

TRANSMITTAL

TO
Board of Public Works

DATE
06/26/2024

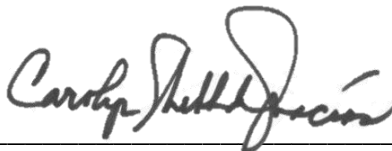
COUNCIL FILE NO.

FROM
The Mayor

COUNCIL DISTRICT

REQUEST TO ACCEPT GRANT FUNDING AND EXECUTE AMENDED AGREEMENT – NATIONAL AERONAUTICS AND SPACE ADMINISTRATION (NASA)

Approved, ED3 Waived, and Transmitted for further processing.



MAYOR
(Carolyn Webb de Macias for)

**BOARD OF PUBLIC WORKS
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PRESIDENT

M. TERESA VILLEGAS
VICE PRESIDENT

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SUSANA REYES
COMMISSIONER

CITY OF LOS ANGELES

CALIFORNIA



KAREN BASS
MAYOR

**OFFICE OF THE
BOARD OF PUBLIC WORKS**

TJ KNIGHT
ACTING EXECUTIVE OFFICER

200 NORTH SPRING STREET
ROOM 361, CITY HALL
LOS ANGELES, CA 90012

TEL: (213) 978-0261
TDD: (213) 978-2310
FAX: (213) 978-0278

<http://bpw.lacity.org>

June 18, 2024

BPW-2024-0370

The Honorable Mayor Bass
City Hall – Room 320
Los Angeles, CA 90012
Attn: Heleen Ramirez

ACCEPT GRANT FUNDING AND EXECUTE AMENDED AGREEMENT – NATIONAL AERONAUTICS AND SPACE ADMINISTRATION (NASA)

As recommended in the accompanying report from the Director of the Bureau of Street Lighting, which this Board has adopted, the Board of Public Works (Board) recommends that the Mayor and City Council:

1. AUTHORIZE the Executive Director of Bureau of Street Lighting (BSL) or designee to accept this NASA Grant and execute any necessary agreements, in an amount not to exceed \$2,500,000 from NASA, for an extended one-year and seven months, extending through December 31, 2024;
2. AUTHORIZE BSL to accept the NASA grant, approve the designation of BSL as the administrative and fiscal agent for the NASA Grant to facilitate receipt and disbursement of grant funds, track and report matching funds, as well as reimburse the City for any grant related expenditures;
3. APPROVE the program grant agreement for BSL to assist the City in the NASA Grant implementation in accordance with the terms and conditions set forth in the grant agreement;
4. AUTHORIZE the Controller to Transfer and deposit \$450,000 from Fund TBD to BSL Fund 347 Dept 50 Account TBD;
5. APPROVE \$25,000 reimbursement to BSL for administration costs for monitoring the project, and processing payments to AI Agora and California State University Los Angeles; and
6. APPROVE \$143,000 reimbursement to the Office of the Mayor for the Finance, Operations and Innovation team to manage the program;

7. APPROVE the program grant agreement between BSL and AI Agora in the amount of \$196,000 to conduct data visualization of digital twin models for air quality and urban air transportation and assist the City in the NASA Grant implementation in accordance with the terms and conditions set forth in the grant agreement; and
8. APPROVE the program grant agreement between BSL and the California State University Los Angeles in the additional amount of \$86,000 to conduct data modeling for air quality prediction and assist the City in the NASA Grant.

Fiscal Impact: There is no impact to the General Fund.

Sincerely,

A handwritten signature in black ink, appearing to read 'TJ Knight', with a stylized, cursive script.

TJ KNIGHT,
Acting Executive Officer, Board of Public Works

TK:lc

**DEPARTMENT OF PUBLIC WORKS
BUREAU OF STREET LIGHTING**

REPORT NO. 1

DATE: June 14, 2024

C.D. All

**ADOPTED BY THE BOARD
PUBLIC WORKS OF THE CITY
of Los Angeles California
AND REFERRED TO THE MAYOR
JUN 14 2024
AND REFERRED TO THE CITY COUNCIL
JTK
Executive Officer
Board of Public Works**

Honorable Board of Public Works
of the City of Los Angeles

REQUEST FOR AUTHORITY TO ACCEPT GRANT FUNDING FROM THE NATIONAL AERONAUTICS AND SPACE ADMINISTRATION (NASA) IN AN AMOUNT NOT TO EXCEED \$2,500,000; AUTHORITY TO EXECUTE AN AMENDED AGREEMENT WITH EACH, AI AGORA, AND THE CALIFORNIA STATE UNIVERSITY LOS ANGELES (CSULA); AUTHORITY TO APPROPRIATE FUNDS TO BUREAU OF STREET LIGHTING'S (BSL) CONTRACTUAL SERVICES ACCOUNT UPON AVAILABILITY OF FUNDS.

RECOMMENDATIONS:

The Board of Public Works (Board), subject to Mayor and Council Approval:

1. AUTHORIZE the Executive Director of BSL or designee to accept this NASA Grant and execute any necessary agreements, in an amount not to exceed \$2,500,000 from NASA, for an extended one-year and seven months, extending through December 31, 2024;
2. AUTHORIZE BSL to accept the NASA grant, approve the designation of the Bureau of Street Lighting as the administrative and fiscal agent for the NASA Grant to facilitate receipt and disbursement of grant funds, track and report matching funds, as well as reimburse the City for any grant-related expenditures;
3. APPROVE the program grant agreement for the Bureau of Street Lighting to assist the City in the NASA Grant implementation in accordance with the terms and conditions set forth in the grant agreement;
4. AUTHORIZE the Controller to Transfer and deposit \$450,000 from Fund TBD to BSL Fund 347 Dept 50 .Account TBD
5. APPROVE \$25,000 reimbursement to the Bureau of Street Lighting for administration costs for monitoring the project, and processing payments to AI Agora and California State University Los Angeles (UAS); and
6. APPROVE \$143,000 reimbursement to the Office of the Mayor for the Finance, Operations and Innovation team to manage the program; and
7. APPROVE the program grant agreement between the Bureau of Street Lighting and AI Agora in the amount of \$196,000 to conduct data visualization of digital twin models for air quality and urban air transportation and assist the City in the NASA Grant implementation in accordance with the terms and conditions set forth in the grant agreement; and
8. APPROVE the program grant agreement between the Bureau of Street Lighting and the California State University Los Angeles in the additional amount of \$86,000 to conduct data modeling for air quality prediction and assist the City in the NASA Grant.

TRANSMITTAL

1. Copy of Agreement with AI Agora
2. Copy of Agreement with CSULA

DISCUSSION

Background

The City submitted a competitive proposal to NASA's Advanced Information Systems Technology call for proposals and was selected. The project, *Predicting What We Breathe*, funds air quality research and system development using machine learning and predictive data analytics using satellite and ground data. This will provide the City of Los Angeles with information about the effectiveness of our interventions (from tree planting to policy changes) on air quality in specific L.A. neighborhoods, and provide a platform for sharing data and successful city solutions with other global cities. In addition, the project will study the effect of decreased traffic during the COVID-19 safer at home time.

