

**AMENDMENT No. 2 TO THE NASA RESEARCH ANNOUNCEMENT (NRA)  
ENTITLED “RESEARCH OPPORTUNITIES IN AERONAUTICS – 2023  
(ROA-2023),” NNH23ZEA001N, RELEASED March 30, 2023**

Changes are made to the following:

- Updated Table of Contents
- Table 5. Solicited Research Programs (in order of proposal due dates)
- Table 6. Solicited Research Programs (in order of Appendices A-D)
- Appendix D.6 - Future Aviation Maintenance Technical Challenges

TABLE 5. SOLICITED RESEARCH PROGRAMS (IN ORDER OF PROPOSAL DUE DATES)

APPENDIX	PROGRAM	NOI DUE DATE	PROPOSAL DUE DATE
D.2	Transformational Tools and Technologies Project (TTT)	December 9, 2022	January 13, 2023, 5PM EST
D.6	Future Aviation Maintenance Technical Challenges	April 21, 2023	May 31, 2023

Note: It is expected that additional project areas will be added in future amendments.

TABLE 6. SOLICITED RESEARCH PROGRAMS (IN ORDER OF APPENDICES A–  
D)

APPENDIX	PROGRAM	NOI DUE DATE	PROPOSAL DUE DATE
D.2	Transformational Tools and Technologies Project (TTT)	December 9, 2022	January 13, 2023, 5PM EST
D.6	Future Aviation Maintenance Technical Challenges	April 21, 2023	May 31, 2023

Note: It is expected that additional project areas will be added in future amendments.

## D.6 Future Aviation Maintenance Technical Challenges

The University Innovation (UI) project enriches the Transformative Aeronautics Concepts Program (TACP) and Aeronautics Research Mission Directorate (ARMD) portfolio with university-led innovation to address system-level challenges, which are outlined in ARMD's Strategic Implementation Plan. UI seeks new, innovative ideas that can support the U.S. aviation community and ARMD portfolio.

In this Appendix, the UI project is soliciting for a new portfolio item, Future Aviation Maintenance Technical Challenges.

### D.6.1 Background, Motivation, and NASA Relevance

NASA Aeronautics Research Mission Directorate's vision (in the Strategic Implementation Plan (see reference 1 in Section D.6.13) includes the safe and widespread use of piloted, remote-controlled, and fully autonomous aircraft of all sizes to move people and packages wherever they need to go – perhaps within a dense urban environment, out to a nearby international airport, or to a rural town on the prairie. With government, industry and academic partners, NASA Aeronautics is working to make real these new forms of air transportation with their new concepts of operations, vehicle designs, airframes, and propulsion systems – whether powered by electric, hydrogen, hybrid power, or other energy source. This program element focuses on these new forms of aviation.

NASA Aeronautics recognizes that to develop this new air transportation ecosystem, it has to focus not just on the new forms of aircraft but also on the wider system in which these aircraft will operate – looking at things like infrastructure, energy supplies, integration with ground transportation, etc. This program element focuses on one of those prominent issues likely to be faced by the future air transportation industry – Aviation Maintenance. Not only is it important to identify the new and unique maintenance issues that will crop up with these new forms of air transportation but also to develop the workforce for it – the Aviation Maintenance Technicians.

In response, the UI project has introduced the Future Aviation Maintenance Technical Challenges program element under ROA-2023 to support an initial set of competitively-selected investigations that will address key maintenance and training challenges facing the next-generation of air transportation.

### D.6.2 Program Element Goals

The goal of Future Aviation Maintenance Technical Challenges is multi-fold:

- a) First, perform a scientific inquiry into aviation's future maintenance technical challenges, both holistically and with some technical specificity; (this is the scope of this solicitation) and
- b) Eventually, develop aviation mechanic standards, training curriculum, required equipment and materials based on the findings of the first phase.

