Lowering Avionics Bus Trust: Moving ARINC 429 Bus Architecture Towards Zero Trust.

Matthew Preston Video Update 2 Group 4

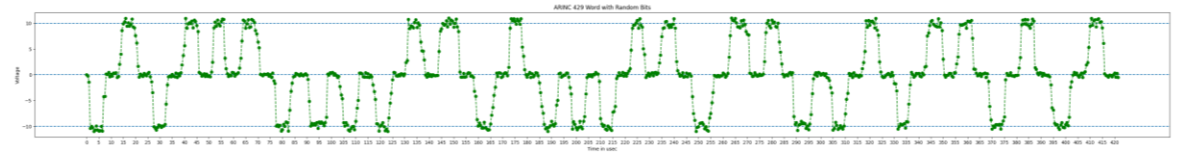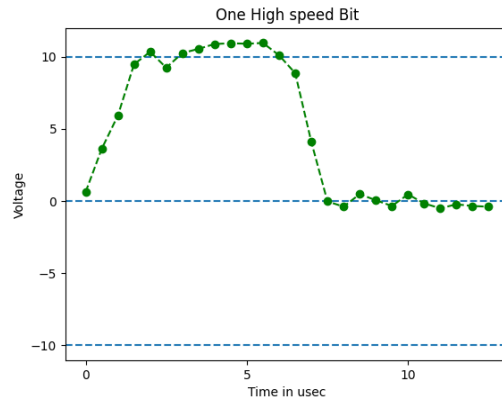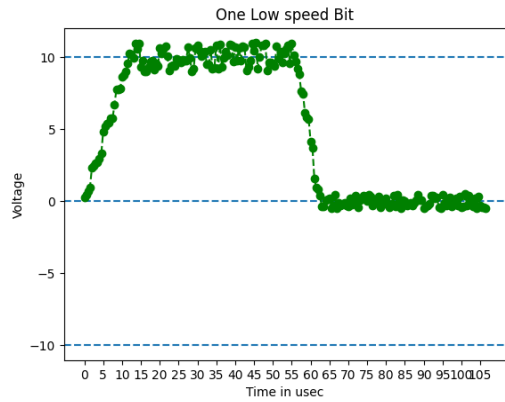# Overview

- Activities from the past week

- Ideas for upcoming week

- Areas for feedback

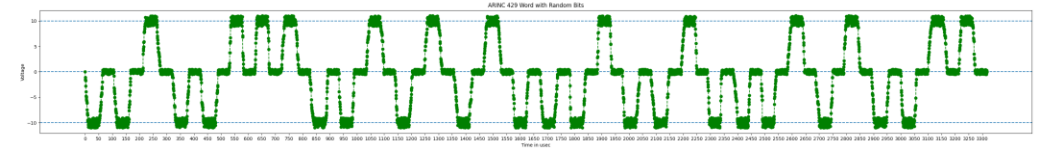# Activities from the past week

- Created many files for simulation:
    - LRUs -> FMC, FAEC, W&BS, RMS, GPS
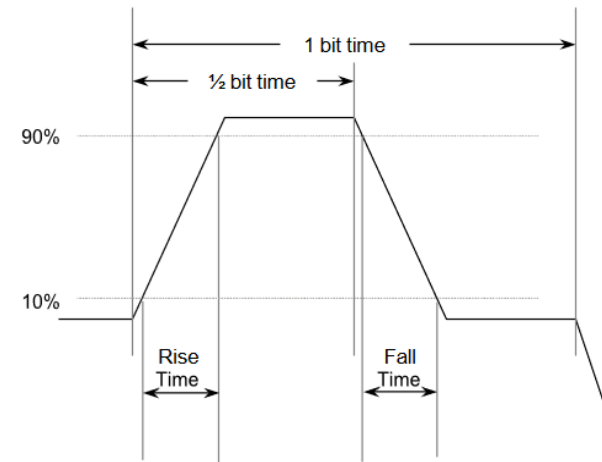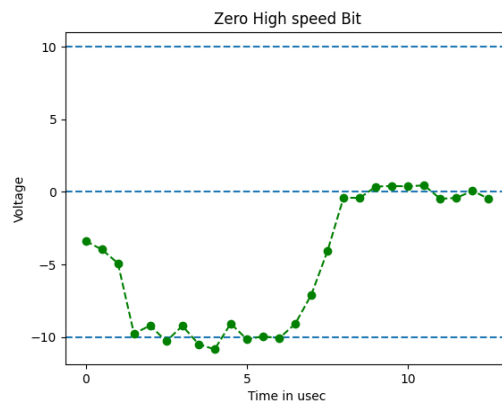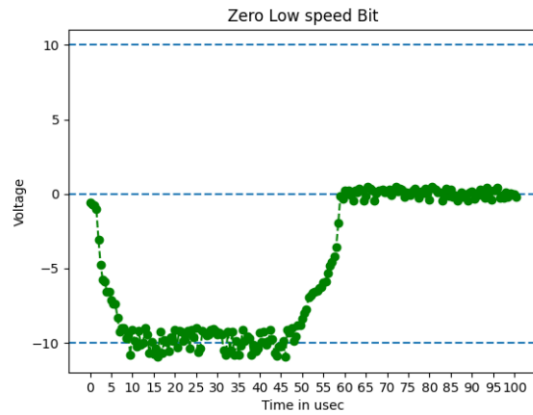   - Voltage & Bus Sims
    - Testbed

