

ENCE464

Embedded Software & Advanced Computing
Tutorial

Term-3 Project Prep.

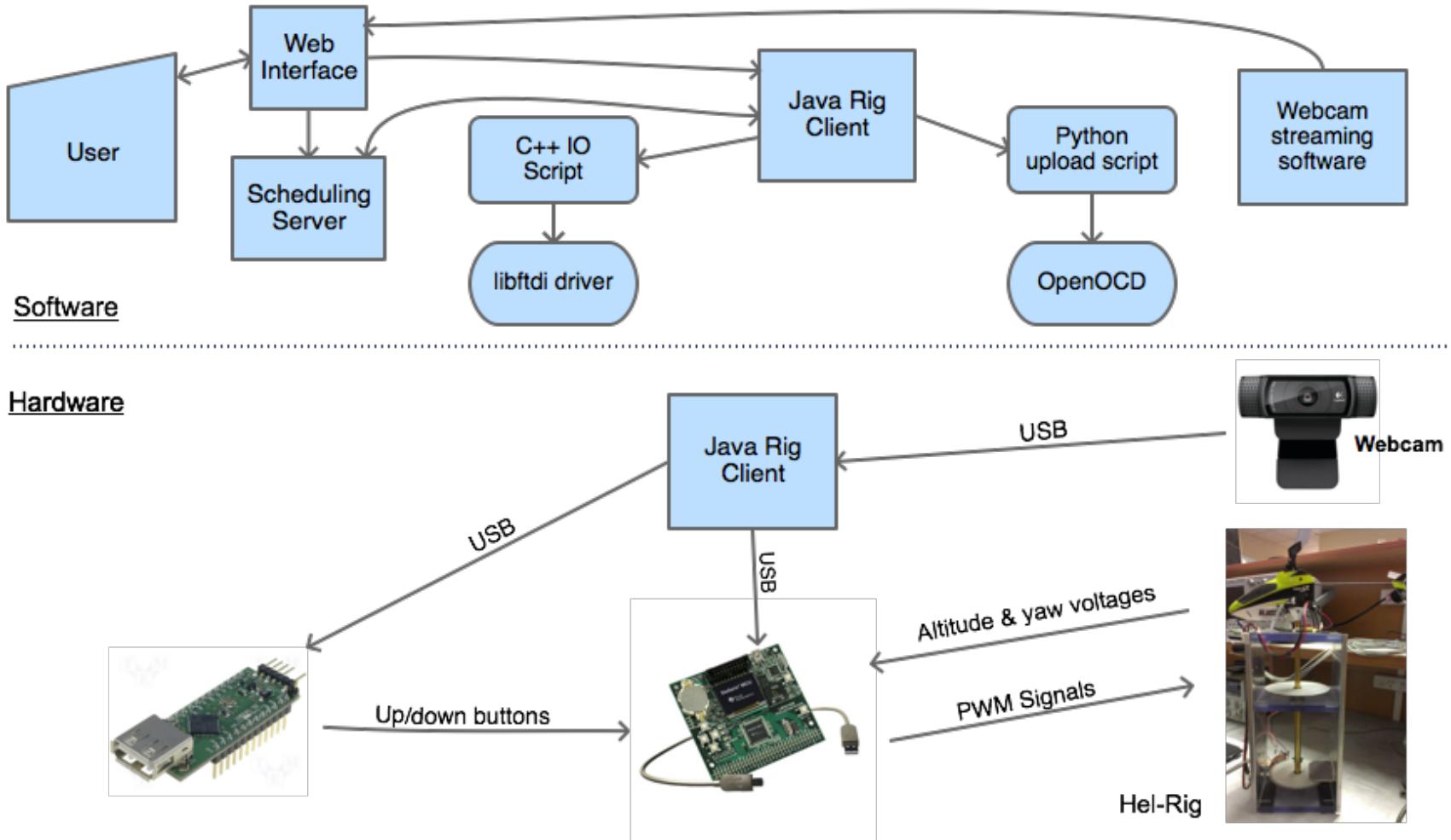
By: Steve Weddell

18 July 2019

Our heli-lab remote lab - 2014 to 2019