The program element goals have been limited in this solicitation to convey the essence of the program element and is not meant to limit future expansions or need for fulfilling additional goals. A full range of activities and investments could also involve:

- Learning from related disciplines like automotive, space, medical, etc. on incorporation of new techniques,
- Investigating new or borrowed methods and techniques which could provide benefits in the existing framework and then extrapolating how these would be implemented for new technologies, and
- Developing new teaching technologies, that are easily updatable to address future aviation technologies, thereby more efficiently teaching Aviation Maintenance Technician Schools (AMTS) students.

These activities are not the primary scope of this solicitation.

Ultimately, the generated data, information, and curriculum should be useful towards establishing future curriculum requirements of FAA-certificated AMTS where gaining knowledge and proficiency becomes easier and more affordable for future aviation maintenance technicians.

#### D.6.3 Scope of Solicited Research within this Program Element

Hundreds of aviation companies are working on technologies that will enable greener flying with a wide range of future possibilities – Unmanned Aircraft Systems (UAS), electric vertical takeoff and landing (eVTOL) vehicles, all electric and electric-hybrid regional aircraft, hydrogen powered aircraft, etc. This has spurred a lot of excitement about the latest and greatest advances in these near-future technologies. Government agencies, including NASA, are working technologies to safely integrate these new-generation aircraft into the national airspace system.

These new paradigms indicate the near-future vehicles will most likely incorporate some fundamentally different requirements for system maintenance. This solicitation focuses on the unique aviation maintenance technical challenges of these near-future technologies that are different from those currently being studied in AMTS. The scope of this solicitation is for two-year investigations that fall within the scientific and technical scope of the program element goal (a) in Section D.6.2, and which have the prospect of analyzing the highest impact aviation maintenance technical challenges within the context of a focused, two-year effort.

Within the above mentioned solicitation scope, the UI project solicits investigations that will:

- Focus on either cross-cutting technologies (as an example, a common new technology, like new materials and structures, shared across multiple new vehicle designs that is not in conventional vehicles) or choose one impactful, near-future vehicle technology (as an example, megawatt electric propulsion systems).
- Partner with an applicable industry member who can provide sufficient information on the new technologies (as an example, in vehicle design) and differences of these new technologies from conventional technologies.

- Critically analyze the maintenance and repair requirements of the new technologies to assess the technical requirements/skills that are not covered in the current AMTS curriculum.
- Focus the research on impactful “gap” elements for the new technologies of either Airframe or Powerplant for the chosen technologies.
- With guidance from the industry partner, assess the unique maintenance and repair requirements for the technologies based on projected operational use.
- Investigate the state-of-science techniques available or needed to deliver AMTS-viable maintenance and repair techniques with potentially thorough certification.
- Ensure existing, available state-of-science techniques meet or exceed safety requirements.
- Develop a prioritized list of the new aviation maintenance technical challenges investigated.

Proposers are required to have a funded AMTS as a team member and have a funded or unfunded industry partner who could guide awardees with new maintenance challenge areas. Having an FAA advisor is optional but may be helpful to awardees in maintenance and certification/qualification requirements.

The proposed technical approach should discuss planned phases of research that would ensure a high probability of a successful outcome. Among selectable proposals, see evaluation criteria in Section D.6.9, proposals with higher potential impact will be prioritized for selection. It is not required for proposals to verify the practicality of maintenance and repair techniques via demonstrations to facilitate technology transfer into the AMTS community. However, a limited number of such demonstrations with the partner AMTS will be an added bonus.

Because of the limited funding available under this solicitation, the scope of this proposal opportunity is limited and should not be construed as representative of the full range of activities and investments that will be required to fully understand aviation’s future maintenance and training challenges. Should this program be continued in future years, it is anticipated that the scope can be broadened in accordance with the highest priorities in this field.

#### D.6.4 Solicited Research Exclusions

This current solicitation narrowly focuses on identifying the state-of-the-science in aviation maintenance technical challenges of the near future. Consequently, proposals in the following categories are not solicited:

- Investigations where the focus is on the advancement of certifiable maintenance and repair techniques.
- The primary emphasis is on designing aviation mechanic curriculum or purchases of equipment and materials.
- Developing maintenance cost analyses or tradeoff analyses among different maintenance techniques.

