

UNIVERSITY OF LOUISIANA AT LAFAYETTE

STEP Committee Technology

Fee Application

Real-time Digital Simulator Request

Title

Dr. Farzad Ferdowsi/Dr. Afef Fekih/Mr. Shelby A. Williams, Jr.

Name of Submitter
(Faculty or Staff Only)

Electrical and Computer Engineering/College of Engineering

Organization

Title: Real-Time Digital Simulator Request

Date: 07/09/2019

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Department/College/Org: EECE/Engineering/University of Louisiana at Lafayette

ABSTRACT

Energy technologies related fields are critical to the state of Louisiana and the nation. To ensure a better prepared workforce and help ensure the competitiveness of UL Lafayette it is important to provide students with a high quality education and mentorship in fields associated with energy technologies. Additionally, it is crucial to connect theoretical material taught in lecture courses with the realities of physical hardware by providing a realistic environment. Well-equipped and realistic teaching laboratories are the cornerstone of effective education for future engineers. Real-time simulation plays an important role in teaching and research labs these days. Real-time simulators provide a “safe”, “cost effective” and “flexible” testbed for modeling the behavioral dynamics of a wide range of power and energy systems. It is becoming difficult for students to get access to an efficient realistic power system lab due to the scarcity, cost, and inherent danger associated with high power and high voltage equipment. Therefore, well equipped digital power education platforms and laboratories are vital in educating the next generation of engineers and researchers.

Hence, in order to endow the students with the theoretical foundation for this important discipline, we propose to equip the power lab with a real-time simulator in order to enable the students to conduct a wide array of experiments and take a more effective hands-on approach. With the new proposed equipment, the power laboratory can really be a flexible teaching/research lab. Additionally, the proposed equipment will be made available to students in the following courses: EECE 447, EECE 448, EECE 450, EECE 570, EECE 571, EECE 461, ENGR 517, EECE 550, EECE 505, EECE 437, MCHE 461, MCHE 474, and MCHE 483.

Purpose of the grant and impact to the student body as a whole

This proposal requests funds to equip the power laboratory with a real-time digital simulator testbed. In order to conduct experiments on power systems (power distribution networks, renewable energies, high voltage transformers, power electronic devices and large scale generators) there are always two important concerns. The first and foremost concern is the cost of components in high power/high voltage applications which becomes worse when additional components are required for different experiments. The second concern is safety that is currently keeping students away from experiments in this area. Using real-time digital simulators will provide students with great insights into the behavior of power and energy components along with their associated control systems. Additionally, all of the experiments provide a flexible, realistic and safe environment. Such equipment will have a tremendously impact on the students, the university and the state.

By incorporating as many hands on experiments as possible into the classroom, we will provide the students with a more effective education, enhance their learning experience, improve their engagement and increase retention. Additionally, we will strengthen the infrastructure of the college, upgrade and increase the availability of technology in the college and on campus and promote the state's economic development by producing a better prepared workforce for the region.

The equipment that we are proposing to purchase will give the students better up-to-date knowledge of the state of the art in energy technologies field. In addition to supplementing the undergraduate power and control courses, this equipment can also be projected as of great value to our graduate program. Students enrolled in the following courses: EECE 461, ENGR 517, EECE 550, EECE 505, EECE 437, EECE 447, EECE 448, EECE 450, EECE 570, EECE 571, MCHE 461, MCHE 474, and MCHE 483 can benefit from the workstation as well.

By having well equipped facilities, we will provide a complete up to date knowledge for our students, increase their retention, and get better prepared students for the local industry. Moreover, hands on experiments will stimulate their curiosity, complete their knowledge and provide potential recruits for our graduate programs. In summary, the availability of technology in our unit will attract more students to our program and therefore impact the recruitment to our university and promote the state's economic development by providing well prepared engineers.

This proposal requests the purchase of the following real time simulator along with the DSP interface and the TI controller board:

- 1- Typhoon Hardware in the Loop Real-Time Emulator (602 series):¹**
- 2- HIL UGrid DSP Interface²**
- 3- TI DSP DIM100 Card³**

The above equipment are suited to introduce fundamental concepts and theories in power and

¹ <https://www.typhoon-hil.com/products/hil602>

² <https://www.typhoon-hil.com/products/hil-ugrid-dsp-interface>

³ <http://www.ti.com/tool/TMDSCNCD28335>

control relevant to real world applications. It comes with ready-made teaching materials for high-power digital control, comprehensive user manual as well as pre-designed controllers and a system model allowing a quick deployment of the lab experiments. A variety of topics in power systems, control theory and system dynamics can be covered, including:

- Testing complex, fast, adaptive, and multilayered control and communication actions
- Electric motors
- Inverters, engine-generators and switchgears
- Central control desk
- Battery storage systems
- Derivation of simple dynamic models
- Incorporating of
- Control parameters tuning
- Implementation and analysis of various control designs
-

Which will enhance the knowledge of our students and give them a better understanding of the topics covered in EECE 461, ENGR 517, EECE 550, EECE 505, EECE 437, EECE 447, EECE 448, EECE 450, EECE 570, EECE 571, MCHE 461, MCHE 474, and MCHE 483.

Projected lifetime of enhancement

The projected lifetime of the equipment requested is eight to ten years. 2 years warranty is included in the quote.

People Responsible

Mr. Shelby Williams is the laboratory manager for the Electrical and Computer Engineering Department. He will be responsible for the implementation, installation and provisioning of the equipment.

