Call No.1: Development of a Turbine for Efficient Utilization of High-Velocity Low-Temperature Air Flow

Issued by: DAC
Start of Submissions: 9/10/2023
Deadline for Submissions: 31/12/2023
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1. Background
DAC invites qualified engineering firms, research institutions, or consortia to submit proposals for the design and development of a turbine capable of converting the kinetic energy of a highly compressed, ultra-cold air stream into shaft power with high efficiency. The proposed solution will be part of an advanced energy recovery system under development.

2. Objective
The goal is to design a turbine that efficiently (target ≥90%) extracts approximately 9 kW of shaft power from an ultra-cold, high-speed air flow, while respecting strict constraints on temperature rise and outlet velocity.

3. Inlet Conditions
- Flow velocity: 400–500 m/s
- Temperature: –70 to –110 °C
- Mass flow rate: 0.1–0.15 kg/s

4. Performance Requirements
- Power Output: ~9 kW on shaft (mechanical)
- Thermal Constraints:
  - Maximum outlet temperature increase: +10 °C above inlet temperature
- Outlet Flow Velocity: 20–30 m/s
- System Efficiency: Target ≥90% of kinetic energy recovery into shaft work

5. Proposal Requirements
Proposals must include:
- Technical Concept: Description of the turbine design approach, impeller selection, stage design, materials, and thermal/structural considerations for cryogenic operation
- Thermodynamic Analysis: Calculations demonstrating compliance with the performance requirements, including simulations or validated models
- Mechanical Design: Preliminary design drawing or 3D CAD model of the turbine
- Efficiency Estimation: Justification for achieving ≥90% conversion efficiency
- Thermal Management Strategy: Explanation of how temperature increase at the outlet is limited
- Implementation Timeline and Budget
- Team Capabilities: Description of experience in turbomachinery and high-speed aerodynamics

6. Evaluation Criteria
Proposals will be evaluated based on:
- Technical feasibility and innovation

- Compliance with performance constraints
- Efficiency and energy balance
- Maturity and clarity of design
- Experience and capabilities of the proposer
- Budget and timeline realism

7. Submission and Timeline

All proposals must be submitted by 31/12/2023 in PDF format. Shortlisted applicants may be contacted for clarification or follow-up interviews.

We look forward to your innovative proposals and your contributions to pioneering turbine design for extreme air flow conditions.