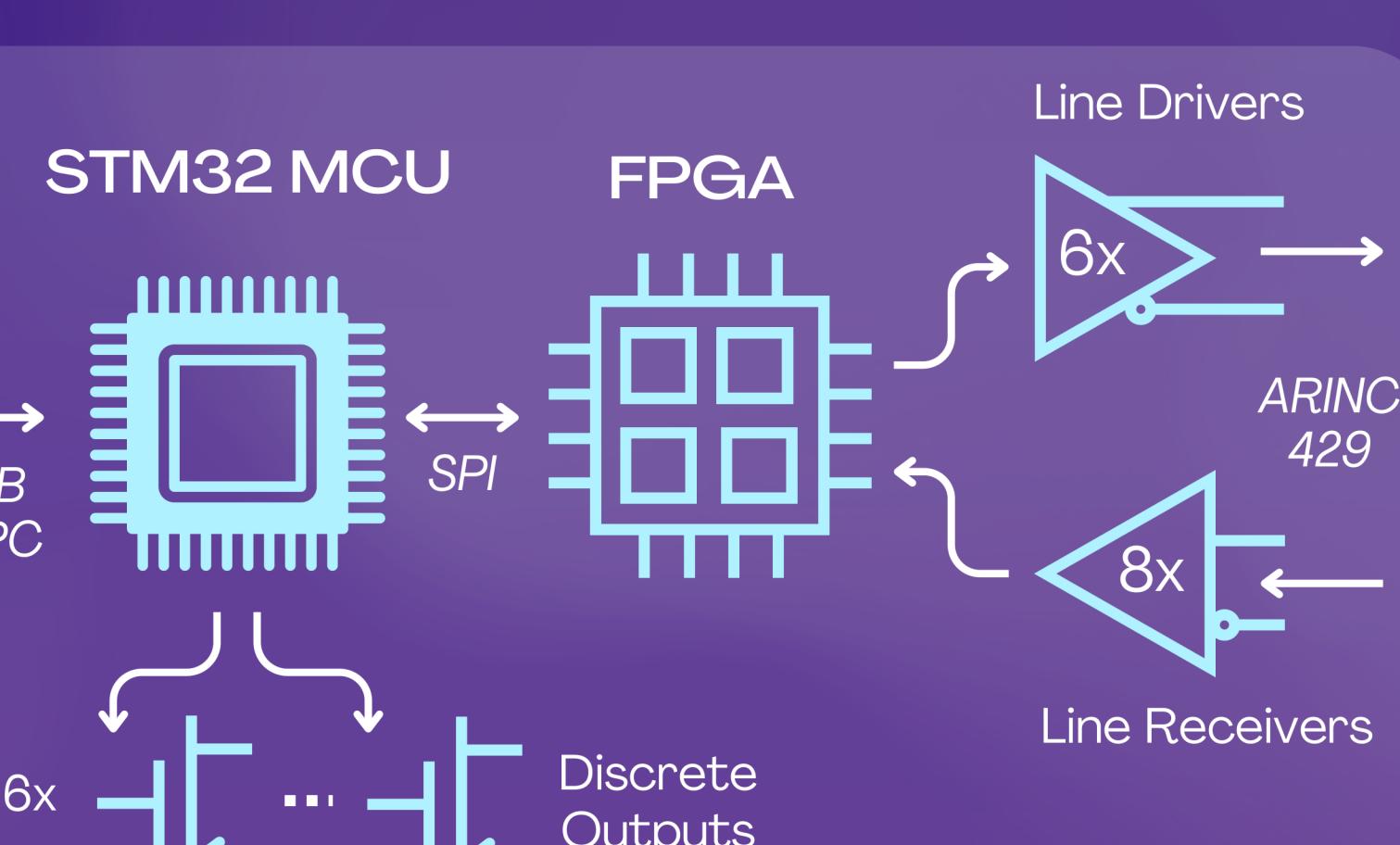
ARINC 429 Data TX Scheduling

	Transmit Interval	Counter	Data
Label 1	0.5 ms	10b00 ...	32b0101...
Label 2	1 ms	10b00 ...	32b1110...
:	:	:	:

FPGA

- Manages ARINC 429 data timing and sequencing logic
- Schedules TX data transfers to instruments
- Reads RX data transfers from instruments

Interface Device



Custom Circuit

- A PCB integrating line drivers/receivers, discrete outputs, microcontroller, and FPGA
- FPGA slots in as a daughter board for debugging and customization purposes

4

AeroSim Features



What is ARINC 429?

ARINC 429 is a **communication protocol** that aircraft electronics use to exchange **flight data**.

ARINC 429 Word Format

0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31

Label	SDI	Data	SSM	P
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Label Field

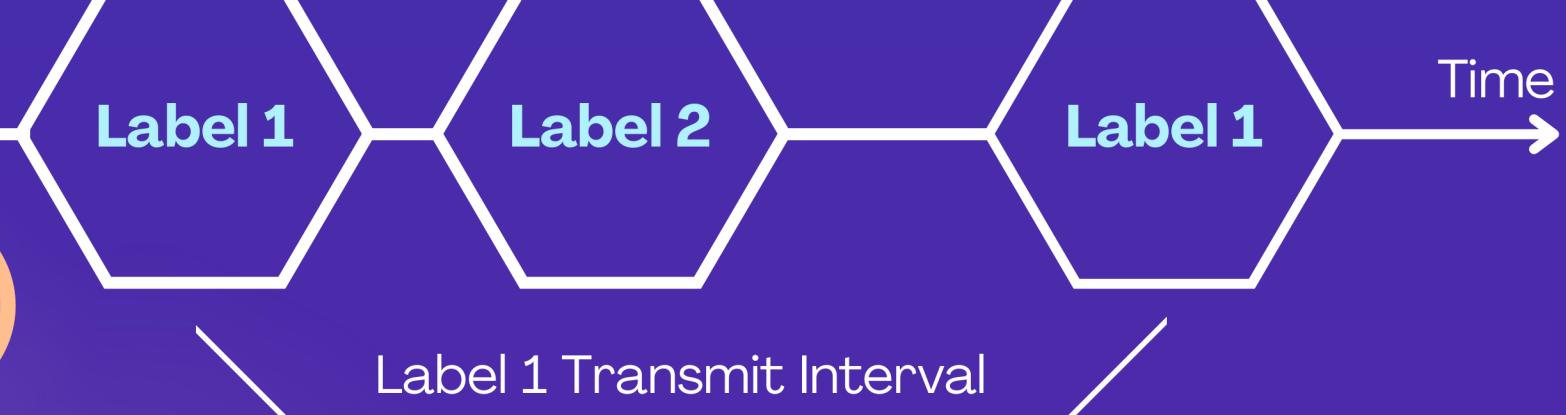
Standard **labels** designate **flight parameter types**. Eg. Label 203 (octal) translates to Pressure Altitude

Word Transmission

ARINC 429 words are **continuously transmitted** to avionics equipment at the **rate** defined by the standard for a specific label

TX Bus

To Avionics Equipment



ARINC 429 Bus

0 and 1 bit pulses are transmitted on **two separate signals** into a line driver.

The output is a **differential voltage** pair.

Differential Bus Voltage