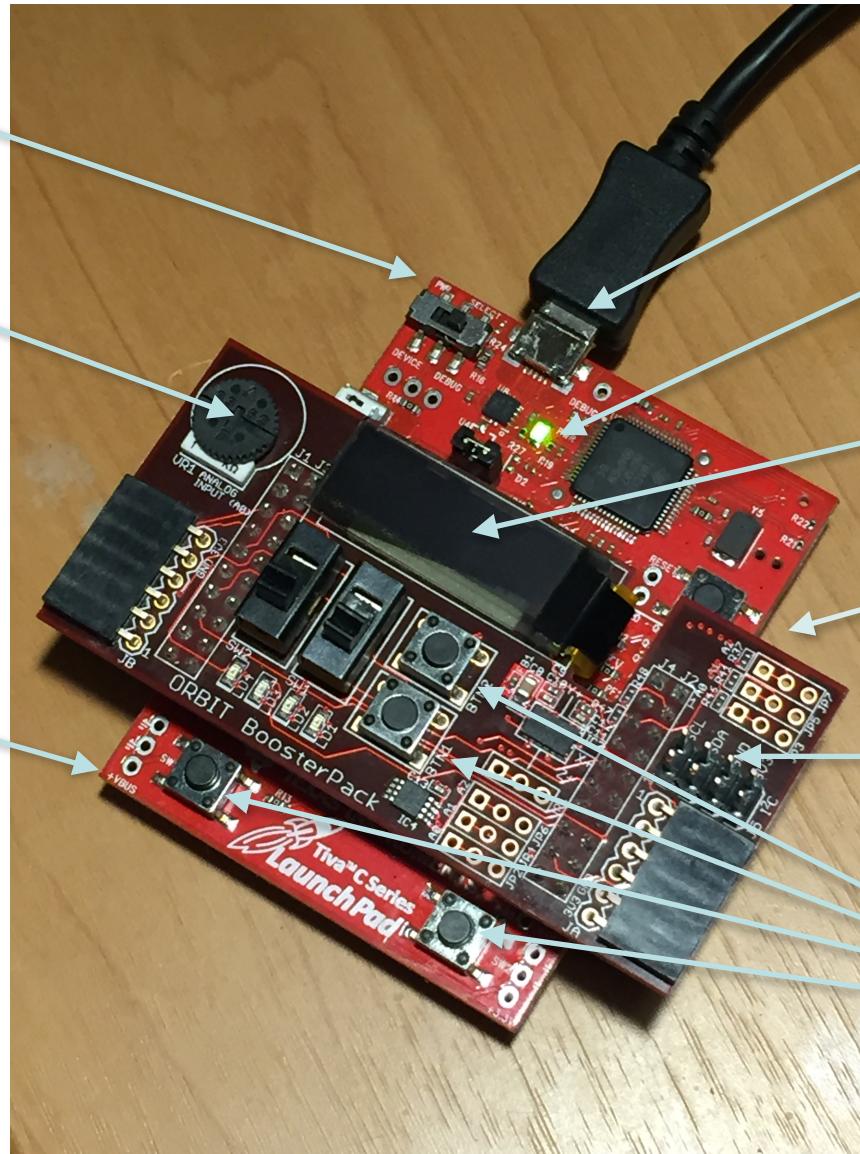


Overview of our remote avionics project



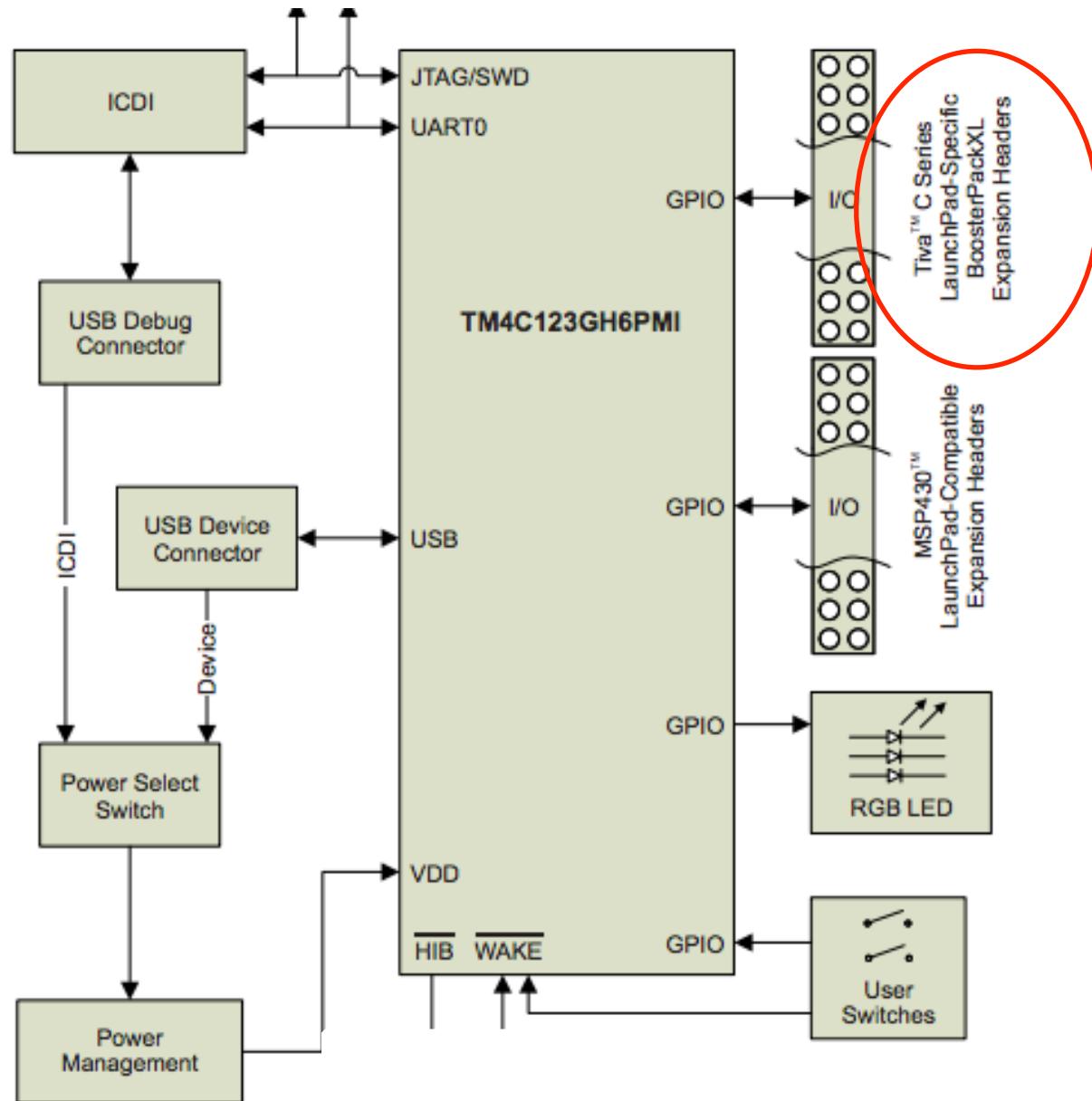
The Tiva development board with Orbit Booster Pack

- Slider switch - select “debug”
- Potentiometer to vary voltage (0-3.0V)
- Launchpad Tiva *motherboard*
- Male connectors on top, F/Male connectors on bottom of board

