ADVANCE CONTRACT AWARD NOTICE (ACAN)

1. Title

Development of High Impact Resistant Hierarchical Functionally Graded Polymeric Composite Structures with Reduced Shock Transfer

2. Definition

An Advance Contract Award Notice (ACAN) allows departments and agencies to post a notice, for no less than fifteen (15) calendar days, indicating to the supplier community that it intends to award a good, service or construction contract to a pre-identified contractor. If no other supplier submits, on or before the closing date, a Statement of Capabilities that meets the requirements set out in the ACAN, the competitive requirements of the government's contracting policy have been met. Following notification to suppliers not successful in demonstrating that their Statement of Capabilities meets the requirements set out in the ACAN, the contract may then be awarded using the Treasury Board's electronic bidding authorities.

If other potential suppliers submit Statement of Capabilities during the fifteen calendar day posting period, and meet the requirements set out in the ACAN, the department or agency must proceed to a full tendering process on either the government's electronic tendering service or through traditional means, in order to award the contract.

3. Background and description of requirement

Natural Resources Canada is currently working on a project which requires the development of a multi-layer material product that serves the purposes of impact resistance and energy absorption. NRCan is unable to meet the required product performance using commercial and/or in-house development and as a result, external support is required to accomplish the task of developing the new materials. One of the critical areas that NRCan requires assistance is with polymeric composites. NRCan has identified a vendor, the University of Toronto, whose staff possesses the knowledge and experience required to develop the requested materials.

U of T's Prof. Hani E. Naguib and his experienced team will make use of the University of Toronto's Smart and Adaptive Polymers Lab (SAPL). SAPL has the facilities for fabrication and characterization of polymeric structures and their composites. This lab is capable of conducting research and testing on the impact and dynamic mechanical properties of polymers, porous structures, and polymeric nanocomposites. SAPL's capabilities include measuring the physical, mechanical, thermal, and electrical properties of the abovementioned material systems. Tailoring the viscus response of polymer composites is one of the areas where SAPL acquired deep knowledge and understanding. Many of those concepts are not clearly defined or customized in the scientific community. However, Professor Naguib and his team have the knowledge and expertise in the area.

Composite development starts from the fundamental testing of candidate polymers and fillers with state-of-the-art testing equipment all in one laboratory. The testing and selection is not random, but rather based on a wide database and knowledge at SAPL that was developed over many years of working with polymers and composites at different length scales. SAPL has the knowledge of starting with the appropriate fabrication technique and suitable processing parameters that guarantee maximum utilization of the composite potential to serve the intended application. SAPL has also developed experience and database in correlating process parameters and microstructure to mechanical properties. That enables SAPL to provide design equations to the customer in case of changing load requirements where the composite system can be adapted very fast and accurate.

Porous structures are superior in damping compared to the solid precursors. Enhanced damping of porous structures is mainly attributed to the reversible large compressive strains during the loading phase. However, porous structures in general lack the structural strength due to the limitation on cells' walls and density. There exists a delicate balance between strength and resilience for porous structures. Professor Naguib and his team are working on developing functionally graded continuous fibre syntactic porous composites that alleviate the problem of structural strength. Tailoring material properties becoming a necessity to the evolving products that have certain design requirements for the intended application. The team has experience in developing property-structure-fabrication relationships in the past and working now to build those relations functionally graded porous continuous fibre composites with focus to energy absorption.

The combined skill sets and exclusive expertise of U of T's research team and NRCan will form a solid consortium to facilitate the proposed research. The research will develop theoretical and/or empirical models to describe the structure-property relationships of heterogeneous and anisotropic ultra-light high-energy absorbing material systems. Information database of these materials will also be developed. Using this data, the consortium will work together to develop material systems that have improved performance. The collaborative efforts will speed up the laboratory-to-application cycle.

4. Objectives

The main objective of this research is to develop polymer composite foam with impact resistance and shock reduction.

The developed material will be an integral part of a component which NRCan is developing for a project. This project fits well within NRCan's program on Materials for Safety and Security.

5. Project Requirements

5.1 Tasks, Deliverables, Milestones and Schedule

This is a multi-year contract spanning the fiscal years 2016/2017 and 2017/2018.

The major tasks are:

1. Development of the Hierarchical Functionally Graded Structures
2. Characterization of the Hierarchical Functionally Graded Structures
3. Modeling of the Hierarchical Functionally Graded Structures
4. Reporting

The estimated timeline of the deliverables are as follows:

Tasks/Activities	Deliverables/Milestones	Time Schedule
1	Report on fabrication plan, property testing methods and modelling development	Feb 20th 2017
2	Report on fabrication results and properties of as-fabricated products	August 20th 2017
3	Report on process improvement, new materials properties and modelling progress	Feb 20th 2018
4	Final report on the materials developed, properties and the modelling results	August 20th 2018

6. Trade Agreements

Applicable Limited Tendering Provision under NAFTA (Article 1016.2*)*

1016.2(b) - where, for works of art, or for reasons connected with the protection of patents, copyrights or other exclusive rights, or proprietary information or where there is an absence of competition for technical reasons, the goods or services can be supplied only by a particular supplier and no reasonable alternative or substitute exists;

7. Title to Intellectual property

The contract will not result in the development of any intellectual property.

8. Contract Period

The contract period shall be from September 1, 2016 to August 20, 2018.

9. Estimated Cost

The estimated maximum value of the contract is $56,500.00, including all applicable taxes.

10. Exception to the Government Contracts Regulations and applicable trade agreements

Sole Source Justification - Exception of the Government Contract Regulations (GCR):

(d) Only one person or firm is capable of performing the contract

University of Toronto is the only provider the personnel resources with the skills, knowledge and access to facilities capable of completing the fabrication of specific high impact resistant hierarchical functionally graded polymer composite structure requested by NRCan (as described in paragraphs 3 and 4 above. Prof. Naguib has developed novel materials and technologies for applications needed in this requirement such as sensors, actuators and supercapacitors, environmental and benign polymers and composites, light weight and high strength/impact to weight components, and biodegradable scaffolds for tissue applications.

11. Name and Address of the Proposed Contractor

University of Toronto
Faculty of Applied Science and Engineering
5 King's College Road
Toronto, ON, Canada
M5S 3G8

12. Inquiries on Submission of Statement of Capabilities

Suppliers who consider themselves fully qualified and available to provide the services/goods described herein, may submit a Statement of Capabilities in writing, preferably by e-mail, to the contact person identified in this Notice on or before the closing date and time of this Notice. The Statement of Capabilities must clearly demonstrate how the supplier meets the advertised requirements.

13. Closing Date

Closing Date: 27 June 2016
Closing Time: noon EDT

14. Contract Authority

Len Pizzi
Procurement Officer
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