New Hampshire DOT
Department of Transportation

THE STATE OF NEW HAMPSHIRE
DEPARTMENT OF TRANSPORTATION

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WILLIAM CASS, P.E.
ASSISTANT COMMISSIONER

Bureau of Materials & Research
September 14, 2015

Her Excellency, Governor Margaret Wood Hassan
and the Honorable Council
State House
Concord, New Hampshire 03301

REQUESTED ACTION

Authorize the Department of Transportation to execute a **sole-source** Cooperative Project Agreement with the UNH Sponsored Programs Administration (Vendor 177867), Durham, New Hampshire, for a total fee not to exceed $455,000, for a cooperative investigation to advance the science and engineering of tidal energy conversion, sensor network development and deployment for structural health monitoring, intelligent transportation system, innovative monitoring and community engagement effective upon Governor and Council approval through May 31, 2019. 100% Federal Funds.

Funding to support this request are anticipated to be available in the following account in State FY 2016, State FY 2017, State FY 2018, and State FY 2019 upon the availability and continued appropriation of funds in the future operating budget, with the ability to adjust encumbrances between State Fiscal Years through the Budget Office, if needed and justified:

04-96-96-962015-3036 SPR Research Funds	FY 2016	FY 2017	FY2018	FY2019
046-500464 General Consultants Non-Benefit	$223,000	$151,000	$71,000	$10,000

EXPLANATION

The research study included in the requested action will address an immediate Department need; is unique to New Hampshire's environment and conditions, thereby requiring substantial local experience; and is directly aligned with a particular area of University expertise. In addition, the Principal Investigator is a nationally recognized expert in her respective field. As such, the proposed work does not lend itself to a selection process that includes private industry or out-of-state organizations, and it is in the Department's and the State's best interest to work directly with the University of New Hampshire.

This work is part of the Departments Statewide Planning and Research (SPR) program. The requested action is in furtherance of a long-standing cooperative relationship of transportation research between the Department of Transportation and the University of New Hampshire. This relationship has been mutually beneficial, culminating in savings to the State while enhancing work force development and maintaining New Hampshire's position on the leading edge of new technology.

Statewide-SPR 26962G – Structural Support for Tidal Energy Conversion at the Memorial Bridge

The Memorial Bridge, crossing over the Piscataqua River between Portsmouth, NH and Kittery, ME, has the capability to serve as an incubator for tidal energy conversion and storage technology. The first step in

developing a field incubator site for tidal energy conversion and the Memorial (Living) Bridge is designing and installing a modular support frame that is adaptable to house a turbine-generator system. An interdisciplinary team of civil, mechanical, and ocean engineers would work together to advance the science and engineering of tidal energy conversion and provide an active, community-oriented laboratory for education about sustainability. In the process of testing tidal energy conversion systems, the predictable, renewable, and clean energy generated, via the tidal turbine, would be used to supplement the power needs of instrumentation, including structural health monitoring instrumentation, and communication systems. This support frame will allow for assessment of feasibility of the incorporation of tidal energy conversion in bridge design. Research is required to determine the effects of the modular support frame and operating turbines on this and other bridges. This portion of the project was approved for $100,000 of SPR Research funds by the Department's Research Advisory Council. Project funding is 80% federal funds with 20% state match. Turnpike toll credit is being used for match requirement, effectively using 100% federal funds.

This project also includes a $355,000 federal demonstration grant received by the Department. The FHWA Accelerated Innovation Deployment (AID) Demonstration grant provides funding as an incentive to accelerate the implementation and adoption of innovation in highway transportation. The project includes installation of atmospheric, structural, and underwater sensors for bridge monitoring technology. The sensors and monitoring system will collect data to assess the effectiveness of bridge structural innovations, including the "gusset-less" truss connections, metalized steel coating and vertical lift balance system. This project is intended to allow NHDOT to add environmental and structural sensors to their toolbox as a cost-effective bridge management tool for high-profile and complex bridge structures. The Department was selected to receive an AID Demonstration grant to create a benchmark example of a self-diagnosing, self-reporting, and smart infrastructure. The NHDOT will use the bridge monitoring technology to provide information for operational management and compile a variety of data to inform decisions with regard to this bridge. Project funding is 80% federal funds up to $355,000 with 20% soft-match provided by UNH ($88,750). Dr. Erin Santini-Bell's salary, fringe benefits, and facilities and administrative cost through the term of the project will be applied.