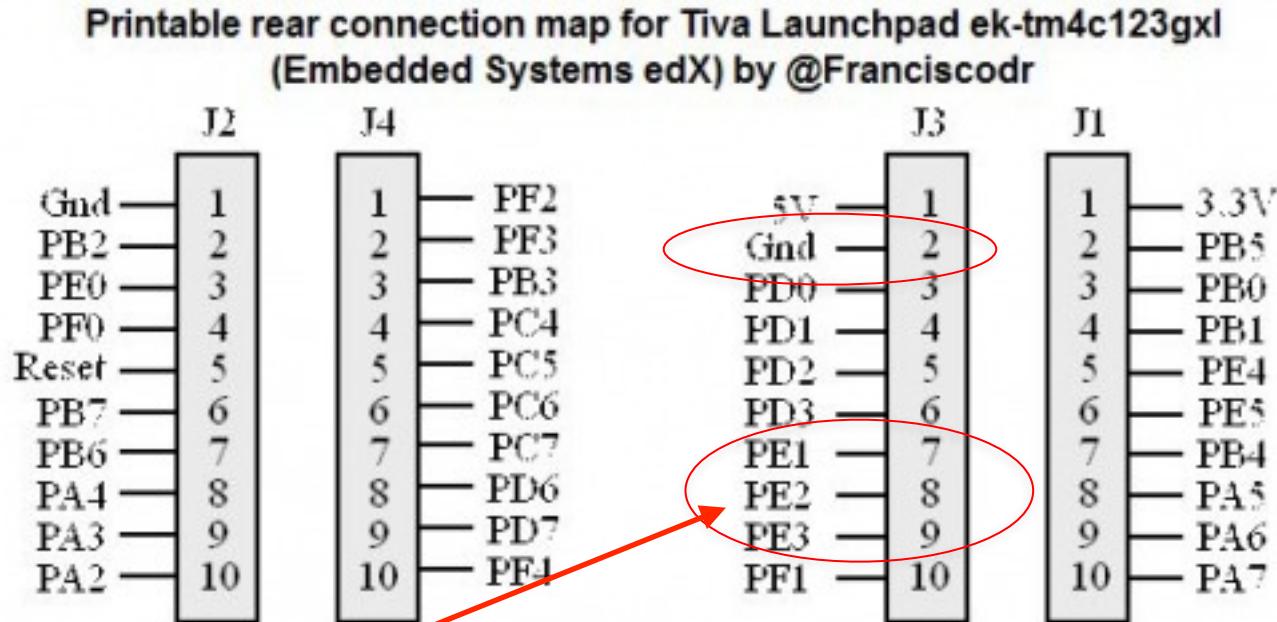


- USB debugger interface port
- Debug “on” LED
- Display, for displaying text
- User LED (under booster board)
- Orbit Booster Pack *daughterboard*
- Four push buttons

Tiva C board block diagram



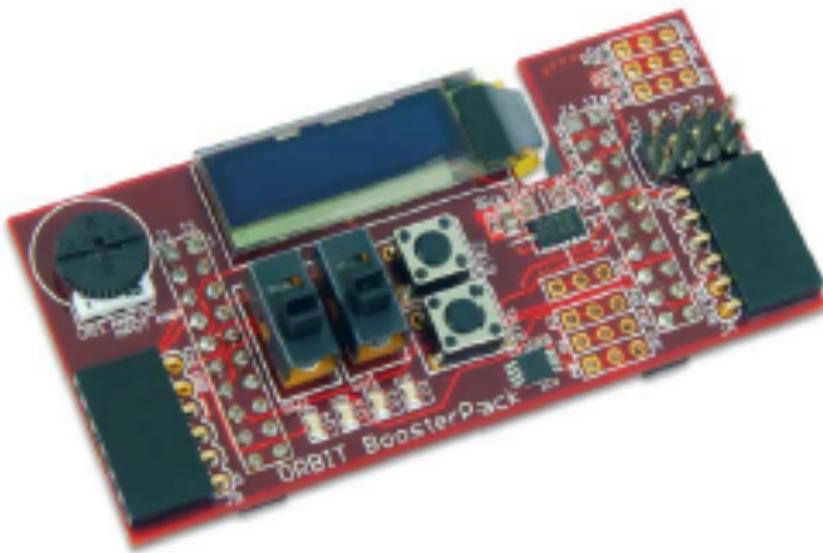
Header Connections



ADC ports { PE3 (AIN0) *internal* (Orbit) for Week-3
PE1 (AIN2) *external* (SigGen) for Week-4

Note: for external connections via the connector on the underside of your Tiva LaunchPad, a Ground connection is essential.

The Orbit BoosterPack by Digilent Inc.



Features include:

- Two 1x6 Digilent Pmod™ connectors
- 3-axis accelerometer
- 256 Kbit I²C EEPROM
- I²C temperature sensor
- 128x32 pixel OLED display
- Analog potentiometer

» Note the following resources:

- » Reference manual <orbit_boosterpack_rm.pdf> and schematic <orbit_boosterpack_sch.pdf> in “Docs” on Learn.
- » Example code is available and this has been rewritten by Matt Pike.