ABOUT L.A.'S AIR QUALITY DATA

The City of Los Angeles is in a unique situation to be an urban proving ground to look at how to better understand, predict, and mitigate the issues of air pollution for 4 million citizens. The proposed system (Predicting What We Breathe) looks at the time-series measurements of aerosol and ozone data and public and private ground data sensors and applies machine learning to uncover patterns that may not be discernible to human analysts. By enhancing human understanding and prediction of air quality, local governments and others can help mitigate the effects of air pollution through interventions that have measured results.

Data will be brought together from multiple sources, many of which (but not all) are running through the OpenAQ platform and are being used or provided by Federal, State, City, or other organizations, and this allows for easier data federation and layering. Most of the data used is expected to be geospatial data as the assessments and sensors are all tied to a specific location. Partners on this project include the South Coast Air Quality Management District (AQMD) and the County of Los Angeles, and private organizations like Anthem Blue Cross, and community groups like the Southern California Asthma Association.

COMPLEMENTING THE COVID DATA ANALYSIS, THE GREEN NEW DEAL, A RESILIENT L.A., AND THE SUSTAINABILITY PLAN

The project supports both the City's Green New Deal Sustainability pLAn and the Resilient Los Angeles Plan as they relate to air quality efforts. Within the Green New Deal, this project supports achieving the targets for clean, healthy air through identifying ways to reduce air pollution (Chapter 8, Industrial Emissions and Air Quality Monitoring). In the Resilient Los Angeles plan, Goals 12 and 15 with corresponding actions 74, 75, and 95 will be addressed by the NASA project:

- Goal 12: Use climate science to develop adaptation strategies consistent with the Paris Climate Agreement
 - Action 74: Transition to zero-emissions technology at the Port of LA to reduce emissions, improve air quality and build disaster resilience
 - Action 75: Transition to fossil-fuel free streets to fight air pollution and help tackle the global threat of climate change
- Goal 15: Grow public, private and philanthropic partnerships that will increase resources dedicated to building resilience
 - Action 95. Collaborate with cities to build resilience around the globe

The Air Quality Lead in the Office of Sustainability and the Chief Resilience Officer are part of the Project's Leadership team.

The Chief Data Officer is also serving as the Principal Investigator and was the submitter of the proposal. She has 30 years of experience at NASA in the field of satellite data and extensive experience in data architectures, machine learning, and smart cities.

PROJECT GOALS AND EXPECTED OUTCOMES

Year One

The team will identify the datasets, and develop a framework to collect and analyze data, look at historical trends and events, select a data architecture and models, initialize the computational space and migrate data to it, create a first set of machine learning algorithms to understand data trends, run the algorithm against the training data, and validate the initial set of algorithms. Community meetings at conferences and in Los Angeles, online forums, and a social media campaign will help to ensure community usage and participation early on. A workshop in L.A. will occur virtually or in person as possible.

Year Two

Focus: The team will refresh the data identification to include possible additional datasets, validate the models based on emergent research, run the algorithms against control data, and update/retrain algorithms and run against additional control data. As this work is completing and preparing for initial open source publication, the team will hold an international workshop to socialize the models, promote the open source, and gather requirements. Sister cities will be identified and recruited.

Throughout the task, there are administrative activities as well to ensure that the project meets the goals and remains on time and on budget. These include:

- Weekly virtual team meetings and monthly virtual team deep dive sessions
- Quarterly technical reports (7) and quarterly budget meetings
- Mid-year interim reports (2) and annual reports (2)
- Annual ESTO meeting attendance

Specific goals of this project are to:

1. Create a sustainable city and community
2. Continue leadership on climate action
3. Innovate approaches to clean water and sanitation

Year Three

Project Augmentation Tasks & Timeline

The scope of the project augmentation will build upon Years 1 and 2 of the project, with a goal of creating a digital twin model of the City of L.A. to understand the intersection of health issues (with a focus on air quality) and transportation, particularly the new operational planning for urban air mobility; with an outcome of creating data models and standards across NASA, FAA, DOT, and city data for urban air mobility.

Partners will continue to include the City of Los Angeles, NASA, California State University, OpenAQ, along with the addition of the FAA and AI Agora. Data from the FAA, the City, NASA, and urban air manufacturers will be used in the data algorithm to establish scenarios to identify the impact of moving traffic to a three dimensional space.

GRANT ADMINISTRATION AND MANAGEMENT

The responsibility for the administration and management of this additional grant will rest with BSL.

Per this amendment, the additional grant funds will be managed as follows: BSL will oversee \$168,000 for project management and data collection, integration, and analysis work to be conducted at the City, while \$86,000 will be contracted to California State University, Los Angeles (a member of the City's Data Science Federation) to apply machine learning to these big data sets and develop algorithms that provide predictive analytics and historical assessment of past interventions. \$196,000 will be used by AI Agora to support high-quality data processing and to conduct data visualization of digital twin models for air quality and urban air transportation. This work will be coordinated with the Sr. Director of Digital Inclusion and Innovation who is the designated NASA Principal Investigator for the project.

FISCAL IMPACT STATEMENT

There is no additional impact to the General Fund in the current year with the approval of the above recommendation. The recommendation in this report is consistent with the City's Financial Policies.

STATUS OF FINANCING

There is no impact to the General Fund, and there is no request necessary for front funding. The City has already been chosen for the grant, with initial funding of \$910,000. This represents additional funding in Year 3 of \$450,000 and the possibility of up to \$2.5M total. NASA will disperse funds twice per year, with the first disbursement expected before October 2023. The second disbursement would be expected in May 2024.

Respectfully submitted,

A handwritten signature in black ink, appearing to read "Miguel Sangalang". The signature is fluid and cursive, with a horizontal line extending to the right.

Miguel Sangalang
Executive Director
Bureau of Street Lighting

AGREEMENT BETWEEN
THE CITY OF LOS ANGELES
AND
AI AGORA LLC

Regarding: Predicting What We Breathe Project

Agreement Number: _____

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**AGREEMENT BETWEEN
THE CITY OF LOS ANGELES
AND
AI AGORA LLC
FOR PREDICTING WHAT WE BREATHE AIR QUALITY PROJECT**

THIS AGREEMENT is made and entered into by and between the City of Los Angeles a municipal corporation (hereinafter referred as the “City”) , acting by and through its Bureau of Street Lighting (“BSL”), and AI AGORA LLC, a corporation under the laws of the State of California (hereinafter referred as the “AI AGORA” or “Contractor”), located at 439 S Catalina Ave Unit 101 Pasadena CA 91106.