This Agreement has been approved by the Attorney General as to form and execution and the Department has verified that the necessary funds are available. Copies of the fully-executed Agreements are on file at the Secretary of State's Office and the Department of Administrative Services, and subsequent to Governor and Council approval will be on file at the Department of Transportation.

It is respectfully requested that authority be given to enter into a sole-source Agreement for services as outlined above.

Sincerely,

William Cass, P.E.
Assistant Commissioner

Attachments

COOPERATIVE PROJECT AGREEMENT
between the
STATE OF NEW HAMPSHIRE, **Department of Transportation**
and the
University of New Hampshire of the UNIVERSITY SYSTEM OF NEW HAMPSHIRE

A. This Cooperative Project Agreement (hereinafter "Project Agreement") is entered into by the State of New Hampshire, **Department of Transportation**, (hereinafter "State"), and the University System of New Hampshire, acting through **University of New Hampshire**, (hereinafter "Campus"), for the purpose of undertaking a project of mutual interest. This Cooperative Project shall be carried out under the terms and conditions of the Master Agreement for Cooperative Projects between the State of New Hampshire and the University System of New Hampshire dated November 13, 2002, except as may be modified herein.

B. This Project Agreement and all obligations of the parties hereunder shall become effective on the date the Governor and Executive Council of the State of New Hampshire approve this Project Agreement ("Effective date") and shall end on **5/31/19**. If the provision of services by Campus precedes the Effective date, all services performed by Campus shall be performed at the sole risk of Campus and in the event that this Project Agreement does not become effective, State shall be under no obligation to pay Campus for costs incurred or services performed; however, if this Project Agreement becomes effective, all costs incurred prior to the Effective date that would otherwise be allowable shall be paid under the terms of this Project Agreement.

C. The work to be performed under the terms of this Project Agreement is described in the proposal identified below and attached to this document as Exhibit A, the content of which is incorporated herein as a part of this Project Agreement.

Project Title: **The Living Bridge: Creating Benchmark for Bridge Monitoring and Tidal Energy**

D. The Following Individuals are designated as Project Administrators. These Project Administrators shall be responsible for the business aspects of this Project Agreement and all invoices, payments, project amendments and related correspondence shall be directed to the individuals so designated.

State Project Administrator	**Campus Project Administrator**
Name: Ann M. Scholz	Name: Dianne Hall
Address: NHDOT Bureau of Mat'ls & Research PO Box 483, 5 Hazen Dr. Concord, NH 03302-0483	Address: University of New Hampshire Sponsored Programs Administration 51 College Rd. Rm 116 Durham, NH 03824
Phone: 603-271-1659	Phone: 603-862-1942

E. The Following Individuals are designated as Project Directors. These Project Directors shall be responsible for the technical leadership and conduct of the project. All progress reports, completion reports and related correspondence shall be directed to the individuals so designated.

State Project Director	**Campus Project Director**
Name: Robert Landry	Name: Dr. Erin Santini Bell
Address: NHDOT Bureau of Bridge Design PO Box 483, 7 Hazen Dr. Concord, NH 03302-0483	Address: University of New Hampshire Civil Engineering W183 Kingsbury Hall Durham, NH 03824
Phone: 603-271-3921	Phone: 603-862-3850

Campus Authorized Official KS
Date 9/9/15

F. Total State funds in the amount of **$455,000** have been allotted and are available for payment of allowable costs incurred under this Project Agreement. State will not reimburse Campus for costs exceeding the amount specified in this paragraph.

Check if applicable

☒ Campus will cost-share **16.32** % of total costs during the term of this Project Agreement.