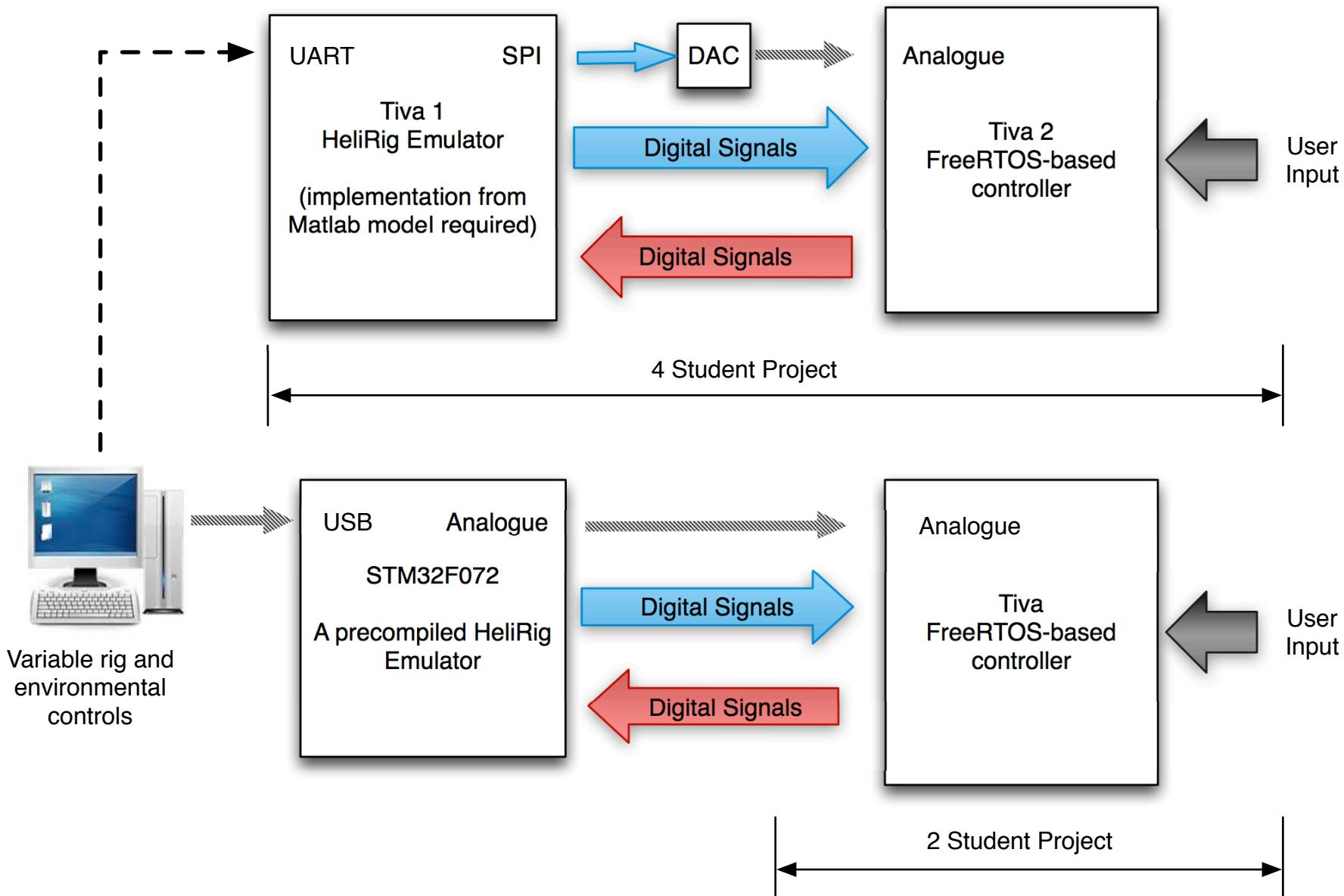
BoosterPack Pinout (1 of 2)

Connector #	Pin #	Port and Bit	Function	Description	Notes
J1	1	-	VCC3V3	Power supply	
J1	2	PB5	LD4	User LED	
J1	3	PB0	JB_03/RX	Pmod connector B pin 3/Rx	UART1
J1	4	PB1	JB_02/TX	Pmod connector B pin 2/Tx	UART1
J1	5	PE4	INT2_ACL	Accelerometer Interrupt Output	
J1	6	PF5	/RES_OLED	OLED reset	
J1	7	PB4	INT1_ACL	Accelerometer Interrupt Output	
J1	8	PA5	JA_02/MOSI	Pmod Connector A pin 2/Serial Out	SSIO
J1	9	PA6	SW2	Slide switch	
J1	10	PA7	SW1	Slide switch	
J2	1	-	GND	Ground	
J2	2	PB2	SCI	I ² C clock	I2C0
J2	3	PE0	BTN2	Push button	
J2	4	-	-	-	Not connected
J2	5	-	-	-	Not connected
J2	6	-	-	-	Not connected
J2	7	-	-	-	Not connected

BoosterPack Pinout (2 of 2)