RECITALS

WHEREAS, the City proposes to gather satellite and ground level data, and use predictive analytics and machine learning to complete extensive air quality research on the effectiveness of the City’s air quality interventions, from tree planting to policy changes, and provide a platform for sharing data and successful City solutions with other global cities; and

WHEREAS, the City will complete this air quality research through a grant from NASA which will aid to inform the City’s Resilient LA and Sustainability plans on improving air quality by taking steps to reduce air pollution; and

WHEREAS, the BSL accepted a grant from NASA and designated the BSL as the administrative and fiscal agent for the grant to facilitate receipt and disbursement of grant funds, track and report matching funds, as well as reimburse the City for any grant-related expenditures.

WHEREAS, the City received an additional grant from NASA to continue this project and build on the success of using satellite and ground-based data, along with predictive analytics and machine learning for the air quality research, with the addition of creating a digital twin model of the City of L.A. to understand the intersection of air quality and transportation, particularly the new operational planning for urban air mobility; and

WHEREAS, the Contractor possesses the data science and data visualization technical skill, knowledge, and expertise to create digital twin models focused on air quality, therefore developing ‘what-if’ visualization scenarios of complex urban air transportation models that will leverage the air quality data predictive algorithms created by the Predicting What We Breathe (“PWVB”) data science team; and

WHEREAS, Contractor has represented that it is willing and able to provide the needed services under this Agreement and City wishes to retain Contractor to provide those services; and

WHEREAS, City and Contractor wish to: (1) enter into an Agreement for one-year and seven months, to expire on Dec 31, 2024, to fulfill the scope of the additional NASA grant received, for a compensation of \$196,000 and (2) make other changes deemed necessary by the Parties; and

WHEREAS, the services required are of an expert and technical nature and are temporary and occasional in character; therefore, competitive bidding under Charter Section 371 is neither practicable nor advantageous, nor compatible with the City's interests; and

NOW THEREFORE, in consideration of the above promises and of the terms, covenants and considerations set forth herein, the parties do agree as follows:

1.0 PARTIES TO THE AGREEMENT AND REPRESENTATIVES

1.1 Parties to the Agreement

The parties to this Agreement are:

- a. City – The City of Los Angeles, a municipal corporation, acting by and through the Bureau of Street Lighting, having its principal office at 1149 South Broadway, #200, Los Angeles, California 90015.
- b. Contractor – AI AGORA LLC, a corporation, with a business address at 439 S Catalina Ave Unit 101 Pasadena CA 91106.

1.2 Representatives to the Agreement

The representatives of the parties who are authorized to administer this Agreement to whom formal notices, demands, and communications will be given are as follows:

- a. The City's representative is, unless otherwise stated in the Agreement:

Matthew Hale, Deputy Mayor
City of Los Angeles
Mayor's Office of Finance & Innovation
200 North Spring Street
Los Angeles, CA 90012

With copies to:

Dawn Comer, Executive Officer
City of Los Angeles
Mayor's Office of Finance & Innovation
200 North Spring Street
Los Angeles, CA 90012

and

Bureau of Street Lighting Contract Administration
 1149 S Broadway #200
 Los Angeles, CA 90015
 Attention: Megan Hackney

- b. The Contractor's representative is, unless otherwise stated in the Agreement:

Amin Emrani, Chief Operations Officer (COO)
 AI AGORA LLC
 439 S Catalina Ave. Unit 101
 Pasadena, CA 91106
amin.emrani@ai-adora.com

1.3 Formal Notices

Formal notices, demands, and communications to be given hereunder by either party must be made in writing and may be affected by personal delivery or by registered or certified mail, postage prepaid, return receipt requested and will be deemed communicated as of the date of mailing.

1.4 Notices of Change

If the name of the person designated to receive the notices, demands or communications or the address of such person is changed, written notice will be given in accordance with this Section, within five (5) business days of said change.

1.5 Conditions Precedent

- a. **Insurance Requirements.** The Contractor shall comply at all times with all of the insurance requirements set forth in the Standard Provision for City Contracts (Rev. 9/22)[v.1], attached hereto and incorporated by reference.
- b. **Changes to Documentation.** Changes to the foregoing documents affecting the performance of the Contractor under this Agreement shall receive City approval in writing before the Contractor may affect the change.
- c. **Agreement Assignment.** This Agreement is not to be assigned to a substitute contractor, a successor in interest, or a purchaser of the Agreement without express permission of the City. If the City does not approve or grant permission for a subsequent contractor to assume the services outlined in this contract, then the Agreement will be terminated.

2.0 TERM OF AGREEMENT

The term of Agreement shall commence on May 18, 2023, and shall end on Dec 31, 2024. Said term is subject to the termination provisions contained in this Agreement.

3.0 SERVICES TO BE PROVIDED

- 3.1 As referenced in Exhibit 1, "Scope of Work", which is attached hereto and incorporated by reference, the Contractor will leverage the work done by City and non-City Air Quality stakeholders noted in Sections 2.1 (Ground AQ Sensor Data) and 2.3 (NASA Mission data) of the PWWB proposal.
- 3.2 The Contractor will work with California State University LA Auxiliary Services, Inc (UAS) to incorporate the predictive air quality data models.
- 3.3 The Contractor will set up the cloud computational environment.
- 3.4 The Contractor will set up and develop cloud-based backend platforms for data analytics algorithms and data processing.
- 3.5 The Contractor will work with the City to showcase the project at scheduled air quality convenings (local and global) from 2023 - 2024.
- 3.6 The Contractor will produce technical reports during the duration of the project.
- 3.7 The Contractor will provide expenditure reports and invoicing during the duration of the project.
- 3.8 The Contractor shall provide the data analysis and services based on the schedule noted below:

Task #	Tasks	Start	Duration
Task 3.1	Set up and develop cloud-based backend platforms. Transportation and AQ Data processing.	Second quarter of 2023	Through fourth quarter of 2023
Task 3.2	Set up data platforms for visualization. Connect cloud-based backend to frontend and activate visualization platform.	Third quarter of 2023	Through second quarter of 2024
Task 3.3	Develop and implement data analytics models on the cloud backend. Run Transportation and AQ Data processing on the backend for visualization	Second quarter of 2024	Through fourth quarter of 2024

	on the frontend.		
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4.0 COMPENSATION AND METHOD OF PAYMENT

4.1 Compensation

The City shall pay the Contractor for the satisfactory performance of the terms and conditions of this Agreement a total amount not to exceed \$196,000, payable per 2 CFR

Timeframe	Estimated Amount	Task
May 2023 - November 2023	\$60,000	Set up and develop cloud-based backend platforms. Transportation and AQ Data processing.
December 2023 - May 2024	\$70,000	Set up data platforms for visualization. Connect cloud-based backend to frontend and activate visualization platform.
June 2024 - December 2024	\$66,000	Develop and implement data analytics models on the cloud backend. Run Transportation and AQ Data processing on the backend for visualization on the frontend.
Total	\$196,000	

200.201, according to completion of the milestones in the table below.

