MEMORANDUM OF AGREEMENT

BETWEEN

THE NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

AND

THE DEPARTMENT OF ENERGY

FOR

ARCTIC CLIMATE AND ECOLOGY RESEARCH IN ALASKA

I. AUTHORITIES AND PARTIES

National Aeronautics and Space Administration (hereinafter referred to as "NASA"), located at 300 E Street SW, Washington DC 20546, and the Department of Energy (hereinafter referred to as "DOE") located at 1000 Independence Avenue SW, Washington, DC 20585 enter into this Memorandum of Agreement (MOA) in accordance with the National Aeronautics and Space Act (51 U.S.C. § 20113(e)), the Atomic Energy Act of 1954, as amended (42 U.S.C. § 2051), Section 107 of the Energy Reorganization Act of 1974 (42 U.S.C. § 5817), Section 646 of the Department of Energy Organization Act (42 U.S.C. 7256), and Section 976 of the Energy Policy Act of 2005 (42 U.S.C. § 16316),. NASA and DOE may be individually referred to as a "Party" and collectively referred to as the "Parties."

This agreement in no way restricts either of the Parties from participating in any activity with other public or private agencies, organizations, or individuals.

II. PURPOSE AND BACKGROUND

This MOA acknowledges DOE's and NASA's efforts to leverage each agency's complementary expertise in Arctic climate change science and related Earth system processes, and it identifies a mechanism to more efficiently advance climate research capabilities of both agencies by coordinating planning processes and developing collaborative research projects that serve the missions and priorities of both agencies. Both agencies will work together to promote collaborative research activities, including working closely with other agencies engaged in advancing sensor, analytical, and computational capabilities. This MOA strives to exploit the unique talents and capacities of NASA and DOE to more efficiently develop an understanding of the interactions between northern ecosystems and the climate system using science-based observing and prediction tools in support of the Nation's needs for secure energy, environment, water, food, health, and economic well-being.

NASA and DOE propose to continue to enhance cooperation and coordination centered on advancing the scientific understanding of Arctic ecology and climate interactions, by coordinating scientific activities, field observing programs, and modeling capabilities.

DOE's Office of Biological and Environmental Research has implemented the Next Generation Ecosystem Experiment-Arctic (NGEE-Arctic), which involves conducting a coordinated set of investigations that target improved process understanding and model representation of important ecosystem-climate feedbacks for high-latitude regions. The focus of NGEE-Arctic and other DOE-

sponsored research in this region, such as the Atmospheric Radiation Measurement (ARM) User Facility, is on interactions that drive ecosystem-climate feedbacks through greenhouse gas fluxes and changes in surface and atmospheric energy balances that will result in the fundamental knowledge needed to reduce uncertainty and improve representation of processes in Earth System Models. This research is currently being carried out at sites near Utqiagvik (formerly Barrow) and Nome, Alaska, with the intent of expanding research into other permafrost areas in Alaska and other pan-Arctic sites in the future.

NASA is supporting the Arctic-Boreal Vulnerability Experiment (ABoVE), a large-scale study of ecosystem responses to environmental change in the Arctic and boreal regions of northwestern North America and the implications for social-ecological systems. ABoVE's science objectives focus on (1) developing a fuller understanding of the vulnerability and resilience of Arctic and boreal ecosystems to environmental change in western North America, and (2) providing the scientific basis for informed decision-making to guide societal responses at local to international levels.

To date, NGEE-Arctic and ABoVE have been working together in several ways, including (1) coordinating airborne campaign efforts and the co-development of scaling algorithms to relate ecosystem process to remote sensing data; (2) NGEE-Arctic scientists collecting data to help validate ABoVE data products such as soil moisture, plant traits, as well as vegetation structure and function; and (3) NGEE-Arctic developing approaches to inform models and model predictions with ABoVE airborne datasets.

NASA and DOE will continue to work together to integrate and coordinate NGEE-Arctic and ABoVE research activities in areas where their respective goals and objectives converge. In particular, NASA will be able to contribute airborne and satellite remote sensing observations, develop regional data products, and provide spatial scaling expertise, and DOE will be able to contribute in-depth Arctic process information and advanced models and modeling expertise. These common areas of interest provide the foundation for collaborations among researchers involved in NGEE-Arctic and ABoVE in pursuing DOE's and NASA's common goals.

This MOA builds on existing federal cooperation between NASA and DOE on climate and ecosystem science and modeling that has been coordinated through the U.S. Global Change Research Program (USGCRP), Interagency Arctic Research Policy Committee (IARPC), and the U.S. Group on Earth Observations (USGEO). This MOA will ensure maximum impact of U.S. Government investment in climate observing and prediction capabilities associated with the Arctic region.