J2	8	PA4	JA_03/MISO	Pmod Connector A pin 3/Serial In	SSIO
J2	9	PA3	JA_01/SS	Pmod Connector A pin 1/Slave Select	SSIO
J2	10	PA2	JA_04/SCK	Pmod Connector A pin 4/Serial Clock	SSIO
J3	1	-	-	-	Not connected
J3	2	-	GND	Ground	
J3	3	PDO	SCK_OLED	OLED serial clock	SSI3/SSI1
J3	4	PD1	/CS_OLED	OLED chip select	SSI3/SSI1
J3	5	PD2	BTN1	Push button	
J3	6	PD3	SDI_OLED	OLED serial data in	SSI3/SSI1
J3	7	PF1	VBAT_OLED	OLED VBAT enable	
J3	8	PE2	VDD_OLED	OLED VDD enable	
J3	9	PE3	AIN	Potentiometer	AIN0
J3	10	-	-	-	Not connected
J4	1	-	-	-	Not connected
J4	2	-	-	-	Not connected
J4	3	PB3	SDA	I ² C data	I2C0
J4	4	PFO	JB_04/RTS	Pmod connector B pin 4/Request to Send	UART1
J4	5	PF1	JB01/CTS	Pmod connector B pin 1/Clear to Send	UART1
J4	6	PC6	LD1	User LED	
J4	7	PC7	LD2	User LED	
J4	8	PD6	LD3	User LED	
J4	9	PD7	/DC_OLED	OLED data/command select	
J4	10		-		Not connected

