Research Development Fund – Fall 2023 Application Template

Application Title: **Interdisciplinary Environmental Chambers with Advanced Capabilities**

Lead contact for RDF Application:
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Key Participating Units: ESL (the Co-leads are Drs. Zheng O'Neill, James Sweeney, David Claridge)

RDF Amount Requested ($): $1,680,197

Executive Summary.

The overall goal is to construct shared, interdisciplinary environmental chambers with advanced capabilities by a team of several colleges at TAMU with the needs of a controlled environment (e.g., temperature, humidity, CO_2, etc.). The requested funding will be used to construct two side-by-side, highly insulated environmental chambers with multi-parameter high-resolution, high-speed data acquisition, storage, and processing/analysis. One chamber simulates the interior of a controlled space (e.g., a building), including temperature, humidity, CO_2, and other factors. The adjacent chamber simulates outdoor conditions. Each chamber is 22 feet long x 22 feet wide x 14 feet high. The temperature control range is 50 to 130F for indoor simulation and -40 to 150F for outdoor simulation. The chambers will be permanently located in the backyard of the RELLIS Energy Efficiency Lab (REEL). It is envisioned that the chamber system significantly (1) advances research capacity for a large group of researchers across different colleges at TAMU by providing a shared state-of-the-art facility for TAMU researchers and industry partners to work on interdisciplinary research and development projects; (2) positions TAMU researchers to attract substantial government and industrial funding (e.g., smart and connected buildings, clean energy and grid service, Lunar and Mars habitation, direct air capture, 3D printing, etc.)

The Chamber system will have the following main functionality and capability: 1) A wide range of controlled environments; 2) The object under test can be connected to a variety of measurement sensors (e.g., voltage, current, temperature, humidity, CO_2, emission, sound, vibration, optical and thermal image, high-speed videos, etc.); 3) A central automation system controls the environmental conditions, among other conditions that are specific to a test, which can be fixed or dynamic per a defined function; 3) A data acquisition system with cloud storage; and 4) Real-time analysis using software (e.g., LabVIEW) specific to the object under test and/or transfer data for further analysis.
Example research thrusts include but are not limited to HVAC equipment and environmental Systems, grid integration of EVs and HVAC systems to benefit power grid operations and reliability, direct CO2 capture, health/safety diagnosis/prognosis of Lithium-Ion batteries, power electronic converters and inverters for Renewable Energy applications, UAV Systems for remote sensing and disasters, Lunar and Mars habitation, harsh environment for chips/servers. Current environmental chambers on the TAMU campus are either outdated or have limited capabilities in terms of size, range and type of controlled parameters, air flow and quality measurement and management, and sensing. The new chambers with broad state-of-the-art heating/cooling equipment and sensing technology will fill this gap by substantially advancing TAMU's research infrastructure and providing significant visibility to TAMU in Texas and Nationally.