4.2 Method of Payment

Invoices

The City shall pay the Contractor in accordance with Section 4.1 and the conditions and provisions of this Section after receipt and approval of the Contractor's invoices by the City. To ensure that services provided under personal services contracts are measured against services as detailed in the contract, the Controller of the City of Los Angeles has

developed a policy requiring that specific supporting documentation be submitted with invoices.

Billing & Invoicing Requirements

The Contractor is required to submit invoices that conform to City standards and include, at a minimum, the following information:

1. Name and address of Contractor
2. Name and address of City department being billed
3. Date of invoice and period covered
4. Contract number
5. Description of completed task and amount due per milestone payments:
6. Certification by Contractor
7. Discount and terms (if applicable)
8. Remittance Address (if different from company address)

All invoices shall be submitted on Contractor's letterhead, contain Contractor's official logo, or other unique and identifying information such as the name and address of the contractor. Evidence that tasks have been completed, in the form of a report, brochure, or photograph, shall be attached to all invoices. Invoices shall be submitted within per quarterly, bi-annual and annual review schedule aligned to the NASA reporting milestones, and shall be payable to the Contractor no later than 30 days after City approval of a complete invoice. Invoices are considered complete when appropriate documentation or services are signed off as satisfactory by the City's Contract Manager.

Invoices and supporting documentation shall be prepared at the sole expense and responsibility of the Contractor. The City will not compensate the Contractor for costs incurred in invoice preparation, and grant funds made available pursuant to this Agreement shall not be used for the preparation of invoices and supporting documents.

The City may request, in writing, changes to the content and format of the invoice and supporting documentation at any time. The City reserves the right to request additional supporting documentation to substantiate at any time. Failure to adhere to these policies may result in nonpayment or non-approval of demands, pursuant to Charter 262(a), which requires the Controller to inspect the quality, quantity, and condition of services, labor, materials, supplies, or equipment received by any City office or department, and approve demands before they are drawn on the Treasury.

The Contractor understands that the City makes no commitment to fund this Agreement beyond the terms set herein.

Invoices must be e-mailed to:

Megan Hackney

Bureau of Street Lighting

City of Los Angeles
1149 S Broadway #200
Los Angeles, California 90015
megan.hackney@lacity.org

5.0 OWNERSHIP AND INTELLECTUAL PROPERTY RIGHTS

5.1 Intellectual Property Warranty

The Contractor represents and warrants that its performance of all obligations under this Agreement does not infringe in any way, directly or indirectly, upon any third party's intellectual property rights, including, without limitation, patents, copyrights, trademarks, trade secrets, and rights of publicity.

5.2 Ownership of Collected Data

The Parties agree that Contractor has no ownership of, and acquires no rights in the data collected pursuant to this Agreement. As between the Parties, City retains all right of ownership, title, and interest in and to City data, including all intellectual property rights therein.

5.3 Survival of Provisions

The provisions of this Section shall survive expiration or termination of this Agreement. Further, the rights and remedies are cumulative of those provided for elsewhere in this Agreement and those allowed under the laws of the United State, the State of California, and the City of Los Angeles.

6.0 CONFIDENTIALITY OF INFORMATION

Information, documents, records, software programs, and data furnished to the Contractor by the City and other documents to which the Contractor has access during the term of this Agreement are confidential information (herein after referred to as "Confidential Information"). The Contractor may not disclose Confidential Information in any manner without the prior written consent of the City.

7.0 AMENDMENTS

Any change in the terms of this Agreement must be incorporated into this Agreement by a written amendment properly executed and signed by the person authorized to bind the parties thereto.

8.0 RATIFICATION

Due to the need for the Contractor's services to be provided expeditiously, Contractor may have provided services prior to the execution of this Agreement. To the extent that Contractor's services were performed in accordance with the terms and conditions of this Agreement, those services are hereby ratified.

9.0 STANDARD PROVISIONS

9.1 Standard Provisions for City Contracts

The Contractor shall comply with the applicable requirements of the Standard Provisions for City Contracts (Rev. 9/22)[v.1], attached hereto as Appendix A and incorporated herein by this reference.

9.2 Disclosure of Border Wall Contracting Ordinance

The CONTRACTOR shall comply with Los Angeles Administrative Code Section 10.50 et seq., 'Disclosure of Border Wall Contracting.' CITY may terminate this AGREEMENT at any time if CITY determines that CONTRACTOR failed to fully and accurately complete the required affidavit and disclose all Border Wall Bids and Border Wall Contracts, as defined in LAAC Section 10.50.1.

10.0 ENTIRE AGREEMENT

- a. This AGREEMENT integrates all the terms and conditions mentioned herein or incidental hereto, and supersedes all negotiations or previous agreements between the parties with respect to the performance of the services under this AGREEMENT.
- b. No oral agreement or conversation with any officer or employee of either party shall affect or modify any of the terms and conditions contained in this AGREEMENT.
- c. This AGREEMENT may be executed in one (1) or more counterpart(s), and by the parties in separate counterparts, each of which when executed shall be deemed to be an original but all of which taken together shall constitute one and the same AGREEMENT. The parties further agree that facsimile signatures, or signatures scanned into portable document format (PDF) or another electronic format designated by CITY and sent by e-mail, shall be deemed original signatures.
- d. In the event of any inconsistency between the provisions contained in the body of this AGREEMENT and the exhibits attached hereto, the inconsistency shall be resolved by giving precedence in the following order: 1) the provisions contained in the body of this AGREEMENT; 2) Exhibit 1, "Scope of Work"; and 3) Attachment A, "Standard Provisions for City Contracts (Rev. 9.22) [v.1]."

IN WITNESS THEREOF, the parties hereto have caused this Agreement to be executed by their respective duly authorized representatives.

CITY OF LOS ANGELES, by and through its
Department of Public Works
Bureau of Street Lighting

AI Agora LLC, a California corporation*

By signing below, the signatory attests
that they have no personal, financial,
beneficial, or familial interest in this contract.

By: _____

AURA GARCIA
President
Board of Public Works

By: _____

AMIN EMRANI
Chief Operations Officer
AI Agora

Date: _____

Date: _____

By: _____

MIGUEL SANGALANG
Executive Director
Public Works Street Lighting

Date: 06/07/2024

APPROVED AS TO FORM:
HYDEE FELDSTEIN SOTO
City Attorney

ATTEST:
HOLLY L. WOLCOTT
City Clerk

By: _____

TANEA YSAGUIRRE
Deputy City Attorney

By: _____

Deputy City Clerk

Date: _____

Date: _____

* Approved signature methods for corporations:

- 1) Two signatures: One of the Chairman of the Board of Directors, President, or Vice-President, and one of the Secretary, Assistant Secretary, Chief Financial Officer, or Assistant Treasurer, or
- 2) One signature of a Corporate-designated individual together with a properly attested resolution of the Board of Directors authorizing the individual to sign.