III. SCOPE

This MOA provides a framework for cooperation and coordination, and is not intended to be an exhaustive description of work to be carried out over the term of the MOA.

IV. RESPONSIBILITIES

Building on the previous MOA, NASA and DOE will jointly coordinate and promote the coordination of research and modeling activities that effectively align with the scientific priorities and planning of NASA and DOE and build upon sampling, observing, and modeling capacities, during the period 2023-2026. The collaborative research will include, but not be limited to, the following:

a. Coordinating planning and investments in Arctic climate and environmental change research, advancing the capabilities of observing technologies and predictive models, and implementing best practices in data management;

b. Identifying candidate demonstration science projects that can be tightly coordinated by NASA and DOE, taking advantage of the science goals of each agency and their anticipated field observing, computational, database, and analytical capabilities; and

c. Documenting the emerging and anticipated developments in Arctic observations, data management, scientific understanding, and predictive capability.

The following are examples of specific Arctic science activities that will expand NASA-DOE collaboration:

a. Enhance coordination of two major field activities conducted by NASA and DOE: the NASA-sponsored ABoVE; and the DOE-sponsored NGEE-Arctic. ABoVE project is a major NASA investment to understand the vulnerability of boreal and Arctic ecosystems to environmental change. NGEE-Arctic is a long-term field project (through 2026) to understand the Earth system/climate drivers and feedbacks associated with Arctic ecology, including special efforts to understand, describe, and predict dynamical, biogeochemical, and geomorphological processes that influence the Earth's radiative balance and carbon cycle. The two projects are highly complementary. The focus of NGEE-Arctic research is at the scale of a next-generation high-resolution grid cell (~1 km x 1 km) with intensive *in-situ* observations and modeling, while ABoVE seeks to develop regional-scale understanding via integration of field measurements, remotely sensed data, and modeling.

b. Where appropriate, design observational strategies and approaches including detailed field deployments to optimize geographic coverage and extent, optimize scientific analysis, and improve modeling and prediction capabilities;

c. Program managers suggest representative NGEE-Arctic-sponsored researchers for membership on the ABoVE Science Team and include representative ABoVE-sponsored researcher(s) on the NGEE-Arctic Scientific Advisory Committee to provide mechanisms for coordination of research and data archiving;

d. Develop a joint DOE-NASA data policy and protocol such that data obtained by the NGEE-Arctic and ABoVE projects are compatible, accessible, and available to their respective science teams and to the international research community in a rapid and coordinated manner; and

e. Institutionalize a standing reciprocal invitation for representatives of each group to attend all-hands NGEE-Arctic and ABoVE Science Team meetings.

Shared responsibilities for programmatic collaboration include:

a. NASA and DOE will acknowledge this collaboration in relevant publications, where scientific documents are produced under this MOA;

b. NASA and DOE will periodically conduct joint, focused workshops or use other means of communication, to discuss topics of common interest to both agencies. The relevant NASA and DOE Principal Investigators and interested outside parties working in the field to foster mutually beneficial interactions will participate in the discussions;

c. NASA and DOE will utilize their respective computer resources to advance the results of the identified science projects, when it is mutually agreeable;

d. Principal Investigator and team meetings about relevant Arctic science issues carried out by DOE will be open to attendance by NASA program managers and lead scientists. Conversely, NASA will invite the attendance of DOE program managers and Arctic scientists to ABoVE Science Team Meetings.

V. FINANCIAL OBLIGATIONS

There will be no transfer of funds between the Parties under this MOA and each Party will fund its own participation. All activities under or pursuant to this MOA are subject to the availability of funds, and no provision of this MOA shall be interpreted to require obligation or payment of funds in violation of the Anti-Deficiency Act (31 U.S.C. § 1341). To the extent that any transfer of funds is required, the transfer will be implemented through a separate instrument.

VI. PRIORITY OF USE

Any schedule or milestone in this MOA is estimated based upon the Parties' current understanding of the projected availability of its respective goods, services, facilities, or equipment. In the event that either Party's projected availability changes, NASA and/or DOE shall be given reasonable notice of that change, so that the schedule and milestones may be adjusted accordingly. The Parties agree their respective use of their own goods, services, facilities, or equipment shall have priority over the use planned in this MOA.

VII. LIABILITY AND RISK OF LOSS

Each Party agrees to assume liability for its own risks arising from or related to activities conducted under this MOA.

