

DIANA Challenge Quad Chart 2023



BEFORE YOU BEGIN:

To submit a proposal package to one of DIANA's open Challenge topics, you must first register on the [Application portal](#) and obtain login credentials to create an account. Once you create an account and log in, you will be directed to complete a form requesting company and contact information. Please ensure that any information requested in this quad chart submission, such as company name and proposal title, are the same as the ones entered on the application portal registration page. You can link back to your application profile at any time by clicking [My Application](#) to verify.

INSTRUCTIONS

Please read these instructions carefully before completing your application. Quad charts that do not comply with these instructions or that are not complete will not be accepted. All proposal packages must contain a Proposal document AND a Quad Chart.

- **Your completed quad chart must be a landscape-mode single page only.** (This instruction page does not count toward this limit)
- **The quad chart is divided into 4 sections, with guidelines provided for the content of each section.** Use the embedded **blue prompts** to guide you in filling out each quadrant. Do not alter the order or organization of the sections.
- Please ensure that pictures, graphics, diagrams or other non-text information be contained within the quadrant.
- Complete this entire template using a **minimum 11-point font size in Calibri font. Do not change this document's margins or alter its format.**
- **Once your quad chart is complete, delete this Instruction page and save this file as a PDF document.** Your file will be renamed for sorting in our database, and you will be able to download the renamed document from [My Application](#).
- **To submit your quad chart, upload via the designated box on the Application registration portal page corresponding to the Challenge problem you are addressing.**

This quad chart will be used by evaluators to view a brief and concise summary of these four different aspects of your submission. Bullet points, rather than full sentences, are encouraged.

Relevance to Challenge problem

Challenge elements:

- Increases sensing in energy constrained polar environments
- Uninterrupted sensing and data transmission during polar night

How problem is addressed:

- Integrable with existing sensing and communications platforms
- Increases sensing for ice buoy-based platforms
- Extends capabilities for AUV-based monitoring platforms
- Enables continuous two-way gateway for data communications

Product differentiation:

- Reliable; durable (no moving parts; proven lifetime, no maintenance)
- Environmentally benign (no fuel, no emissions)
- Modular and scalable

Defence and security needs:

- Increases weather/climate observations for operational safety
- Incursion detection (manned/unmanned)
- Improves capabilities of AUV-based observational platforms

Roadmap with Risks, Mitigation, and Maturation Plan

Key milestones:

6 Month milestones (@ TRL 5)

- Develop new mathematical model with integrated photovoltaics
- Next-generation prototype with key design improvements:
 - Micro-channel evaporator plates
 - Vacuum sealed pre-fabricated TEG
 - Optimized heat carrier
- Fabricate and test prototype in relevant environment (TRL 6)

1 Year milestones (@ TRL 6)

- Develop power management system
- Incorporate module into system with balance of plant (battery, solar)
- Integrate with satellite communications equipment and demonstrate in an operational environment (TRL 7)
- Customer discovery, identification of strategic partners and investors

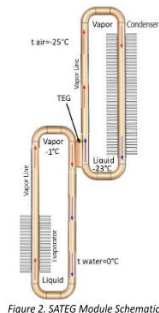
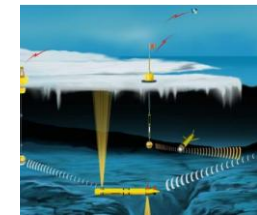
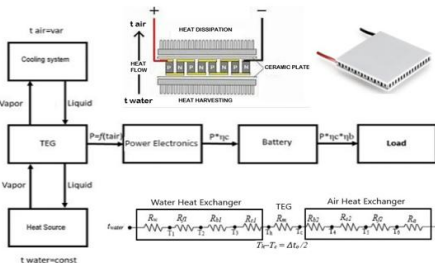
Technical Risks: (i) Icing on water-side heat exchanger; (ii) snow packing on air-side heat exchanger; (iii) unable to meet power requirements

Mitigation: (i) Optimize thermal flux; (ii) alter geometry of air-side heat exchanger/add cover; (iii) increase SATEG device size and/or add modules

Technical Approach

SATEG Module: 40kg device makes 7-10W without fuel or maintenance

- Renewable power generated from unlimited source (temp. gradients)
- Based on TEG technology with proven ultra-long lifetime (decades)
- Coupled with photovoltaics for reliable year-round renewable power
- Enables observations during polar night @ -50 C
- Low-cost design for ease of transport and on-site assembly
- Unlimited pre-deployment storage life



Commercial viability

Commercial market (non-defense or government research):

- Oil and gas exploration
- Inspection of critical underwater pipeline and telecommunication infrastructure
- Telemetry data in support of new shipping lanes
- Aggressive commercial interest in the region is generated by receding ice floes
 - Ice mounted versions of this technology can help track ice movement and mark shipping lanes
- \$140,000 received from the United States Navy to develop SATEG at parent company
- \$30,000 from WHOI
- Approximately \$250,000 spent in kind on internal development of SATEG technology
- Working relationship with WHOI
- Intent to leverage DIANA for additional systems integration partners for commercializing SATEG