EXHIBIT 1: Scope of Work

Scope of Work: Predicting What We Breathe Project

City of Los Angeles Bureau of Street Lighting, AI Agora

Background

The City of Los Angeles is in a unique situation to be an urban proving ground to look at how to better understand, predict, and mitigate the issues of air pollution for 4 million citizens. The Predicting What We Breathe (PWVB) project has taken time-series measurements of satellite and ground data and applied machine learning to uncover patterns that may not be discernible to human analysts. Enhancing human understanding and prediction of air quality has resulted in a tool that helps inform local governments and others on appropriate measurements, analytics, predictive algorithms and mitigation strategies that are useful for dealing with air quality variability.

The City, in partnership with California State University Los Angeles and OpenAQ, has built and validated a highly accurate predictive algorithm which forecasts air quality as well as identifies the attributes that exacerbate air quality. This work is directly aligned to two key areas in NASA's Advanced Information Systems Technology (AIST) program for (1) increasing the accessibility and use of Earth / Space science data, to provide more usability to cities and (2) for the improvement of human health outcomes. The tool has been shared with cities around the world, and the project also worked with impacted communities and youth to empower them to engage on air quality. By applying machine learning to satellite and ground data, the project has been able to immediately help inform the City of L.A. as well as other cities on appropriate measurements, analytics, predictive algorithms, and mitigation strategies that are useful for dealing with air quality variability.

Fundamentally, achieving the City's sustainability and resilience goals will require the deployment of specific interventions in neighborhoods where the impact is highest. The NASA Earth science data and the City's dense sensor data made available through this program have helped the City promote data-driven decision making to track how specific interventions impact health outcomes over time.

This project matures NASA's Strategic Goal to advance Earth system science to meet the challenges of climate and environmental change by creating perhaps the largest in-situ urban prototype laboratory used to date. The lessons learned and technologies used here will further the use of Earth system science research to inform decisions and provide benefits to society.

Project Plan

The objective of this project is to increase the accessibility and use of space data by using machine learning to help cities predict air quality in ways that can be acted upon to improve human health outcomes and provide better data to individuals and cities. Secondly, the goal is to provide these tools and algorithms to future Earth science missions (e.g., MAIA) to provide rapid ground truth, combine multiple data sources, and support more rapid use of mission data.

This project has focused on maturing the technologies involved in:

- Developing machine learning algorithms for predictive models for air quality based on PM2.5 and other air pollutants
- Building a big data analytics algorithm for integrating ground and space data
- Providing predictive models for health risk using deep learning and machine learning
- Building an open source PM2.5 stack for integrating ground and space data
- Creating a model for cities with shared attributes to understand predictions and effective interventions

This work contributes to the state of knowledge in several specific ways.

- The application of machine learning models has allowed for the processing of big data with complexity of velocity, veracity, and volume in a human understandable way and at actionable speed
- The set of infusion partners gathered provides actions that have the potential to demonstrably improve human health and outcomes, as well as commercialization of the technology
- Combining in-situ ground data and satellite data with machine learning has allowed us to create wide areas of ground truth and fidelity. This has implications for providing ground to orbital measurements and validation of flight hardware against ground truth.

Year 3 - Project Augmentation Tasks & Timeline

The scope of the project augmentation will build upon Years 1 and 2 of the project, with a goal of creating a digital twin model of the City of L.A. to understand the intersection of health

issues (with a focus on air quality) and transportation, particularly the new operational planning for urban air mobility; with an outcome of creating data models and standards across NASA, FAA, DOT, and city data for urban air mobility.

Partners will continue to include the City of Los Angeles, NASA, California State University, along with the FAA and AI Agora. Data from the FAA, the City, NASA, and urban air manufacturers will be used in the data algorithm to establish scenarios to identify the impact of moving traffic to a three-dimensional space.

Task	May 2023	Jun	Jul	Aug	Oct	Dec	Jan 2024	Mar	May	Jul	Aug	Oct	Dec	Task Owner
Initiate team members/space	X													All
Data Identification/Refresh	X	X	X	X										All
Transportation Data Pre-Processing and cleaning	X	X												CSULA
Traffic Data Interpolation and Expansion for the city area	X	X	X	X										CSULA
Real-time Transportation Data generation		X	X	X	X									CSULA, AI Agora
Real-time Transportation Data projection to Air Pollution and greenhouse gasses		X	X	X	X	X	X	X						CSULA, AI Agora
Visualization backend framework/model implementations		X	X	X	X	X	X	X	X	X	X			AI Agora
Digital Twin Model: Understanding the impact of Transportation on AQ in real-time				X	X	X	X	X	X	X				CSULA, AI Agora, City

Digital Twin Model: Understanding the impact of Transportation on AQ and Health								X	X	X	X	X		All
Validate the Digital Twin Models											X	X	X	CSULA, CITY
Final model refinement											X	X	X	AI Agora
Publish the results												X	X	CSULA, CITY
Final Report													X	All
AIST reporting														
ESTO Science Forum	X													City
Quarterly Technical Report		X			X			X			X			All
Mid-Year Interim Report					X						X			All
Annual Report									X					All

RESTATED AND SUPPLEMENTAL AGREEMENT BETWEEN
THE CITY OF LOS ANGELES
AND
CAL STATE LA UNIVERSITY AUXILIARY SERVICES, INC. (UAS)

Regarding: Predicting What We Breathe Project

Agreement Number: C-138405

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**RESTATED AND SUPPLEMENTAL AGREEMENT BETWEEN
THE CITY OF LOS ANGELES
AND
CAL STATE LA UNIVERSITY AUXILIARY SERVICES, INC. (UAS)
FOR PREDICTING WHAT WE BREATHE AIR QUALITY PROJECT**

THIS AGREEMENT is made and entered into by and between the City of Los Angeles, a municipal corporation (hereinafter referred as the “City”) , acting by and through its Bureau of Street Lighting (“BSL”), and Cal State LA University Auxiliary Services, Inc., a non-profit corporation under the laws of the State of California (hereinafter referred as the “UAS” or “Contractor”), located on the campus of California State University, Los Angeles (hereinafter referred as the “University”).

RECITALS

WHEREAS, the City proposes to gather satellite and ground level data, and use predictive analytics and machine learning to complete extensive air quality research on the effectiveness of the City’s air quality interventions, from tree planting to policy changes, and provide a platform for sharing data and successful City solutions with other global cities; and

WHEREAS, the City will complete this air quality research through a grant from NASA which will aid to inform the City’s Resilient LA and Sustainability plans on improving air quality by taking steps to reduce air pollution; and

WHEREAS, the BSL accepted a grant from NASA and designated the BSL as the administrative and fiscal agent for the grant to facilitate receipt and disbursement of grant funds, track and report matching funds, as well as reimburse the City for any grant-related expenditures.