Voltage Simulator

One Low speed Bit

One High speed Bit

1 Random Word - HS

1 Random Word - LS

Zero Low speed Bit

Zero High speed Bit

3 Random Words

ARINC 429 Word Example - Latitude & Longitude Positions

Table 6-25-1 BCD ENCODING OF LATITUDE AND LONGITUDE

Bit No.	32	31 30	29	28 27 26 25	24 23 22 21	20 19 18 17	16 15 14 13	12 11 10 9	8 7 6	5 4 3	2 1
PARAMETER (Label)		SSM				DATA FIELD				LABEL	
			MSC					LSC			
			1	8 4 2 1	8 4 2 1	8 4 2 1	8 4 2 1	8 4 2 1	1 2 4	1 2 4	1 2
Present Position (Lat.) N 75 Deg 59.9' (010)	1	0 0	0	0 1 1 1	0 1 0 1	0 1 0 1	1 0 0 1	1 0 0 1	0 0 0	1 0 0	0 0

Parity bit -> 12 "1"s = 0

00: 0   7   5   5   9   9   0   1   0   <- label digits

N.

N 075 Deg 59.9'

0o010
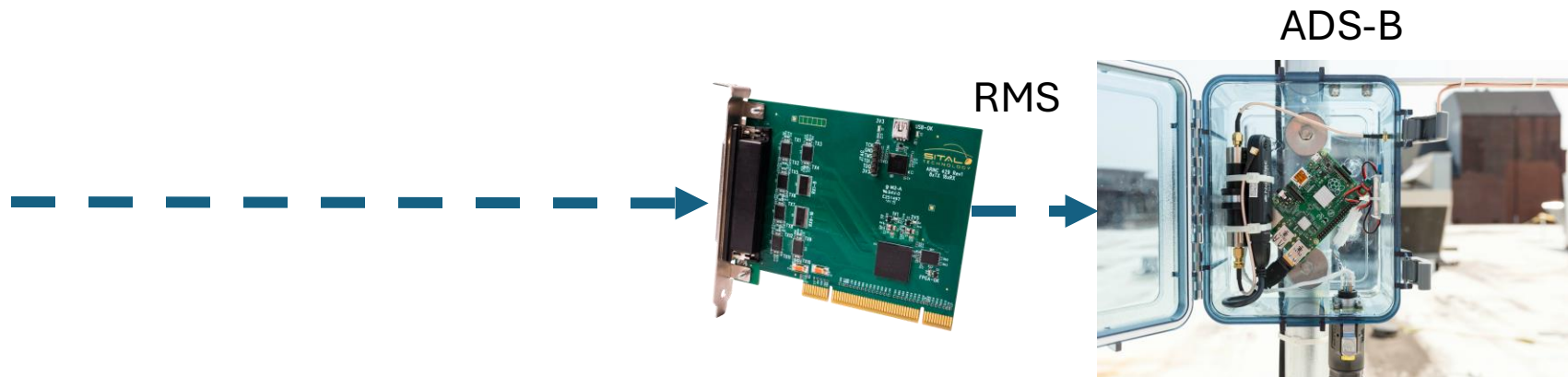
RMS

ADS-B

ARINC 429 Word Example - Latitude & Longitude Positions
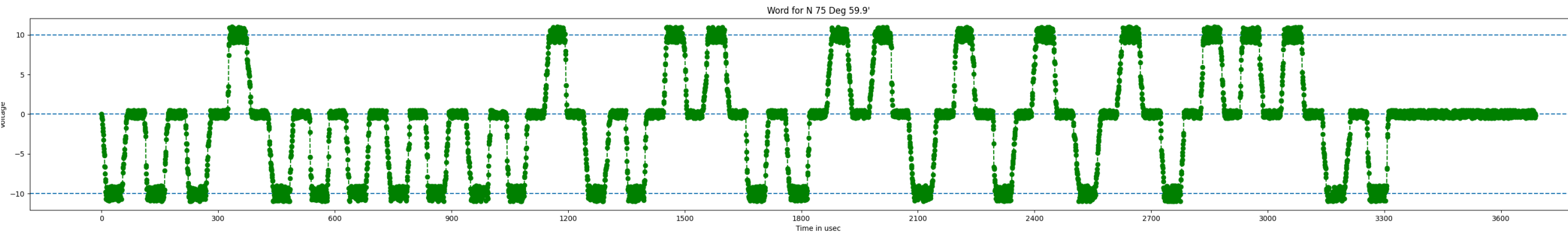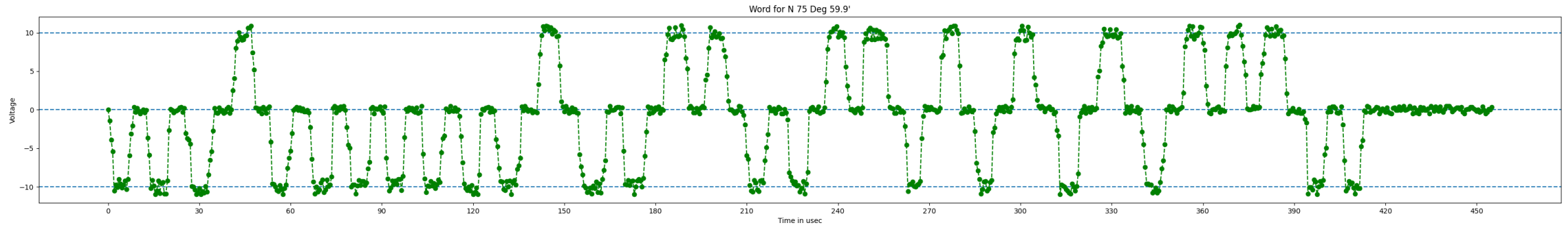
Table 6-25-1 BCD ENCODING OF LATITUDE AND LONGITUDE

Parity bit -> 12 "1"s = 0

Bit No.	32	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
PARAMETER (Label)		SSM		DATA FIELD MSC																			LSC		LABEL							
					1	8	4	2	1	8	4	2	1	8	4	2	1	8	4	2	1	8	4	2	1	1	2	4	1	2	4	1	2
Present Position (Lat.) N 75 Deg 59.9' (010)	1	0	0	0	0	1	1	1	0	1	0	1	0	1	0	1	1	0	0	1	1	0	0	1	0	0	0	1	0	0	0	0

Word for N 75 Deg 59.9'

Word for N 75 Deg 59.9'

Flight Management Computer LRU Design

Scheduled Mode (every x usec)
vs
Software Defined Mode (non-uniform)

LRU

Irregular, custom word generation

Fly-by-wire input

IP Access /Eth

Maintenance Program (vuln w/ root system priv)

User (Pilot) Input

Word Generation Flight Software

Regular Word Generation

RX Voltage from Words

FIFO

WORD1

WORD2

WORD3

WORD4

WORD5

OR

Advanced Scheduler (i.e. Decision Tree)