#### D.6.5 Expected Outcomes

The following are the desired outcomes:

- Write a final report including a prioritized list of aviation maintenance technical challenges of the future for your focused area of examination that are currently not addressed in AMTS curriculum.
- For each listed challenge, identify either existing technique or a maintenance and repair technique need for the near-future, new aviation technologies.
- Publicly disseminate final report and research results so that future work can build on them. Disseminate results to a range of AMTS.
- Involve undergraduate, graduate, and AMTS students in meaningful ways while performing the research.

#### D.6.6 Funding Information and Projected Distribution of Awards

The UI Project anticipates that the total amount allocated for this program is approximately \$900K/year for two years. Proposals are invited from eligible organizations (see Section D.6.7) for a 2-year duration and should have budgets \$300K/year or less per award, with ~\$50K/year directed towards a partner AMTS. The UI Project anticipates investing in three awards in this solicitation. It is expected that the majority of the Year 1 funding will be available in October 2023 for Year 1 performance and similarly Year 2 funding will be available in October 2024. Actual spending and timely invoicing by the awardees are important to NASA and proposed budgets must consider ramp ups within the team.

The actual number, value, and duration of the awards will depend on the quality of the proposals received, the scope of the proposed work, funding availability, and program needs. In addition, these projections represent the UI project's plans at the time of the release of this solicitation. These conditions are subject to change, and therefore there is no guarantee that the awards will be allocated as described above. Awards for multiple years of performance are subject to adequate performance during previous years and funding availability in subsequent fiscal years. In some cases, only a portion of a proposal may be selected for award.

#### D.6.7 Eligibility

For this solicitation, the proposing (lead) organization must be an accredited, degree-granting U.S. college or university. Community colleges are encouraged to participate as either as the lead organization or as team members. Proposing organizations are encouraged to include accredited AMTS as partners in their team, such that they can receive funds from the NASA award. Historically Black Colleges and Universities (HBCU) and other minority-serving institutions (MSI) are strongly encouraged to participate. Industry partners can be funded or unfunded team members.

Collaboration with FAA and other U.S. government agencies that adds value towards the research is encouraged. Collaborating U.S. government agencies will not receive funds from the NASA award.

Other eligibility criteria, not superseded by the above, are in Section III of this ROA. Proposals involving bilateral participation, collaboration, or coordination in any way with China or any Chinese-owned company, whether funded or performed under a no-exchange-of-funds basis, shall be ineligible for award.

#### D.6.8 Proposal Preparation

##### Notice of Intent (NOI) to Propose

NOIs are encouraged but not required for this solicitation.

##### General Requirements

A competitive proposal will clearly and concisely: (1) describe the proposed innovations and/or research approaches relative to the state-of-the-science; (2) address the scientific, technical merit and feasibility of the proposed activities, and (3) relevance and significance to this solicitation's stated needs in Sections D.6.2 to D.6.5.

##### Format Requirements

Unless otherwise noted, all proposals submitted in response to this solicitation shall be in accordance with Section 2 and 3 of the *NASA Proposer's Guide, Edition: February 2023* (see reference 2 in Section D.6.13). Proposals that do not follow the formatting requirement are subject to rejection during administrative screening.

##### Technical Section

The Scientific/Technical/Management Plan of the proposal is the most important for selection. The proposal must address a topic within scope of Section D.6.3. It must clearly describe: the background and objectives of the proposed research; the approaches to be considered; the workforce required; the anticipated results; and the contribution of the work. The proposal must identify milestones with measurable metrics toward achieving the proposer's goal, with a minimum of one milestone per year. The proposal must address all requirements of this solicitation.

