



U.S. Department of Energy Categorical Exclusion Determination Form

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Proposed Action Title: Raytheon Technologies Research Center - Ultra-Light, iNtegrated, Reliable, Aviation-class, Co-Optimized Motor & Power converter with Advanced Cooling Technology (ULTRA-COMPACT)

Program or Field Office: Advanced Research Projects Agency - Energy

Location(s) (City/County/State): East Hartford, Connecticut; Daytona, Florida; Blacksburg, Virginia

Proposed Action Description:

AMENDED NEPA DETERMINATION: (See attached original Determination, dated December 17, 2020). This Amended Determination follows the approval of additional funds, extended period of performance, and new project performers (Pratt & Whitney and Verdego Aero) to support the project team's continued small-scale, research and development activities of a fully integrated all-electric aircraft powertrain under the Aviation-class Synergistically Cooled Electric-motors with iNtegrated Drives (ASCEND) program. Specifically, the project team will begin testing and implementing modifications to their prototype powertrain for use in a hybrid electric aviation system. If successful, this project would facilitate more efficient, large-scale electric aircraft powertrains, weigh less than conventional aircraft, and reduce the use of fossil fuels in aviation and greenhouse gas emissions.

Project activities will be conducted at existing facilities at Raytheon (RTX) Corporation, RTX Technology Research Center (East Hartford, CT), Pratt & Whitney (East Hartford, CT), Virginia Polytechnic Institute (Blacksburg, VA), and Verdego Aero (Daytona, FL). Project tasks continue to fit within the class of actions identified under the DOE Categorical Exclusions identified below and do not involve any extraordinary circumstances that may affect the significance of the environmental effects of the project. This assessment was based on a review of the proposed scope of work and the potential environmental impact of the project. Project tasks will be conducted in accordance with established safety and materials/waste management protocols and pursuant to applicable Federal, State, and local regulatory requirements. No modifications will be made to the existing facilities to accommodate the proposed work.

Categorical Exclusion(s) Applied:

A9 - Information gathering, analysis, and dissemination

B3.6 - Small-scale research and development, laboratory operations, and pilot projects

For the complete DOE National Environmental Policy Act regulations regarding categorical exclusions, including the full text of each categorical exclusion, see Subpart D of [10 CFR Part 1021](#).

Regulatory Requirements in 10 CFR 1021.410(b): (See full text in regulation)

The proposal fits within a class of actions that is listed in Appendix A or B to 10 CFR Part 1021, Subpart D.

To fit within the classes of actions listed in 10 CFR Part 1021, Subpart D, Appendix B, a proposal must be one that would not: (1) threaten a violation of applicable statutory, regulatory, or permit requirements for environment, safety, and health, or similar requirements of DOE or Executive Orders; (2) require siting and construction or major expansion of waste storage, disposal, recovery, or treatment facilities (including incinerators), but the proposal may include categorically excluded waste storage, disposal, recovery, or treatment actions or facilities; (3) disturb hazardous substances, pollutants, contaminants, or CERCLA-excluded petroleum and natural gas products that preexist in the environment such that there would be uncontrolled or unpermitted releases; (4) have the potential to cause significant impacts on environmentally sensitive resources, including, but not limited to, those listed in paragraph B(4) of 10 CFR Part 1021, Subpart D, Appendix B; (5) involve genetically engineered organisms, synthetic biology, governmentally designated noxious weeds, or invasive species, unless the proposed activity would be contained or confined in a manner designed and operated to prevent unauthorized release into the environment and conducted in accordance with applicable requirements, such as those listed in paragraph B(5) of 10 CFR Part 1021, Subpart D, Appendix B.

There are no extraordinary circumstances related to the proposal that may affect the significance of the environmental effects of the proposal.

The proposal has not been segmented to meet the definition of a categorical exclusion. This proposal is not connected to other actions with potentially significant impacts (40 CFR 1508.25(a)(1)), is not related to other actions with individually insignificant but cumulatively significant impacts (40 CFR 1508.27(b)(7)), and is not precluded by 40 CFR 1506.1 or 10 CFR 1021.211 concerning limitations on actions during preparation of an environmental impact statement.

Based on my review of the proposed action, as NEPA Compliance Officer (as authorized under DOE Order 451.1B), I have determined that the proposed action fits within the specified class(es) of action, the other regulatory requirements set forth above are met, and the proposed action is hereby categorically excluded from further NEPA review.

NEPA Compliance Officer: **GEOFFREY GOODE** Digitally signed by GEOFFREY GOODE
Date: 2024.02.06 15:47:25 -05'00'

Date Determined:



U.S. Department of Energy Categorical Exclusion Determination Form

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Proposed Action Title: Aviation-class Synergistically Cooled Electric-motors with iNtegrated Drives (ASCEND & ASCEND SBIR/STTR) (FOA Nos. DE-FOA-0002338 & DE-FOA-0002339) Program

Program or Field Office: Advanced Research Projects Agency - Energy (ARPA-E)

Location(s) (City/County/State): CA; CO; CT; FL; IA; IL; IN; MD; OH; NY; TN; TX; VA; WA; WI

Proposed Action Description:

The ASCEND Program seeks to develop innovative lightweight and ultra-efficient electric motors, drives, and associated thermal management systems (all-electric powertrain) that will help enable net-zero carbon emissions in single-aisle, 150-200 passenger commercial aircraft. ASCEND teams will work in two phases, delivering (1) conceptual designs and computer simulations of the motor, drive, and integration and (2) development, fabrication, and testing of an integrated sub-scale all-electric powertrain, including thermal management system. If successful, ASCEND team technologies will enable a fully integrated all-electric powertrain system at a power density of ≥ 12 kW/kg with an efficiency at $\geq 93\%$.