WHEREAS, the grant requires the City to partner with an academic institution; and

WHEREAS, the Contractor has provided data analytics and machine learning expertise through other grant work and as a partner in the City’s Data Science Federation; and

WHEREAS, the Contractor possesses the data science technical skill, knowledge, and expertise to apply machine learning to the City’s large data sets and the various NASA data sets, and develop algorithms that provide predictive analytics and historical assessments of past interventions; and

WHEREAS, the Contractor has completed the first phase of the Predicting What We Breathe (“PWVB”) project successfully, developing an air quality prediction algorithm that has been shared with NASA and sister cities around the world, with the research providing preliminary results; and

WHEREAS, the Contractor has represented that it is willing and able to provide the needed goods and services under the Agreement and City wishes to retain Contractor to provide those goods and services; and

WHEREAS, the parties entered into an Agreement (Contract # C-138405) in June 2021, pursuant to which the Contractor agreed to perform the work and furnish the services as described herein for consideration and upon the terms and conditions as hereinafter provided; and

WHEREAS, the City received an additional grant from NASA to continue this project and build on the success of using satellite and ground-based data, along with predictive analytics and machine learning for the air quality research, with the addition of creating a digital twin model of the City of L.A. to understand the intersection of health issues, with a focus on air quality, and transportation, particularly the new operational planning for urban air mobility; and

WHEREAS, City and Contractor now wish to: (1) extend the term of the Agreement for an additional one-year and seven months, to expire on Dec 31, 2024, (2) to increase the compensation by \$86,000, and (3) make other changes deemed necessary by the Parties; and

WHEREAS, the services required are of an expert and technical nature and are temporary and occasional in character; therefore, competitive bidding under Charter Section 371 is neither practicable nor advantageous, nor compatible with the City's interests; and

NOW THEREFORE, in consideration of the above promises and of the terms, covenants and considerations set forth herein, the parties do agree as follows:

1.0 PARTIES TO THE AGREEMENT AND REPRESENTATIVES

1.1 Parties to the Agreement

The parties to this Agreement are:

- a. City – The City of Los Angeles, a municipal corporation, acting by and through the Bureau of Street Lighting, having its principal office at 1149 South Broadway, #200, Los Angeles, California 90015.
- b. Contractor – Cal State LA University Auxiliary Services, Inc., a non-profit corporation and Sponsored Program Administrator for California State University, Los Angeles, with a business address at 5151 State University Drive, GE 314, Los Angeles, CA 90032.

1.2 Representatives to the Agreement

The representatives of the parties who are authorized to administer this Agreement to whom formal notices, demands, and communications will be given are as follows:

- a. The City's representative is, unless otherwise stated in the Agreement:

Matthew Hale, Deputy Mayor
City of Los Angeles
Mayor's Office of Finance & Innovation
200 North Spring Street
Los Angeles, CA 90012

with cc to:

Dawn Comer, Executive Offer
 City of Los Angeles
 Mayor's Office of Finance & Innovation
 200 North Spring Street
 Los Angeles, CA 90012

With copies to:

Bureau of Street Lighting Contract Administration
 1149 S Broadway #200
 Los Angeles, CA 90015
 Attention: Megan Hackney

- b. The Contractor's representative is, unless otherwise stated in the Agreement:

Raul Castaneda, Interim Executive Director
 Cal State LA University Auxiliary Services, Inc.
 5151 State University Drive, GE 314
 Los Angeles, CA 90032

1.3 Formal Notices

Formal notices, demands, and communications to be given hereunder by either party must be made in writing and may be effected by personal delivery or by registered or certified mail, postage prepaid, return receipt requested and will be deemed communicated as of the date of mailing.

1.4 Notices of Change

If the name of the person designated to receive the notices, demands or communications or the address of such person is changed, written notice will be given in accordance with this Section, within five (5) business days of said change.

1.5 Conditions Precedent

- a. **Insurance Requirements.** The Contractor shall comply at all times with all of the insurance requirements set forth in the Standard Provision for City Contracts (Rev. 9/22)[v.1], attached hereto and incorporated by reference.
- b. **Changes to Documentation.** Changes to the foregoing documents affecting the performance of the Contractor under this Agreement shall receive City approval in writing before the Contractor may affect the change.
- c. **Agreement Assignment.** This Agreement is not to be assigned to a substitute contractor, a successor in interest, or a purchaser of the Agreement without express permission of the City. If the City does not approve or grant permission for a subsequent contractor to assume the services outlined in this contract, then the Agreement will be terminated.

2.0 TERM OF AGREEMENT

The term of Agreement shall commence on May 18, 2020, and shall end on Dec 31, 2024. Said term is subject to the termination provisions contained in this Agreement.

3.0 SERVICES TO BE PROVIDED

- 3.1 As referenced in Exhibit 1, “Scope of Work”, which is attached hereto and incorporated by reference, the Contractor will work with City and non-City Air Quality stakeholders noted in Sections 2.1 (Ground AQ Sensor Data) and 2.3 (NASA Mission data) of the PWVB proposal to collect, cleanse and analyze the data collected.
- 3.2 The Contractor will develop machine learning algorithms for identifying and monitoring air quality trends, as well as predicting air quality patterns, using satellite and ground level data and leveraging other data sets to measure mode shift and other changes in air quality patterns.
- 3.3 The Contractor will select the cloud computational environment.
- 3.4 The Contractor will work with the City to showcase the project at scheduled air quality convenings (local and global) from 2020 - 2024.
- 3.5 The Contractor will make algorithms and cleansed datasets accessible via GitHub and/or other agreed upon open-source tools
- 3.6 The Contractor will produce quarterly technical, mid-year interim and annual reports during the duration of the project.
- 3.7 The Contractor will provide expenditure reports and invoicing during the duration of the project.
- 3.8 The Contractor will synthesize research, outcomes, and key findings into annual reports during each project year.
- 3.9 The Contractor shall provide the data analysis and services based on the schedule noted below:

Task #	Tasks	Start	Duration
Task 3.1	Identify, develop, confirm data models	Third quarter 2020	Through first quarter 2022
Task 3.2	Select data architecture	Fourth quarter 2020	Through fourth quarter 2020
Task 3.3	Initialize computational space	Fourth quarter 2020	Through fourth quarter 2021
Task 3.4	Migrate data to platform	Fourth quarter 2020	Through fourth quarter 2021
Task 3.5	Data cleansing and preprocessing	Fourth quarter 2020	Through fourth quarter 2020
Task 3.6	Develop machine learning	Fourth quarter 2020	Through first quarter 2022

	algorithm		
Task 3.7	Conduct training runs	First quarter 2021	Through fourth quarter 2022
Task 3.8	Validate algorithm	Second quarter 2021	Through first quarter 2024
Task 3.9	Final machine learning model refinement	Fourth quarter 2021	Through third quarter 2024
Task 3.10	End-to-end system integration and test	Fourth quarter 2021	Through fourth quarter 2024
Task 3.11	Complete Financial Reporting (per reporting requirements)	Third quarter 2020	Through fourth quarter 2024
Task 3.12	Complete Quarterly Technical report	Third quarter 2020	Through third quarter 2024
Task 3.13	Mid-Year Interim Report	Fourth quarter 2020	Through second quarter 2024
Task 3.14	Annual Report	Second quarter 2021	Through fourth quarter 2024

4.0 COMPENSATION AND METHOD OF PAYMENT

4.1 Compensation

The City shall pay the Contractor for the satisfactory performance of the terms and conditions of this Agreement a total amount not to exceed \$519,593.00, payable per 2 CFR 200.201, according to completion of the milestones in the table below. This grant allows for 8% Facilities and Administrative Costs. This is inclusive of any required lab space.