VIII. INTELLECTUAL PROPERTY RIGHTS

NASA and DOE agree that the information and data exchanged in furtherance of the activities under this MOA will be exchanged without use and disclosure restrictions unless required by national security regulations (*e.g.*, classified information) or as otherwise provided in this MOA or agreed to by NASA and DOE for specifically identified information or data (*e.g.*, information or data specifically marked with a restrictive notice).

IX. INTELLECTUAL PROPERTY RIGHTS - INVENTION AND PATENT RIGHTS

Ownership of inventions made (conceived or first actually reduced to practice) under this MOA shall be in accordance with applicable statutes. Unless otherwise agreed upon by NASA and DOE, custody and administration of inventions made (conceived or first actually reduced to practice) under this MOA will remain with the respective inventing Party. In the event an invention is made jointly by employees of the Parties (including by employees of a Party's contractors or subcontractors for which the U.S. Government has ownership), the Parties will consult and agree as to future actions toward establishment of patent protection for the invention.

X. RELEASE OF GENERAL INFORMATION TO THE PUBLIC AND MEDIA

NASA or DOE may, consistent with Federal law and this Agreement, release general information regarding its own participation in this Agreement as desired. Insofar as participation of the other Party in this IAA is included in a public release, NASA and DOE will seek to consult with each other prior to any such release, consistent with the Parties' respective policies. The Parties acknowledge that, if this IAA is entered into pursuant to NASA's 51 U.S.C. §20113(e) authority, this IAA will be disclosed, without redaction, in accordance with the NTAA.

Pursuant to Section 841(d) of the NASA Transition Authorization Act of 2017, Public Law 115- 10 (the "NTAA"), NASA is obligated to publicly disclose copies of all agreements conducted pursuant to NASA's 51 U.S.C. §20113(e) authority in a searchable format on the NASA website within 60 days after the agreement is signed by the Parties. The Parties acknowledge that, if this IAA is entered into pursuant to NASA's 51 U.S.C. §20113(e) authority, this IAA will be disclosed, without redaction, in accordance with the NTAA.

XI. TERM OF MOA

This MOA is effective upon signature by all parties. It shall remain in effect for three years beginning on its effective date. The MOA may be renewed for additional terms of periods to be determined upon mutual agreement of the parties.

XII. RIGHT TO TERMINATE

The MOA may be terminated at any time by mutual agreement of the parties or unilaterally by either party providing sixty (60) calendar days written notice is provided to the other party.

XIII. CONTINUING OBLIGATIONS

The rights and obligations of the Parties that, by their nature, would continue beyond the expiration or termination of this MOA, *e.g.*, "Liability and Risk of Loss" and "Intellectual Property Rights" shall survive such expiration or termination of this MOA.

XIV. POINTS OF CONTACT

The Parties have identified the following individuals as the primary points of contact for this MOA:

Management Points of Contact

NASA
Jack Kaye
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Technical Points of Contact

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XV. DISPUTE RESOLUTION

All disputes concerning questions of fact or law arising under this MOA shall be referred by the claimant in writing to the appropriate person identified in this MOA as the "Points of Contact." The persons identified as the "Points of Contact" for NASA and DOE will consult and attempt to resolve all issues arising from the implementation of this MOA. If they are unable to come to agreement on any issue, the dispute will be referred to the signatories to this MOA, or their designees, for joint resolution after the Parties have separately documented in writing clear reasons for the dispute. As applicable, disputes will be resolved pursuant to the Department of the Treasury's Intragovernmental Transaction Guide (Treasury Financial Manual, Vol. 1, Chapter 2, Part 4700, Appendix 10 (hereinafter, the "Intragovernmental Transaction Guide")).

XVI. MODIFICATIONS

This MOA may be amended by mutual agreement of the parties. The MOA will be reviewed every three years to determine whether it should be renewed and whether changes are needed. Any modification to this MOA shall be executed, in writing, and signed by an authorized representative of NASA and DOE.

XVII. APPLICABLE LAW

U.S. Federal law governs this MOA for all purposes, including, but not limited to, determining the validity of the MOA, the meaning of its provisions, and the rights, obligations and remedies of the Parties.

XVIII. SIGNATORY AUTHORITY

Approved and authorized on behalf of each Party by:

KAREN St Germain Digitally signed by KAREN St Germain Date: 2023.05.17 18:31:27 -04'00'

Karen St. Germain, Ph.D.
Director, Earth Science Division
Science Mission Directorate
NASA

Date: 5/17/2023

GERALD GEERNAERT Digitally signed by GERALD GEERNAERT Date: 2023.05.11 16:02:36 -04'00'

Gerald Geernaert, Ph.D.
Acting Associate Director,
Office of Biological and Environmental Research
DOE

Date: 5/11/2023