☒ Federal funds paid to Campus under this Project Agreement are from Grant/Contract/Cooperative Agreement No. from **Department of Transportation**under CFDA# **20.205**. Federal regulations required to be passed through to Campus as part of this Project Agreement, and in accordance with the Master Agreement for Cooperative Projects between the State of New Hampshire and the University System of New Hampshire dated November 13, 2002, are attached to this document as Exhibit B, the content of which is incorporated herein as a part of this Project Agreement.

G. Check if applicable

☒ Article(s) **7** of the Master Agreement for Cooperative Projects between the State of New Hampshire and the University System of New Hampshire dated November 13, 2002 is/are hereby amended to read:

Budget reallocations to cost share will require prior State approval.

H. ☒ State has chosen **not to take** possession of equipment purchased under this Project Agreement.
☐ State has chosen **to take** possession of equipment purchased under this Project Agreement and will issue instructions for the disposition of such equipment within 90 days of the Project Agreement's end-date. Any expenses incurred by Campus in carrying out State's requested disposition will be fully reimbursed by State.

This Project Agreement and the Master Agreement constitute the entire agreement between State and Campus regarding this Cooperative Project, and supersede and replace any previously existing arrangements, oral or written; all changes herein must be made by written amendment and executed for the parties by their authorized officials.

IN WITNESS WHEREOF, the University System of New Hampshire, acting through the **University of New Hampshire** and the State of New Hampshire, **NH Department of Transportation** have executed this Project Agreement.

By An Authorized Official of:
University of New Hampshire
Name: Karen M Jensen
Title: Manager Sponsored Programs Administration
Signature and Date: 9/9/15

By An Authorized Official of:
Department of Transportation
Name: Christopher R Waszczuk
Title: Director of Project Development
Signature and Date: 10/7/15

By An Authorized Official of: the New Hampshire Office of the Attorney General
Name: John J. Corbett
Title: Assistant Attorney General
Signature and Date: 10/20/15

By An Authorized Official of: the New Hampshire Governor & Executive Council
Name:
Title: Deputy Secretary of State
Signature and Date:

Campus Authorized Official KJ
Date 9/9/15

EXHIBIT A

A. Project Title: The Living Bridge: Creating Benchmark for Bridge Monitoring and Tidal Energy

B. Project Period: Governor and Council Approval - May 31, 2019

C. Objectives: See attached Proposal. 1, traffic and environmental instrumention powered by renewable tidal energy in the management of a complex estuarine bridge. Specifically, the project will involve deployment of sensors and a support structure for the tidal energy conversion system, including a tidal turbine at the Memorial Bridge in Portsmouth, NH. The sensor data will be used to calibrate a three-dimensional structural model, which will be evaluated for use in bridge management and bridge inspection planning. The tidal energy conversion system will be provided by a complimentary project funded by the National Science Foundation (IIP 14-30260).

D. Scope of Work:

Tidal Turbine Deployment Structure

Deployment Structure Design - Design the deployment structure including the support posts, floating platform, turbine deployment barge and electrical connection

Project Permitting - Obtain the appropriate permits for support structure installation

Installation of Support Posts - Coordinate with NHDOT, USCG and other entities for permitting

Construction of the floating - Construct the floating dock with post connection

Procurement of the Turbine deployment barge - Identify the barge vendor and procure the required barge

Site Installation - Install the floating dock and barge at the bridge

Electrical Connection - Deploy the electrical and communication connection on the support structure

Final Report - Document design methodology, recommended maintenance and instruction for removal, if needed.

Living Bridge: Creating a Benchmark for Bridge Monitoring

Project Coordination - Working with stakeholders to identify project priorities

Structural Model Creation - Create a set of structural models using as-built drawings, field observation

Design the instrumentation Plan - Determine the locations, power and communication needs for each sensor

Work plan and schedule for the sensor installation including data acquisition system

Sensor Deployment - Installation sensor, wires, conduits and DAQ system

Data Collection and Model Calibration - Conduct a controlled static load test to validate sensor data, data collection for model calibration and baseline response.

