1. **Research Title:** Design Approaches for Hypersonic Inlet and Isolator Operability

2. **Individual Sponsor:**

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3. **Academic Area/Field and Education Level:** Aerospace Engineering / Hypersonic Aerodynamics and Propulsion (M.S. or Ph.D. level)

4. **Objectives:** Explore methods to improve the understanding of hypersonic inlets and isolators by refining inlet starting criteria or prediction methods, expanding inlet operable range, and/or improving inlet/isolator stability and performance.

5. **Description:** The inlet and isolator are key components of any hypersonic air-breathing propulsion system. Air in the atmosphere is captured and compressed by the inlet during flight. The isolator provides further compression and also serves to contain and stabilize the internal shock train. While the purpose of these components is simple, hypersonic compression systems are governed by complex flow physics and phenomena.

   One of the challenges associated with inlet operability is predicting inlet start and unstart boundaries. Traditionally, the Kantrowitz limit has been used as a design criterion to estimate the minimum internal area ratio/maximum internal contraction ratio an inlet can have while still reliably starting. Empirical data show this limit to be conservative such that an inlet will start with an area ratio between the Kantrowitz limit and the isentropic compression limit.

   Inlet operability can also be affected by flow phenomena such as shock wave – boundary layer interactions and boundary layer separation. Any separation of the boundary layer near the inlet throat can reduce the effective area of the throat, potentially causing the inlet to unstart. Other flow phenomena can similarly impact inlet operability.

   For the proposed project, computational and/or experimental methods may be employed to refine inlet starting criteria and/or to study the flow physics and phenomena that affect inlet operability.

6. **Research Classification/Restrictions:** U.S. Citizens only

7. **Eligible Research Institutions:** DAGSI

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