Timeframe	Estimated Amount	Task
May 18, 2020 - May 18, 2023	\$433,593.00	Phase I deliverables (Tasks 3.1 - 3.7)
May 2023 - November 2023	\$35,368.42	Data identification and pre-processing
December 2023 - May 2024	\$25,315.79	Set up data visualization and design preliminary model for digital twin
June 2024 - December 2024	\$25,315.79	Complete data visualization to include air quality data, City of LA environmental and publicly available transportation data (land and air)
Total	\$519,593.00	

4.2 Method of Payment

Invoices

The City shall pay the Contractor in accordance with Section 4.1 and the conditions and provisions of this Section after receipt and approval of the Contractor's invoices by the City. To ensure that services provided under personal services contracts are measured against services as detailed in the contract, the Controller of the City of Los Angeles has developed a policy requiring that specific supporting documentation be submitted with invoices.

Billing & Invoicing Requirements

The Contractor is required to submit invoices that conform to City standards and include, at a minimum, the following information:

1. Name and address of Contractor
2. Name and address of City department being billed
3. Date of invoice and period covered
4. Contract number
5. Description of completed task and amount due per milestone payments:
 - a. Name of personnel working on tasks
 - b. Description of completed task(s) associated with the project milestone payments
6. Certification by Contractor
7. Discount and terms (if applicable)
8. Remittance Address (if different from company address)

All invoices shall be submitted on Contractor's letterhead, contain Contractor's official logo, or other unique and identifying information such as the name and address of the contractor.

Evidence that tasks have been completed, in the form of a report, brochure, or photograph, shall be attached to all invoices. Invoices shall be submitted within per quarterly, bi-annual and annual review schedule aligned to the NASA reporting milestones, and shall be payable to the Contractor no later than 30 days after City approval of a complete invoice. Invoices are considered complete when appropriate documentation or services are signed off as satisfactory by the City's Contract Manager.

Invoices and supporting documentation shall be prepared at the sole expense and responsibility of the Contractor. The City will not compensate the Contractor for costs incurred in invoice preparation, and grant funds made available pursuant to this Agreement shall not be used for the preparation of invoices and supporting documents.

The City may request, in writing, changes to the content and format of the invoice and supporting documentation at any time. The City reserves the right to request additional supporting documentation to substantiate at any time. Failure to adhere to these policies may result in nonpayment or non-approval of demands, pursuant to Charter 262(a), which requires the Controller to inspect the quality, quantity, and condition of services, labor, materials, supplies, or equipment received by any City office or department, and approve demands before they are drawn on the Treasury.

The Contractor understands that the City makes no commitment to fund this Agreement beyond the terms set herein.

Invoices must be e-mailed to:

Megan Hackney
Bureau of Street Lighting
City of Los Angeles
1149 S Broadway #200
Los Angeles, California 90015
megan.hackney@lacity.org

5.0 OWNERSHIP AND INTELLECTUAL PROPERTY RIGHTS

5.1 Intellectual Property Warranty

The Contractor represents and warrants that its performance of all obligations under this Agreement does not infringe in any way, directly or indirectly, upon any third party's intellectual property rights, including, without limitation, patents, copyrights, trademarks, trade secrets, and rights of publicity.

5.2 Ownership of Collected Data

The Parties agree that Contractor has no ownership of, and acquires no rights in the data collected pursuant to this Agreement. As between the Parties, City retains all right of ownership, title, and interest in and to City data, including all intellectual property rights therein.

5.3 Survival of Provisions

The provisions of this Section shall survive expiration or termination of this Agreement. Further, the rights and remedies are cumulative of those provided for elsewhere in this Agreement and those allowed under the laws of the United State, the State of California, and the City of Los Angeles.

6.0 CONFIDENTIALITY OF INFORMATION

Information, documents, records, software programs, and data furnished to the Contractor by the City and other documents to which the Contractor has access during the term of this Agreement are confidential information (hereinafter referred to as “Confidential Information”). The Contractor may not disclose Confidential Information in any manner without the prior written consent of the City.

7.0 AMENDMENTS

Any change in the terms of this Agreement must be incorporated into this Agreement by a written amendment properly executed and signed by the person authorized to bind the parties thereto.

8.0 RATIFICATION

Due to the need for the Contractor’s services to be provided expeditiously, Contractor may have provided services prior to the execution of this Agreement. To the extent that Contractor’s services were performed in accordance with the terms and conditions of this Agreement, those services are hereby ratified.

9.0 STANDARD PROVISIONS

9.1 Standard Provisions for City Contracts

The Contractor shall comply with the applicable requirements of the Standard Provisions for City Contracts (Rev. 9/22)[v.1], attached hereto as Appendix A and incorporated herein by this reference.

9.2 Disclosure of Border Wall Contracting Ordinance

The CONTRACTOR shall comply with Los Angeles Administrative Code Section 10.50 et seq., 'Disclosure of Border Wall Contracting.' CITY may terminate this AGREEMENT at any time if CITY determines that CONTRACTOR failed to fully and accurately complete the required affidavit and disclose all Border Wall Bids and Border Wall Contracts, as defined in LAAC Section 10.50.1.

10.0 ENTIRE AGREEMENT

- a. This AGREEMENT integrates all the terms and conditions mentioned herein or incidental hereto, and supersedes all negotiations or previous agreements between the parties with respect to the performance of the services under this AGREEMENT.
- b. No oral agreement or conversation with any officer or employee of either party shall affect or modify any of the terms and conditions contained in this AGREEMENT.

c. This AGREEMENT may be executed in one (1) or more counterpart(s), and by the parties in separate counterparts, each of which when executed shall be deemed to be an original but all of which taken together shall constitute one and the same AGREEMENT. The parties further agree that facsimile signatures, or signatures scanned into portable document format (PDF) or another electronic format designated by CITY and sent by e-mail, shall be deemed original signatures.

d. In the event of any inconsistency between the provisions contained in the body of this AGREEMENT and the exhibits attached hereto, the inconsistency shall be resolved by giving precedence in the following order: 1) the provisions contained in the body of this AGREEMENT; 2) Exhibit 1, "Scope of Work"; and 3) Attachment A, "Standard Provisions for City Contracts (Rev. 9.22) [v.1]."

