SON Number: RCSON-14-02 **October 25, 2012**

Strategic Environmental Research and Development Program (SERDP)

FY 2014 STATEMENT OF NEED

Resource Conservation and Climate Change (RC) Program Area

CLIMATE CHANGE IMPACTS TO BUILT INFRASTRUCTURE IN ALASKA

1. Objective of Proposed Work

The objective of this Statement of Need (SON) is to improve our understanding and capacity to respond to potential climate change impacts on Department of Defense (DoD) built infrastructure in Alaska and similar climates. Research proposals are sought that improve our ability to: (1) predict the potential impacts to and vulnerability of existing and future infrastructure and (2) mitigate these impacts through improved decisions, design, and assessment tools. Both buildings and horizontal infrastructure such as roads and runways are of interest.

Research needs include but are not limited to:

1. Scenario and climate modeling output relevant to the potential impacts to built infrastructure. Scenarios should address timeframes of interest (for example, near term or 10 to 20 years in the future; long term or 40 to 50 years, or longer if appropriate, in the future) typically considered when assessing built infrastructure decisions and should support a range of built infrastructure design issues such as location, expected lifetime, and detailed design requirements.
2. Technologies for detecting environmental conditions impacted by climate change that may adversely affect built infrastructure. An example includes an enhanced capability to detect (within) ground ice over large areas relevant to military infrastructure projects.
3. Improved understanding of the interrelationships between built infrastructure and the environment that become more acute under plausible future climate change scenarios. An example includes how the thermal profile of built infrastructure and the immediately adjacent land use affect permafrost freeze-thaw cycling, in the presence and absence of ground ice, and ultimately lead to differential settlement and heaving.
4. Improved infrastructure vulnerability and impact assessment tools, including sensitivity analyses, that incorporate the potential effects of climate change and climate variability on built infrastructure. Examples of issues of concern include the effects of permafrost thawing on infrastructure and roof loading requirements.

Proposals submitted in response to this SON may address one or more of the research needs listed above. Proposals should justify any identified earth system models, regional climate models, or scenarios used as a basis for the proposed work.

2. Expected Benefits of Proposed Work

The desired outcomes are technologies, models, and tools for design engineers and built infrastructure managers to: (1) use scenario planning to conduct vulnerability and impact assessments related to built infrastructure in Alaska and similar climates; (2) guide design, operation, and maintenance considerations for existing and new built infrastructure under non-stationary climate conditions; and (3) efficiently and accurately detect environmental conditions that may affect built infrastructure siting considerations.

3. Background

Climate change poses challenges for DoD missions and infrastructure in Alaska and other Arctic regions. The impacts of climate change in Alaska are already occurring. These impacts include shifts in seasonal temperatures, coastal erosion, increased storm effects, sea ice retreat and permafrost thawing. DoD has significant assets in Alaska, ranging from 15% of the total U.S Army training lands in the world to major missile defense facilities. Climate change introduces uncertainty and variability into the design of future built infrastructure: that is, those structures and facilities that may not have even been planned as of today. Equally important, however, is the future operation and maintenance of existing built infrastructure as 80% of the infrastructure that will exist in 2050 is already in place.

The focus of this SON is on DoD built infrastructure issues in interior Alaska and similar interior cold region climates, especially those areas in which permafrost currently or in the future may be subject to discontinuities and excessive thawing. As DoD considers expanding the use of existing infrastructure or building new infrastructure in Alaska, it must recognize that a non-stationary climate will have an effect on the environment and built infrastructure and that such infrastructure also may have an effect on the surrounding environment that will be greater than it would have been if climatic conditions were to remain stationary (i.e., stay within previously assumed variability limits). In the planning, design, operation, and maintenance of its built infrastructure, DoD will be concerned with two primary issues: (1) how to locate new infrastructure in a way that will avoid the areas that pose the greatest risks to infrastructure and its sustainability and (2) how to design new or modify existing infrastructure so the risks associated with the environment are minimized, when the most hazardous areas cannot be avoided.

Proposed improvements in knowledge, technologies, and tools can encompass the effects of permafrost thawing on foundations, roads, and runways; changes in building roof loads as a result of changes in the amount and water content of snow; and so on. Assessments of and modifications to built infrastructure that (1) address existing design codes and (2) can lead to recommendations for their appropriate modifications are encouraged. In addition, model and tool development should incorporate a robust risk-based framework that enables installations and built infrastructure design engineers to determine the tradeoffs involving increased design, construction, operation, and maintenance costs versus the risk of failure for military built infrastructure in Alaska in the face of climate change and climate variability. Proposed scenarios should support built infrastructure design issues holistically: for example, both roof loading issues as well as foundation stability issues under climate change and climate variability should be considered.

Complementary SERDP/ESTCP-Funded Projects: SERDP has supported several projects relating to permafrost behavior and vegetation change under climate change in interior Alaska. A brief description of these ongoing projects can be found at the SERDP and ESTCP website (www.serdp-estcp.org/Program-Areas/Resource-Conservation-and-Climate-Change).

4. Cost and Duration of Proposed Work

The cost and time to meet the requirements of this SON are at the discretion of the proposer. Two options are available:

Standard Proposals: These proposals describe a complete research effort. The proposer should incorporate the appropriate time, schedule, and cost requirements to accomplish the scope of work proposed. SERDP projects normally run from two to five years in length and vary considerably in cost consistent with the scope of the effort. It is expected that most proposals will fall into this category.

Limited Scope Proposals: Proposers with innovative approaches to the SON that entail high technical risk or have minimal supporting data may submit a Limited Scope Proposal for funding up to $150,000 and approximately one year in duration. Such proposals may be eligible for follow-on funding if they result in a successful initial project. The objective of these proposals should be to acquire the data necessary to demonstrate proof-of-concept or reduction of risk that will lead to development of a future Standard Proposal. Proposers should submit Limited Scope Proposals in accordance with the SERDP Core Solicitation instructions and deadlines.

5. Point of Contact

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For Core proposal submission due dates, instructions, and additional solicitation information, visit the SERDP web site at www.serdp-estcp.org/Funding-Opportunities/SERDP-Solicitations.