The following checklist describes the minimum information expected in the Scientific/Technical/Management Plan of the proposal. It must clearly describe:

- a. Topic area and challenges the proposal is addressing
  - Objectives and technical approach
  - Targeted/anticipated result and deliverables at the end of the period of performance
  - Expected impact/benefits if successful
  - Quantifiable metrics to evaluate progress
  - Assessment of what is innovative or novel in the proposal
- b. Detailed work plan, that also includes the following
  - Schedule with milestones with success criteria
  - Team members - qualifications and experience
  - Strategy to involve students in the research
  - Technology transfer plan
  - Detailed budget – level of effort, estimated costs, travel, etc.

- Organization capabilities and resources
- Computing requirements: If any NASA computational resource is proposed, include specific computing requirements (CPUs, hours, timeframe, etc.) and state its criticality to the proposed work (select from below):
  - i) Require NASA computation resources as go/no go for proposed work
  - ii) Optional need for NASA computation resources to enhance research execution

A letter of support for supercomputing is not possible during the proposal submission phase. If awarded, one can apply for supercomputing allocation under the UI Project.

#### Other Requirements

Please refer to Section IV of this ROA and the *NASA Proposer's Guide* for additional requirements on proposal content, format, budget details, and submission procedures. A budget justification, including justification for any foreign travel, is required in the proposal, but will not be counted toward the Scientific/Technical/ Management page limit; nor will other supporting information, such as the Data Management Plan, references, résumés and optional letters of support from partners and collaborators.

#### D.6.9 Proposal Evaluation Criteria

All proposals will be reviewed according to the evaluation criteria listed in this section.

- Relevance and Impact (weight 30%)
  - Relevance to specific goals and objectives in Sections D.6.2 to D.6.5
  - Expected significance and/or impact of the proposed work
  - Clear link between the proposed objectives, research products, and milestones to the expected outcomes
  - Value of the proposed dissemination of final report and transfer of research results
- Technical Merit (weight 30%)
  - Overall scientific or technical merit of the proposal, including unique and innovative methods, approaches, or concepts
  - Credibility of technical approach, including a clear assessment of primary risks and a means to address them
  - Comprehensiveness of work plan, effective use of resources, management approach, milestones and proposed schedule for meeting the proposed objectives
  - Facilities, instruments, equipment, and other resources or support systems presented in the proposal that will affect the likelihood of achieving the proposed objectives
  - Documentation of approach and results in the form of final written technical reports is required
- Teaming and Education (30%)
  - Proposed team qualifications and experience including AMTS
  - Integrated team contributes to overall proposal strength
  - Training of student team members
  - Value of the industry partner and FAA advisor
- Cost (weight 10%)

- Proposed cost realism and reasonableness. Appropriateness of proposed effort and proposed other direct costs with those required to accomplish the goals of the investigation.
- Value of the proposal - cost to NASA in time and budget relative to the expected impact
- Budget for AMTS and industry partner in research

E-mail debriefs of the review panel comments of proposals from NASA will be provided after reviews are completed.

Note that NASA reserves the right to offer selection of only a portion of a proposed investigation; in such a case, the proposer will be given the opportunity to accept or decline NASA's offer.

#### D.6.10 Source Selection

The Source Selection Official is the UI Project Manager. After review of proposals, the Source Selection Official has the option to consider program portfolio priorities, team disciplinary and expertise diversity, and budget constraints when making a final selection.

#### D.6.11 Reporting and NASA Oversight

NASA intends to conduct oversight through annual reviews and quarterly reports/meetings.

Awardees shall hold a kickoff meeting and annual reviews for NASA to assess the work effort's relevance, quality and performance. The location and medium for this review are at the discretion of the awardee with NASA concurrence. The review will also provide a forum to discuss the awardee's handling of issues and risks that have arisen during the year, as well as provide a mechanism for technology transfer and knowledge dissemination to NASA.

Awardees shall also conduct quarterly status reviews with NASA. These reviews shall provide an update on technical progress, completed milestones, notable accomplishments, and any changes to the plan that occurred during the quarter. This review discussion is expected to take place via video or teleconference. Quarterly status reviews will occur after the first, second, and third quarters of each fiscal year during the period of performance. No quarterly status review is required for the fourth quarter (i.e., the quarter preceding the annual review). Information from the fourth quarter can be incorporated into the annual review.