WORD1 -> send on condition X

WORD2 -> send on condition Y

Generate Voltage for Word

Channel A
Channel B

Radio Management System

Engine Control - RIGHT

Weight and Balance System

Engine Control - LEFT

ADIRU

Demos of progress thus far

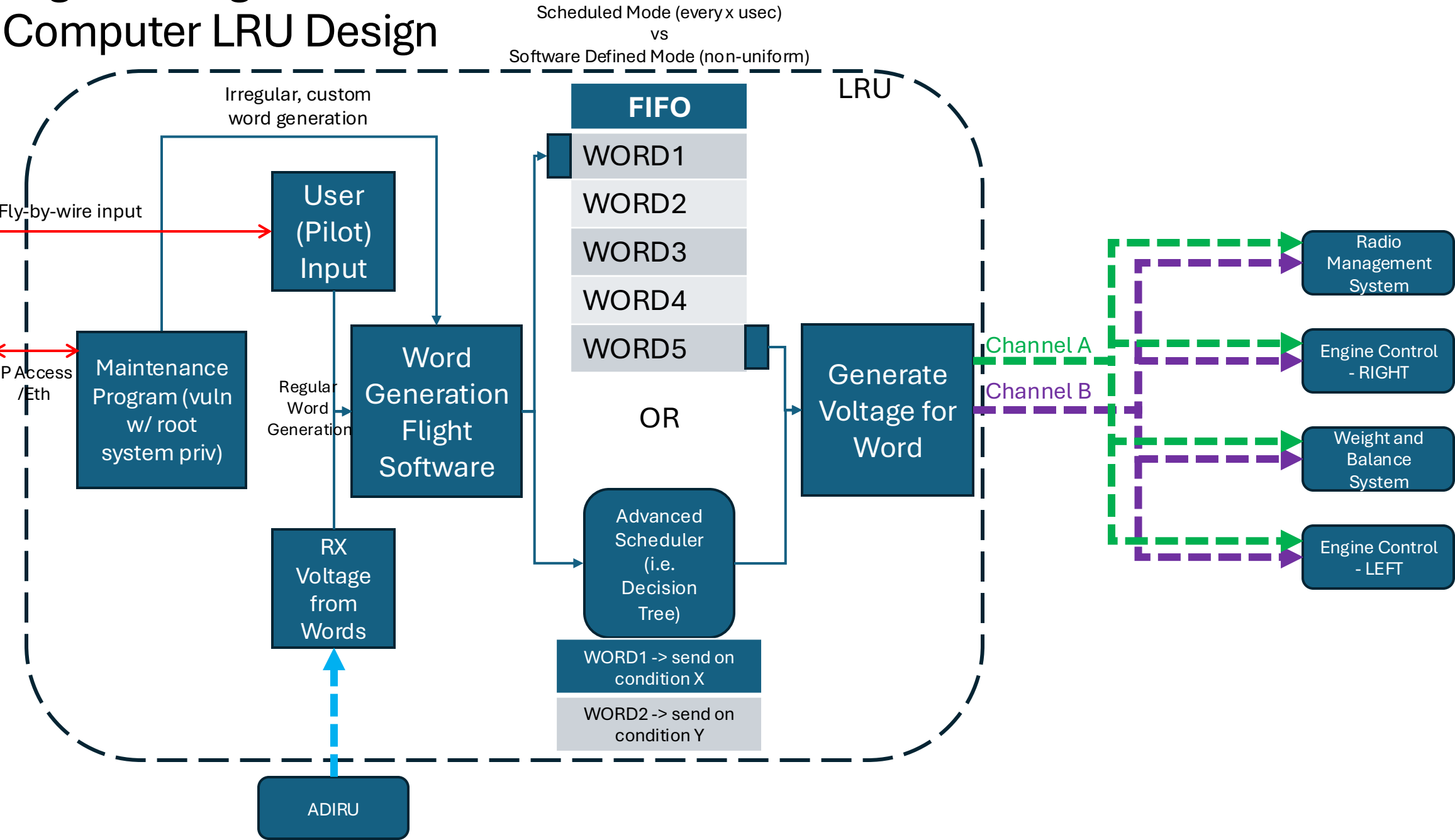# ARINC 429 Word Example - Latitude & Longitude Positions

Table 6-25-1 BCD ENCODING OF LATITUDE AND LONGITUDE

Bit No.	32	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
		SSM		DATA FIELD																					LABEL							
				MSC																	LSC											
				1	8	4	2	1	8	4	2	1	8	4	2	1	8	4	2	1	8	4	2	1	1	2	4	1	2	4	1	2
Present Position (Long) W 169 Deg 25.8' (011)	0	1	1	1	0	1	1	0	1	0	0	1	0	0	1	0	0	1	0	1	1	0	0	0	1	0	0	1	0	0	0	0