(Signature Page to Follow)

IN WITNESS THEREOF, the parties hereto have caused this Agreement to be executed by their respective duly authorized representatives.

CITY OF LOS ANGELES, by and through its
Department of Public Works
Bureau of Street Lighting

Cal State LA University
Auxiliary Services, Inc., a non-profit
corporation*

By signing below, the signatory attests
that they have no personal, financial,
beneficial, or familial interest in this contract.

By: _____

AURA GARCIA
President
Board of Public Works

By: _____

RAUL CASTANEDA
Interim Executive Director
Cal State LA University Auxiliary
Services, Inc.

Date: _____

Date: _____

By:  _____

MIGUEL SANGALANG
Executive Director
Public Works Street Lighting

Date: 06/07/2024

APPROVED AS TO FORM:

HYDEE FELDSTEIN SOTO
City Attorney

By: _____
TANEA YSAGUIRRE
Deputy City Attorney

Date: _____

ATTEST:

HOLLY L. WOLCOTT
City Clerk

By: _____
Deputy City Clerk

Date: _____

* Approved signature methods for corporations:

- 1) Two signatures: One of the Chairman of the Board of Directors, President, or Vice-President, and one of the Secretary, Assistant Secretary, Chief Financial Officer, or Assistant Treasurer, or
- 2) One signature of a Corporate-designated individual together with a properly attested resolution of the Board of Directors authorizing the individual to sign.

EXHIBIT 1: Scope of Work

Scope of Work: Predicting What We Breathe Project

City of Los Angeles Bureau of Street Lighting California
State University, Los Angeles

Background

The City of Los Angeles is in a unique situation to be an urban proving ground to look at how to better understand, predict, and mitigate the issues of air pollution for 4 million citizens. The Predicting What We Breathe (PWVB) project has taken time-series measurements of satellite and ground data and applied machine learning to uncover patterns that may not be discernible to human analysts. Enhancing human understanding and prediction of air quality has resulted in a tool that helps inform local governments and others on appropriate measurements, analytics, predictive algorithms and mitigation strategies that are useful for dealing with air quality variability.

The City, in partnership with California State University Los Angeles and OpenAQ, has built and validated a highly accurate predictive algorithm which forecasts air quality as well as identifies the attributes that exacerbate air quality. This work is directly aligned to two key areas in NASA's Advanced Information Systems Technology (AIST) program for (1) increasing the accessibility and use of Earth / Space science data, to provide more usability to cities and (2) for the improvement of human health outcomes. The tool has been shared with cities around the world, and the project also worked with impacted

communities and youth to empower them to engage on air quality. By applying machine learning to satellite and ground data, the project has been able to immediately help inform the City of L.A. as well as other cities on appropriate measurements, analytics, predictive algorithms, and mitigation strategies that are useful for dealing with air quality variability.

Fundamentally, achieving the City's sustainability and resilience goals will require the deployment of specific interventions in neighborhoods where the impact is highest. The NASA Earth science data and the City's dense sensor data made available through this program have helped the City promote data-driven decision making to track how specific interventions impact health outcomes over time.

This project matures NASA's Strategic Goal to advance Earth system science to meet the challenges of climate and environmental change by creating perhaps the largest in-situ urban prototype laboratory used to date. The lessons learned and technologies used here will further the use of Earth system science research to inform decisions and provide benefits to society.

Project Plan

The objective of this project is to increase the accessibility and use of space data by using machine learning to help cities predict air quality in ways that can be acted upon to improve human health outcomes and provide better data to individuals and cities. Secondly, the goal is to provide these tools and algorithms to future Earth science missions (e.g., MAIA) to provide rapid ground truth, combine multiple data sources, and support more rapid use of mission data.

This project is focused on maturing the technologies involved in:

- Developing machine learning algorithms for predictive models for air quality based on PM2.5 and other air pollutants
- Building a big data analytics algorithm for integrating ground and space data
- Providing predictive models for health risk using deep learning and machine learning
- Building an open source PM2.5 stack for integrating ground and space data
- Creating a model for cities with shared attributes to understand predictions and effective interventions

This work contributes to the state of knowledge in several specific ways:

- The application of machine learning models has allowed for the processing of big data with complexity of velocity, veracity, and volume in a human understandable way and at actionable speed
- The set of infusion partners gathered provides actions that have the potential to demonstrably improve human health and outcomes, as well as commercialization of the technology
- Combining in-situ ground data and satellite data with machine learning has allowed us to create wide areas of ground truth and fidelity. This has implications for providing ground to orbital measurements and validation of flight hardware against ground truth.

Project Tasks and Timeline
Year 1 & Year 2

Task	May 2020	Jun	Jul	Aug	Sept	Oct	Nov	Dec	Jan 2021	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec	Jan 2022	Feb	Mar	Apr	Task Owner
Initiate team space	X																								City
Data Identification/Refresh		X	X	X	X								X												OpenAQ, City
Identify/confirm models (ESIP)			X	X									X							X					CSULA, ESIP
Select data architecture				X																					CSULA
Initialize computational space					X																				CSULA
Migrate data to platform						X																			CSULA
Data cleaning, preprocessing				X	X																				CSULA
Develop machine learning algorithm				X	X	X	X	X	X																CSULA
Identify City interventions				X	X	X	X										X	X	X	X	X	X			City
Validate megacities attributes and recruit cities						X	X	X						X	X	X							X		City
Conduct training runs								X	X	X				X	X	X									CSULA
Conduct pre- and post-intervention analysis								X	X								X	X	X	X	X	X	X		City
Create data visualizations								X									X								City
Validate algorithm										X	X	X					X	X	X						CSULA
Final ML model refinement																		X	X	X	X	X			CSULA

Traffic Data Interpolation and Expansion for the city area	X	X	X	X										CSULA
Real-time Transportation Data generation		X	X	X	X									CSULA, AI Agora
Real-time Transportation Data projection to Air Pollution and greenhouse gasses		X	X	X	X	X	X	X						CSULA, AI Agora
Visualizations and framework/model implementations		X	X	X	X	X	X	X	X	X	X			AI Agora
Digital Twin Model: Understanding the impact of Transportation on AQ in real-time				X	X	X	X	X	X	X				CSULA, AI Agora, City
Digital Twin Model: Understanding the impact of Transportation on AQ and Health								X	X	X	X	X		City, CSULA, AI Agora
Validate the Digital Twin Models											X	X	X	CSULA, CITY
Final model refinement											X	X	X	AI Agora
Publish the results												X	X	CSULA, CITY
Final Report													X	All
AIST reporting														
ESTO Science Forum	X													City
Quarterly Technical Report		X			X			X			X			All
Mid-Year Interim Report					X						X			All
Annual Report									X					All