The ASCEND Program is composed of 10 small-scale research and development projects that will be conducted by universities, non-profit entities, for-profit entities, and federal laboratories. This Determination covers 9 of the 10 projects (listed in Attachment A). All 9 projects fit within the class of actions identified under the DOE Categorical Exclusion identified below and do not involve any extraordinary circumstances that may affect the significance of the environmental effects of the projects. This assessment was based on a review of the proposed scope of work and the potential environmental impacts of each project. All project tasks will be conducted in accordance with established safety and materials/waste management protocols and pursuant to applicable Federal, State, and Local regulatory requirements.

Categorical Exclusion(s) Applied:

A9 - Information gathering, analysis, and dissemination

B3.6 - Small-scale research and development, laboratory operations, and pilot projects

B3.15 - Small-scale indoor research and development projects using nanoscale materials

For the complete DOE National Environmental Policy Act regulations regarding categorical exclusions, including the full text of each categorical exclusion, see Subpart D of [10 CFR Part 1021](#).

Regulatory Requirements in 10 CFR 1021.410(b): (See full text in regulation)

The proposal fits within a class of actions that is listed in Appendix A or B to 10 CFR Part 1021, Subpart D.

To fit within the classes of actions listed in 10 CFR Part 1021, Subpart D, Appendix B, a proposal must be one that would not: (1) threaten a violation of applicable statutory, regulatory, or permit requirements for environment, safety, and health, or similar requirements of DOE or Executive Orders; (2) require siting and construction or major expansion of waste storage, disposal, recovery, or treatment facilities (including incinerators), but the proposal may include categorically excluded waste storage, disposal, recovery, or treatment actions or facilities; (3) disturb hazardous substances, pollutants, contaminants, or CERCLA-excluded petroleum and natural gas products that preexist in the environment such that there would be uncontrolled or unpermitted releases; (4) have the potential to cause significant impacts on environmentally sensitive resources, including, but not limited to, those listed in paragraph B(4) of 10 CFR Part 1021, Subpart D, Appendix B; (5) involve genetically engineered organisms, synthetic biology, governmentally designated noxious weeds, or invasive species, unless the proposed activity would be contained or confined in a manner designed and operated to prevent unauthorized release into the environment and conducted in accordance with applicable requirements, such as those listed in paragraph B(5) of 10 CFR Part 1021, Subpart D, Appendix B.

There are no extraordinary circumstances related to the proposal that may affect the significance of the environmental effects of the proposal.

The proposal has not been segmented to meet the definition of a categorical exclusion. This proposal is not connected to other actions with potentially significant impacts (40 CFR 1508.25(a)(1)), is not related to other actions with individually insignificant but cumulatively significant impacts (40 CFR 1508.27(b)(7)), and is not precluded by 40 CFR 1506.1 or 10 CFR 1021.211 concerning limitations on actions during preparation of an environmental impact statement.

Based on my review of the proposed action, as NEPA Compliance Officer (as authorized under DOE Order 451.1B), I have determined that the proposed action fits within the specified class(es) of action, the other regulatory requirements set forth above are met, and the proposed action is hereby categorically excluded from further NEPA review.

NEPA Compliance Officer: **Geoffrey Goode** Digitally signed by Geoffrey Goode
Date: 2020.12.17 11:17:54 -05'00'

Date Determined:

Attachment A: Projects in the ASCEND (FOA No. DE-FOA-0002338) & ASCEND SBIR/STTR (FOA No. DE-FOA-0002339) Programs

Full Application Control Number	Lead Organization	Project Title	Categorical Exclusion
2238-1503	RAYTHEON TECHNOLOGIES RESEARCH CENTER	Ultra-Light, inTegrated, Reliable, Aviation-class, Co-Optimized Motor & Power converter with Advanced Cooling Technology (ULTRA-COMPACT) (P.300.0762)	A9; B3.6
2238-1508	MARQUETTE UNIVERSITY	High Power Density Motor Equipped with Additively Manufactured Windings Integrated with Advanced Cooling and Modular Integrated Power Electronics	A9; B3.6
2238-1510	GENERAL ELECTRIC COMPANY, GE RESEARCH	Electric Flightworthy Lightweight Integrated Thermally-Enhanced powertrain System (eFLITES) for Narrow-body Commercial Aircraft	A9; B3.6
2238-1534	HONEYWELL INTERNATIONAL, INC.	Advanced Electric Propulsion System (AEPS)	A9; B3.6
2238-1545	UNIVERSITY OF CALIFORNIA: SANTA CRUZ	Flux-Switching Machine Based All-Electric Power Train for Future Aircraft	A9; B3.6
2238-1556	TEXAS A&M ENGINEERING EXPERIMENT STATION	Multi-physical Co-Design of Next Generation Axial Motors for Aerospace Applications	A9; B3.6; B3.15
2239-1502	WRIGHT ELECTRIC INC.	AERIALIST - 2nd generation motor for lArge ElectRiC Aircraft propuLSion SysTems	A9; B3.6
2239-1514	HYPER TECH RESEARCH INC.	Cryo Thermal Management of High Power Density Motors and Drives	A9; B3.6
2239-1520	ADVANCED MAGNET LAB	High Power Density Dual Rotor Permanent Magnet Motor with Integrated Cooling and Drive for Aircraft Propulsion	A9; B3.6