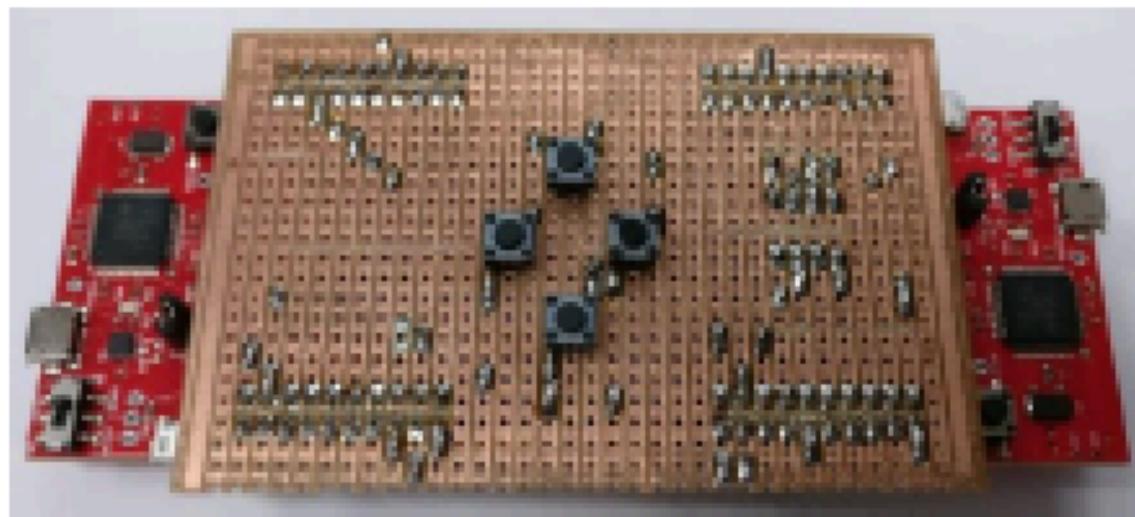
One Project, Two Perspectives



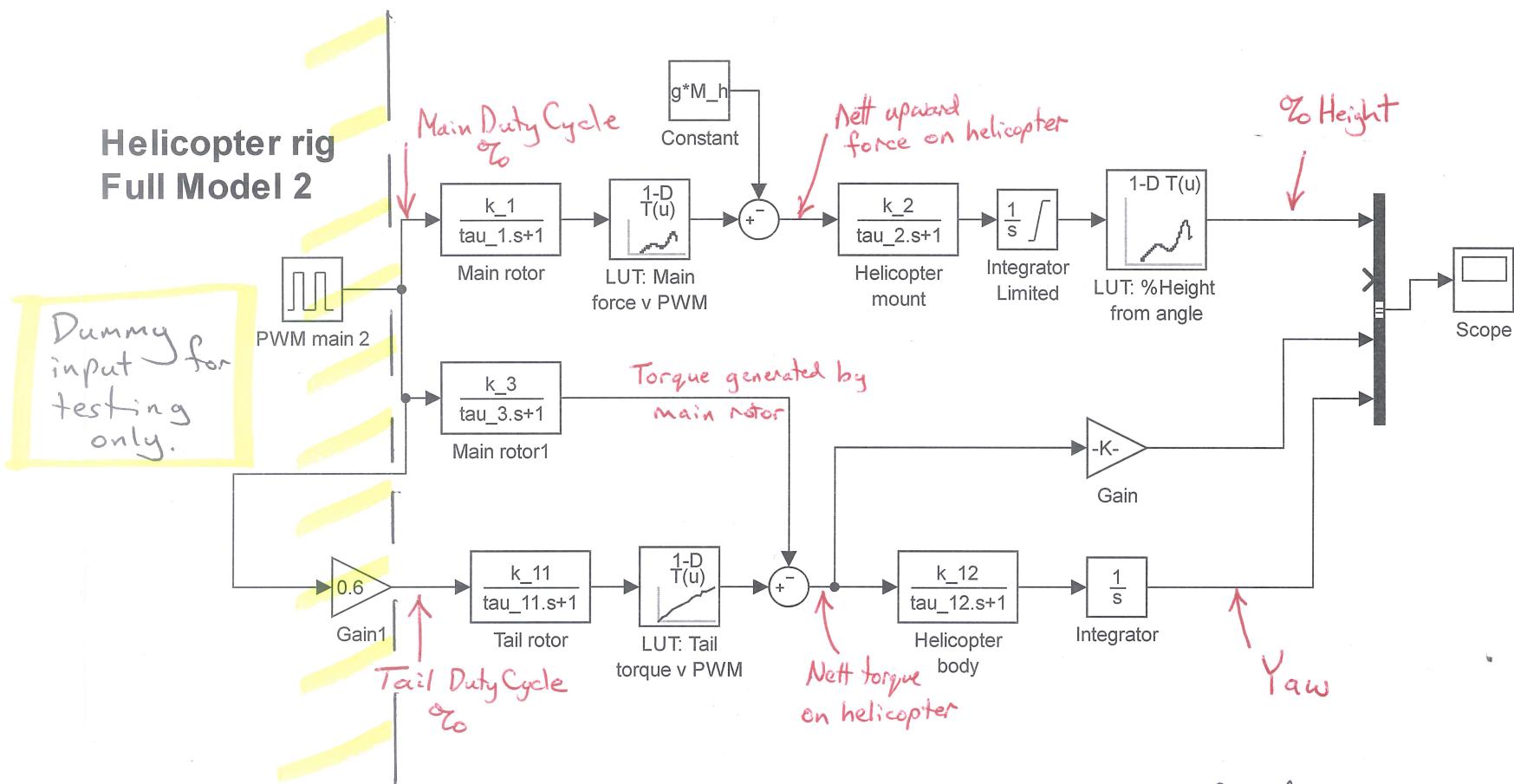
HeliRig Emulator to controller Interfaces



We also have DIL breadboards...



