

PMC-ND

(1.08.09.13)

**U.S. DEPARTMENT OF ENERGY
OFFICE OF ENERGY EFFICIENCY AND RENEWABLE ENERGY
NEPA DETERMINATION**

**RECIPIENT:** University of Tennessee, Knoxville**STATE:** TN

PROJECT TITLE: Physics-Guided Machine Learning (PGML) for Improved Aerostructure Manufacturing

| | | | |
|--|--------------------------------------|----------------------------|-------------------|
| Funding Opportunity Announcement Number | Procurement Instrument Number | NEPA Control Number | CID Number |
| DE-FOA-0002252 | DE-EE0009400 | GFO-0009400-001 | GO9400 |

Based on my review of the information concerning the proposed action, as NEPA Compliance Officer (authorized under DOE Policy 451.1), I have made the following determination:

CX, EA, EIS APPENDIX AND NUMBER:

Description:

A9 Information gathering, analysis, and dissemination Information gathering (including, but not limited to, literature surveys, inventories, site visits, and audits), data analysis (including, but not limited to, computer modeling), document preparation (including, but not limited to, conceptual design, feasibility studies, and analytical energy supply and demand studies), and information dissemination (including, but not limited to, document publication and distribution, and classroom training and informational programs), but not including site characterization or environmental monitoring. (See also B3.1 of appendix B to this subpart.)

B3.6 Small-scale research and development, laboratory operations, and pilot projects Siting, construction, modification, operation, and decommissioning of facilities for smallscale research and development projects; conventional laboratory operations (such as preparation of chemical standards and sample analysis); and small-scale pilot projects (generally less than 2 years) frequently conducted to verify a concept before demonstration actions, provided that construction or modification would be within or contiguous to a previously disturbed or developed area (where active utilities and currently used roads are readily accessible). Not included in this category are demonstration actions, meaning actions that are undertaken at a scale to show whether a technology would be viable on a larger scale and suitable for commercial deployment.

Rationale for determination:

The U.S. Department of Energy (DOE) is proposing to provide funding to the University of Tennessee at Knoxville to improve aerospace manufacturing productivity by combining machine learning, physics-based process models, and sensors/data in a digital environment. A physics-guided machine learning (PGML) framework would be created to machine aerospace flight vehicle panels. The PGML framework would employ computerized machining center capabilities and would incorporate data having to do with workpiece material, geometry, and support. In addition, polymer composite fixtures would be designed, printed, and tested as a substitute for the typical metal fixtures that are used for securing parts during the machining process. The project would be completed over two Budget Periods (BPs) with a Go/No-Go decision point in between each BP. This NEPA Determination is applicable to both BPs.

Lab-scale milling on aluminum flight vehicle panel test parts would be conducted in existing facilities at the University of Tennessee in Knoxville, TN and Oak Ridge National Laboratory (ORNL) Manufacturing Demonstration Facility (MDF) in Knoxville, TN. Sensors would be installed on computer numerically-controlled (CNC) machining centers which would measure sound, force, and vibration to help inform machine learning. Metal fixtures for machining the lab-scale flight vehicle panel would be designed, then used as a model to design polymer composite counterparts. These counterparts would then be printed using additive manufacturing at ORNL, to determine if they would be an acceptable substitute for metal in aerospace fixtures.

Full-scale PGML framework trials would be implemented in a production environment at GKN Aerospace in St. Louis, MO where full-scale flight vehicle panels of approximately 4 feet long would be created using the full-scale polymer composite fixtures. Raytheon Technologies Research Center (RTRC) in East Hartford, CT could also support the machine learning process using physics-based modeling and possibly use existing machining capabilities to validate the PGML framework.

Work would occur in dedicated laboratory and production facilities. Minor modifications would include the addition of sensors in existing machining equipment to monitor the machining process and inform the machine learning model. No other changes in the use, mission, or operation of existing facilities would be required as part of this project and no additional permits would be required in order to conduct any of the work activities.

Project activities would involve the use of milling machines. Any risks associated with the handling of this equipment would be mitigated through adherence to established health and safety policies and procedures. Protocols would

include personnel training and the use of personal protective equipment. All waste products would be disposed of by licensed waste management service providers. University of Tennessee at Knoxville and its project partners would observe all applicable Federal, state, and local health, safety, and environmental regulations.

Any work proposed to be conducted at a federal facility may be subject to additional NEPA review by the cognizant federal official and must meet the applicable health and safety requirements of the facility.

NEPA PROVISION

DOE has made a final NEPA determination.

Notes:

Advanced Manufacturing Office

This NEPA determination does not require a tailored NEPA provision.

Review completed by Shaina Aguilar on 5/20/21.

FOR CATEGORICAL EXCLUSION DETERMINATIONS

The proposed action (or the part of the proposal defined in the Rationale above) 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 proposed action that may affect the significance of the environmental effects of the proposal.

The proposed action 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.

The proposed action is categorically excluded from further NEPA review.

SIGNATURE OF THIS MEMORANDUM CONSTITUTES A RECORD OF THIS DECISION.

NEPA Compliance Officer Signature: _____

 Electronically
Signed By: Casey Strickland

NEPA Compliance Officer

Date: 5/24/2021

FIELD OFFICE MANAGER DETERMINATION

- Field Office Manager review not required
 Field Office Manager review required

BASED ON MY REVIEW I CONCUR WITH THE DETERMINATION OF THE NCO :

Field Office Manager's Signature: _____

Field Office Manager

Date: _____