A written report that completely documents the approach and results shall be submitted for each year's effort.

All technical deliverables identified in the proposal, along with a final report documenting the approach, results, recommendations, and conclusions of the entire work effort shall be submitted no later than 90 days after the end of the period of performance.



Sensitive information may be provided to NASA in a proprietary appendix. Software developments and/or enhancements shall be developed in modular form and delivered in appropriate computer file formats.

D.6.12 Cost Monitoring

Cost monitoring is a part of performance monitoring. The awardees should have procedures for planning, budgeting, tracking, and reporting their costs from all partners. Although NASA understands that there will be a time lag between the institutions’ use of funds and when funds are drawn down, invoicing should be timely and prompt.

Pre-Award Costs

Pre-award costs are allowable but at the grantee's own risk. Per 2 CFR § 1800.210, Pre-Award Costs, NASA has waived the requirement for award recipients to obtain written approval prior to incurring project costs up to 90 calendar days before NASA issues an award.

D.6.13 References

- [1] NASA, “NASA Aeronautics Strategic Implementation Plan, 2019 Update” <https://www.nasa.gov/aeroresearch/strategy>, 2019.
- [2] NASA. “NASA Proposer’s Guide,” [https://www.nasa.gov/sites/default/files/atoms/files/2023\\_-\\_nasa\\_proposers\\_guide\\_-\\_final.pdf](https://www.nasa.gov/sites/default/files/atoms/files/2023_-_nasa_proposers_guide_-_final.pdf), Edition: February 2023

D.6.14 Summary of Key Information

Expected budget for new awards	Nominally \$300K per award per year, depending on scope
Anticipated number of new awards pending adequate proposals of merit and funds availability	Nominally three awards
Maximum duration of awards	Up to 2 years
Applicant’s Workshop	Wednesday April 26, 2023; 1:00-2:00 p.m. ET
Due date for Notice of Intent (NOI) to propose	April 21, 2023, 5 pm ET
Due date for proposals	May 31, 2023, 5 pm ET
Start of Period of Performance	Fall 2023
General information and overview of this solicitation	See the <i>Summary of Solicitation</i> in the ROA
Detailed instructions for the preparation and submission of proposals	See D.6.8 and the <i>NASA Proposer’s Guide, Edition: February 2023</i> at <a href="https://www.nasa.gov/sites/default/files/atoms/files/2023_-_nasa_proposers_guide_-_final.pdf">https://www.nasa.gov/sites/default/files/atoms/files/2023_-_nasa_proposers_guide_-_final.pdf</a>

Page limit for the central Science-Technical-Management section of proposal	15 pages
Submission medium	Electronic proposal submission is required; no hard copy is required. See also Section IV in the <i>Summary of Solicitation</i> of the ROA and Chapter 3 of the <i>NASA Proposer's Guide</i> .
Web site for submission of proposal via NSPIRES	<a href="https://nspires.nasaprs.com">https://nspires.nasaprs.com</a> (help desk available at <a href="mailto:nspires-help@nasaprs.com">nspires-help@nasaprs.com</a> or (202) 479-9376)
Expected award type	Grants
Funding opportunity number	NNH23ZEA001N-UI
NASA technical point of contact concerning this program	Steven Holz, < <a href="mailto:steven.m.holz@nasa.gov">steven.m.holz@nasa.gov</a> >, (757) 864-9798
NASA Procurement point of contact concerning this program	DeLunzo Bartee, < <a href="mailto:delunzo.bartee@nasa.gov">delunzo.bartee@nasa.gov</a> >, (228) 688-2781
Questions and Answers (Q&A)	Quickest way to resolve questions about this NRA is to e-mail questions to: <a href="mailto:HQ-UnivPartnerships@mail.nasa.gov">HQ-UnivPartnerships@mail.nasa.gov</a> Responses will be provided by e-mail. NASA will also post any general Q&A on-line in the NSPIRES website, so that all proposers will have access to the same information.