Dr. Farzad Ferdowsi & Dr. Afef Fekih will manage the equipment operation by managing teaching labs on power and control courses respectively.

Previous Funded Grants

- MATLAB/Simulink on UCS System – July 1999
- Additional and Upgrade of for EECE Student Laboratory – July 1999
- EE Electronics Laboratory – January 2012
- EE Computational Upgrades – July 2014
- Test and Measurement Upgrades – Fall 2017
- EECE 140 Computer Engineering Teaching Lab Upgrade, Fall 2018



Figure 1. Typhoon real-time digital simulator

Budget Proposal

1.	Equipment	\$ 38,840 – HIL Simulator (Quote attached) \$3,950 – DSP Interface (Quote attached) \$65– TI Control board
		<hr/>
		Subtotal: \$42,855
2.	Software	\$ 0 (software is included)
3.	Supplies	\$
4.	Maintenance	\$
5.	Personnel	\$
6.	Other	\$

TOTAL: **\$ 42,855**

Note: The permanent software license with unlimited number of seats, remote online support, and approach to the special Power Electronics course materials are all included in the quote above. Also, the company is committed to 1 day of on-site training.



Typhoon HIL, Inc.
15 Ward Street
Somerville, MA 02143 US

ADDRESS

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QUOTE 190710_HIL602+acad

DATE 07/10/2019

EXPIRATION DATE 08/10/2019

ACTIVITY	QTY	RATE	AMOUNT
Academic packages:HIL602+ package w/ permanent licence Premier University Package. Includes: 1. HIL602+ emulator unit with 2 years of warranty, 2. Permanent device license, Typhoon HIL (Control Center) Software with 4 software updates per year, 3. Online technical support, online HIL academy courses, and the following toolboxes: Expert Power Electronics, Microgrid and Communications.	1	48,500.00	48,500.00
Strategic Academic Partner Discount 20% 20 % special discount for new academic customer.	-0.20	48,500.00	-9,700.00
Shipping and handling	1	40.00	40.00

Payment terms: Net30.
Shipping terms: ExWorks Somerville, MA.
Point of Contact:
caroline.almeida@typhoon-hil.com
bozica.kovacevic@typhoon-hil.com

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TOTAL	\$38,840.00
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Accepted By

Accepted Date



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QUOTE 190711_HIL402acad

DATE 07/11/2019

EXPIRATION DATE 08/11/2019

ACTIVITY	QTY	RATE	AMOUNT
Hardware:HIL402 HW Typhoon HIL402 Emulator Hardware Unit	1	9,100.00	9,100.00
Permanent Device License HIL402 Permanent license (Academic).	1	9,300.00	9,300.00
			Subtotal: 18,400.00
MEMBER DISCOUNT	1	-8,410.00	-8,410.00
Engineering Services:Academic service package Basic service package (One time purchase).	1	7,900.00	7,900.00
MEMBER DISCOUNT	1	-7,900.00	-7,900.00
Hardware:HIL uGrid DSP Interface HIL Microgrid DSP Interface Board	1	3,950.00	3,950.00

Payment terms: Advance Payment.
Shipping terms: ExWorks Somerville, MA
Delivery terms: 3-5 days.
Point of Contact:
caroline.almeida@typhoon-hil.com
bozica.kovacevic@typhoon-hil.com

TOTAL \$13,940.00

TMS320F28335 controlCARD

TMDSCNCD28335 (ACTIVE)

[Description & Features](#)
[Technical Documents](#)
[Support & Training](#)
[Order Now](#)

Description

TMDSCNCD28335 is a DIMM100 controlCARD based evaluation and development tool for the [Delfino F2833x](#) series. controlCARDs are ideal to use for initial evaluation and system prototyping. controlCARDs are complete board-level modules that utilize one of two standard form factors (100-pin DIMM or 180-pin HSEC) to provide a low-profile single-board controller solution. For first evaluation, controlCARDs are typically purchased [bundled with a baseboard](#), a [Peripheral Explorer Kit](#), or an application kit. The TMDSCNCD28335 control card requires a baseboard to function.

Features

Hardware Features

[TMDSCNCD28335: TMS320F28335](#) DIMM100 based controlCARD

Small form factor

F28x analog I/O, digital I/O and JTAG signals to DIMM interface

Isolated RS-232 interface

5V power and JTAG debug probe required ([provided with baseboard bundles](#))

Hardware Files are in C2000Ware at boards\controlCARDs\TMDSCNCD28335

Software Features

Free download of [Code Composer Studio IDE](#)

Free download of [controlSUITE](#) for device drivers and example projects

Several [C2000 workshops](#) were created to help teach users about the F2833x family of devices.

The [2010 C2000 Teaching ROM](#) was built around the similar [TMDSPREX28335](#) kit and can serve as a good reference.

MathWorks [Embedded Target Support](#)

solidThinking [Embed Support](#)

Get Started

Install [controlSUITE](#)

Install [Code Composer Studio IDE](#)

Ask questions on the TI C2000 [e2e forum](#)

What's Included

Delfino F28335 controlCARD

Order Now

Part Number	Buy from Texas Instruments or Third Party	Buy from Authorized Distributor	Status
TMDSCNCD28335: TMS320F28335 controlCARD	\$69.00(USD) Add to cart	Pricing may vary.	ACTIVE
		Buy from distributor	



TMDSCNCD28335



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