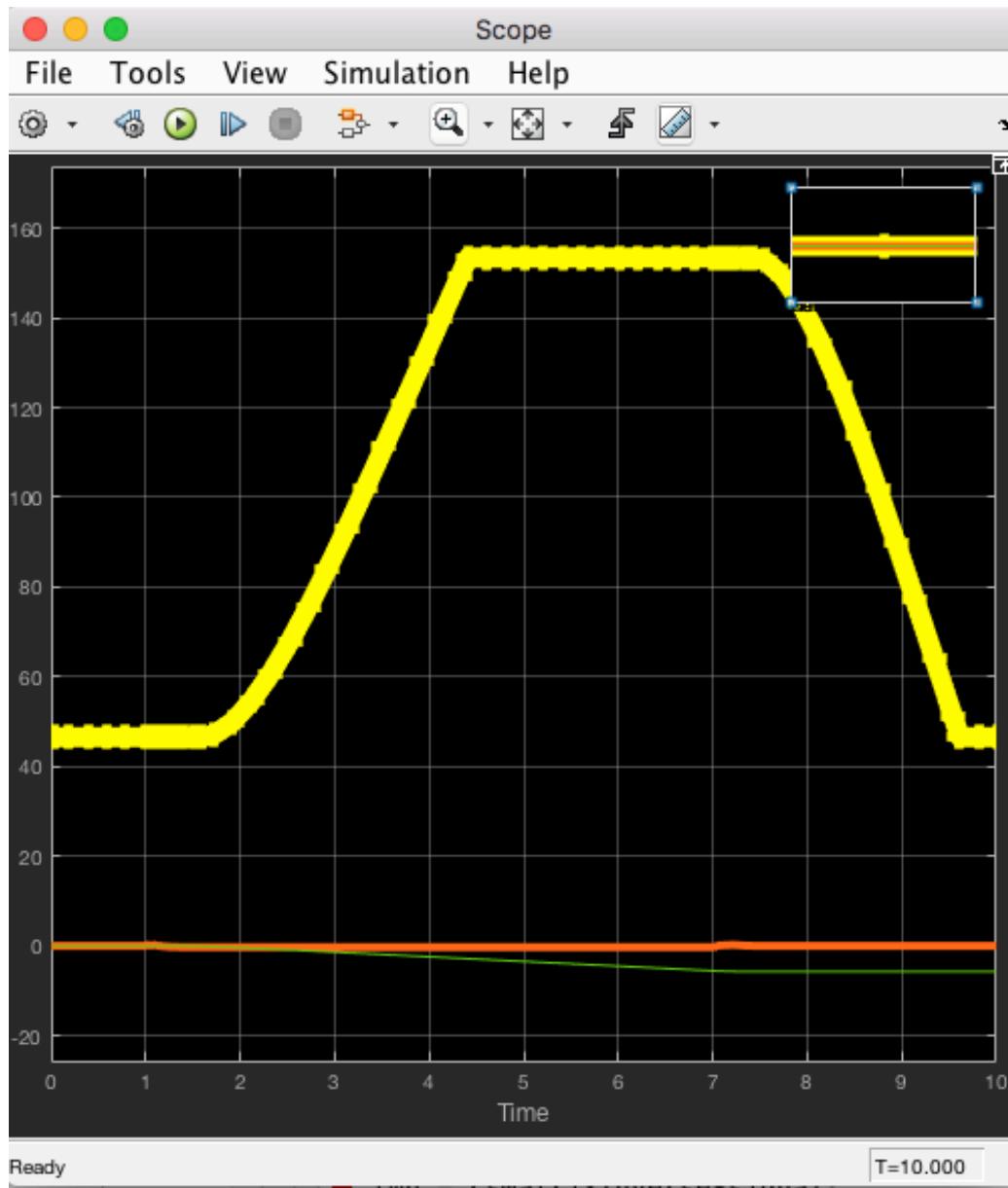
A Matlab Model for a HeliRig Emulator



A few notes on the HeliRig Model...

- » The provided simplified model is a work in progress.
- » The model has NOT been extensively tested.
- » The assumption is that an LTI system prevails; in practice however, this is not the case.
- » Teams should consider the following scenario: A fellow employee from your institution (Prof. Bones) was working on a flight emulator for the latest range of model helicopters. However, This engineer has now been asked to work on something else. Therefore, it would be inappropriate to discuss this model with him.
- » The bottom line is this: *it is what it is*. Feel free to use this model, modify it, an preferably, improve on it, but you should report any modifications in your report and provide an updated copy of this model in your code submission.

Testing the model...



Yellow: Height
Orange: Touque
Green: Yaw

Project Milestones and Deliverables

WinCalendar	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
Jul 2019	1 Mid-year break	2 Mid-year break	3 Mid-year break	4 Mid-year break	5 Mid-year break	6	7
	8 Mid-year break	9 Mid-year break	10 Mid-year break	11 Mid-year break	12 Mid-year break	13	14
	15 Outline ENCE464 proj. in Lect.	16 ENCE464 Term3 Project spec. on Learn	17 Project group selection on Learn	18 ENCE464 Proj. discussion in ESL	19 Students allocated if not in a group!!	20	21
	22	23	24	25 ENCE464 Milestone 1: Interface	26	27	28
	29	30	31	1 ENCE464 M2: Control & Emulator	2	3	4
	5	6	7	8 ENCE464 Milestone 3: Emulator	9	10	11
Aug 2019	12	13	14	15 ENCE464 Milestone 4: Testing	16	17	18
	19	20	21	22 Deadline!! Deliverable 1: Demo; 2: Code	23	24	25 Deadline!! Deliverables 3: Critiq.; 4: Report
	26 Lecture break	27 Lecture break	28 Lecture break	29 Lecture break	30 Lecture break	31	1