PROJECT IDEA SUBMISSION – *RESEARCH*

LABORATORY INFORMATION

Name: Purdue University Boiling and Two-Phase Flow Laboratory

Date: 10/12/2024

LABORATORY'S LIAISON CONTACT INFORMATION

Name: Issam Mudawar

Title: Prof., Lab Director **E-Mail:** mudawar@ecn.purdue.edu

Phone: (765) 463-3771 **Cell:** _(___)_____ **Fax:** _(___)_____

Address: 585 Purdue Mall (Street Address / P.O. Box) Room ME3170 (Room/Suite #)

West Lafayette (City) IN (State) 47907 (ZIP Code)

PROJECT NAME

Data center thermal management - Project B

GENERAL PROJECT DESCRIPTION

Thermal management is widely acknowledged as one of the primary challenges in development of advanced data centers. Trends point to enormous increases in the amount of heat to be removed from individual circuit modules as well the entire data center. There is now a realization that liquid cooling with phase change is the only method for tackling the cooling requirements at both module and system levels. The proposed project will address the thermal management requirements by designing and constructing a subset of modules and external cooling system.

The proposed work will be pursued by two design teams: Project Team A and Project Team B.

WHAT IS THE MECHANICAL ENGINEERING PROBLEM (APPARATUS) YOU ARE WANTING SOLVED (BUILT)?

The team will be tasked with assisting in the development of cooling modules design with focus on use of CAD and CNC machining of interconnecting cooling modules.

WHY IS THIS PROBLEM (APPARATUS) WORTH SOLVING (BUILDING)? (Value Proposition)

Effective thermal management is widely acknowledged as essential to the development of high-performance data centers.

WHAT ARE THE MOST IMPORTANT FUNCTIONAL REQUIREMENTS AND SPECIFICATIONS FOR THIS PROJECT?

Req. 1: Through coordination with Team A, contact large US-based data center developers to seek technical support as well acquisition of multiple modules, cabinet, and components of external cooling

Req. 2: Recommend improved module design

Req. 3: Using CAD and finite element analysis software, and with assistance of Project A team, provide detailed design of improved module

Req. 4: Using CNC machining, construct multiple modules

Req. 5: Coordinate with Project A team on developing cooling system, including fluid couplers, pump and external heat exchanger.

WHAT DO YOU ANTICIPATE THE STUDENTS DESIGNING, ANALYZING, BUILDING/PROTOTYPING AND TESTING? BE AS SPECIFIC AS POSSIBLE.

Design: cooling modules, external cooling system

Analyze: structural integrity of modules

Build: cooling modules, external cooling system

Test: cooling modules, external cooling system

WHAT IS YOU BEST ESTIMATE OF THE COST OF THE HARDWARE, COMPONENTS, MATERIALS, … OF THE PROPOSED PROTOTYPE?

Total $: hardware, component, and material costs will have a budget of about $1,000 to be provided to the team.

HOW MUCH TIME AND EFFORT WOULD YOU EXPECT TO SPEND ON THIS PROJECT IF YOU WERE DOING IT INTERNALLY?

About 9 hours per week as instructor for one division of ME463.

DO YOU BELIEVE THE PROJECT CAN BE COMPLETED WITH EXISTING TECHNOLOGY, IF NOT, ELABORATE ON NEEDED DEVELOPMENTS?

Prof. Mudawar has developed multiple cooling module designs over the past 40 years. Available expertise will ensure successful attainment of the project's objectives.

CONCERNS OR OTHER RELATED INFORMATION ASSOCIATED TO THE PROPOSED PROJECT?

Any Concerns: None

ATTACH ANY APPROPRIATE SKETCHES, DRAWINGS, STANDARDS, DATA, PHOTOS, … USEFUL IN JUDGING APPROPRIATENESS AND SCOPE OF PROPOSED PROJECT.

Details be provided after the team selection.

ARE YOU WORKING WITH ME SENIORS WHO YOU WOULD LIKE ON THIS PROPOSED PROJECT? YES/NO (If YES, provided what information you can.)

NAME	PHONE	EMAIL

Save this filled out .docx with the following naming nomenclature: "RESEARCH_*project name* – *student point of contact full name*.docx" where the *italic strings* get replaced with appropriate actual text strings.

If you have any questions concerning a proposed project or completing this form please contact Professor Greg Jensen.

To submit a project for consideration, please return attached as a PDF (preferred) this form and any attachments to:

C. Greg Jensen, PhD

Director of Senior Design
Professor of Engineering Practice
School of Mechanical Engineering, Room 2195
Purdue University
585 Purdue Mall
West Lafayette, IN 47907-2088

Office: 765-496-0214
Cell: 801-367-6145
Fax: 765-496-1114
E-mail: jensen23@purdue.edu