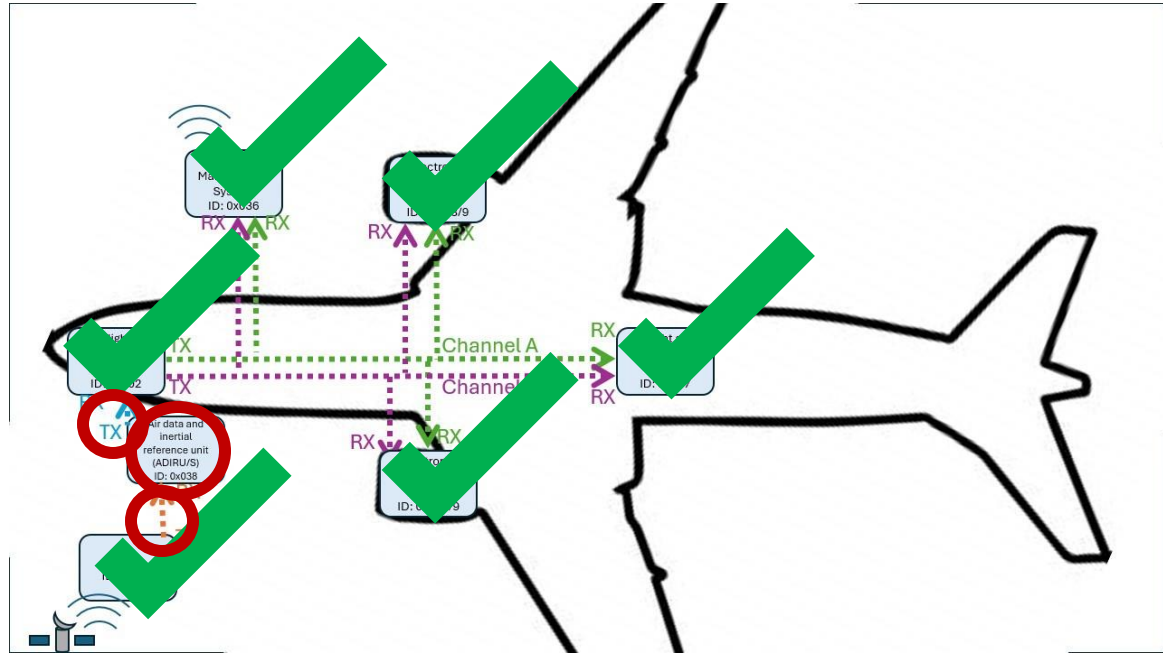Parity bit -> 12 "1"s = 0

00: W. 1 6 9 2 5 8 1 1 0   <- label digits

0o011

W 169 Deg 25.8'
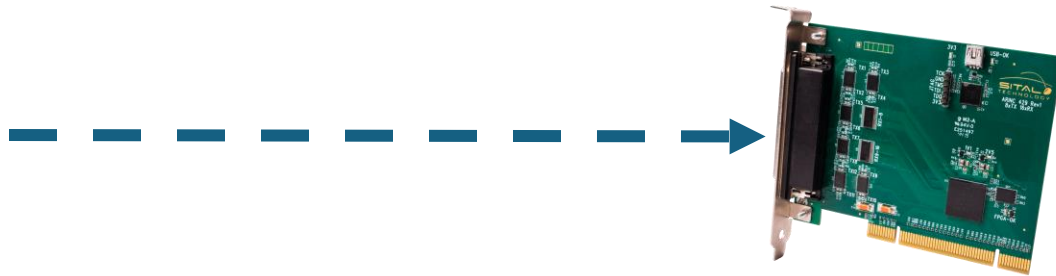
Ideas for upcoming week

- Create ADIRU LRU Simulator

- Create Blue and Orange Buses

- Continue to Refine Current LRUs with testbed

Areas for Feedback

- How should I go about creating an evaluation framework for my bus simulator?

- How should I go about creating an evaluation framework for my IDS when I implement it?