Incorporation of collected data and model into NHDOT protocols Provide bridge maintenance, traffic management and bridge operations with collected information to advance current modes of operation

Final Report and Adoption Recommendation - Document the instrumentation plan and deployment, detail the benefit of instrumentation to the Memorial Bridge and other bridges across New Hampshire

Campus Authorized Official KJ
Date 9/9/15

E. Deliverables Schedule: Campus will submit quarterly progress reports, 4 milestone reports, and a final report.

The milestone reports will be based on the following milestones:

1. Deploying the support structure connecting the tidal turbine and the bridge pier
2. Deploying sensors for weather, marine and structural conditions
3. Calibration of the finite element bridge model for monitoring/assessing infrastructure performance (structural integrity and the impact of traffic and lift span operation)
4. Developing guidelines to create smart bridges that incorporate monitoring systems and structural modeling into their design, construction and maintenance and enhance traffic management programs

The final report shall be stand-alone (i.e. a student thesis is not sufficient) and shall have undergone a complete grammatical and editorial review prior to submittal to the State, in order that State reviewers can focus only on the technical aspects of the report. The report shall include, an abstract, executive summary, project objectives, data collected, analyses performed, conclusions, and recommendations. The final report shall be provided in electronic format ready for publication within 30 days of the completed review by the State. In addition, the Campus shall prepare a poster suitable for display at regional and national transportation research conferences in coordination with the State. State will reply with approval or needed revisions within 30 days of receipt of final report.

Note: The Deliverables Schedule represents the principle tasks and milestones associated with the project and is subject to modification based on concurrent work, availability of materials, construction schedules, and initial results from the research.

F. Budget and Invoicing Instructions: Campus will submit invoices to State on regular Campus invoice forms no more frequently than monthly and no less frequently than quarterly. Invoices will be based on actual project expenses incurred during the invoicing period, and shall show current and cumulative expenses by major cost categories, and shall document cumulative cost sharing of Dr. Erin Santini- Bell's salary, fringe benefits, and facilities and administrative cost through the end of the invoicing period according to the following:

Year	Amount	Cumulative Total
1	$28,713	$28,713
2	$29,575	$58,228
3	$30,462	$88,750

Campus will invoice $100,000 of tidal turbine equipment separately. State will pay Campus within 30 days of receipt of each invoice. Campus will submit its final invoice not later than 75 days after the Project Period end date. Total payments will not exceed 90% until receipt of final report acceptable to State. State will provide final payment within 30 days of receipt of the accepted final report.

Budget Items	State Funding	Cost Sharing	Total
1. Salaries & Wages	136,291	50,856	187,147
2. Employee Fringe Benefits	7,490	19,580	27,070
3. Travel	6,700	0	6,700
4. Supplies and Services	63,852	0	63,852
5. Equipment	200,000	0	200,000
6. Facilities & Admin Costs	40,667	18,314	58,981
Subtotals	455,000	88,750	543,750
Total Project Costs:			543,750

Campus Authorized Official KS
Date 9/9/15

EXHIBIT B

This Project Agreement is funded under a Grant/Contract/Cooperative Agreement to State from the Federal sponsor specified in Project Agreement article F. All applicable requirements, regulations, provisions, terms and conditions of this Federal Grant/Contract/Cooperative Agreement are hereby adopted in full force and effect to the relationship between State and Campus, except that wherever such requirements, regulations, provisions and terms and conditions differ for INSTITUTIONS OF HIGHER EDUCATION, the appropriate requirements should be substituted (e.g., OMB Circulars A-21 and A-110, rather than OMB Circulars A-87 and A-102). References to Contractor or Recipient in the Federal language will be taken to mean Campus; references to the Government or Federal Awarding Agency will be taken to mean Government/Federal Awarding Agency or State or both, as appropriate.

Special Federal provisions are listed here: ☒ None or .

Campus Authorized Official KS
Date 9/24/15