



REPORT TO CONGRESS

NOAA'S ANNUAL REPORT TO CONGRESS ON THE USE OF OTHER TRANSACTION AUTHORITY FOR FISCAL YEAR 2022

Developed pursuant to: National Integrated Drought Information System Reauthorization Act of 2018 (Public Law 115-423) and S. 2981 (National Oceanic and Atmospheric Administration Commissioned Officer Corps Amendments Act of 2020 (Public Law 116-259))

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THE NATIONAL INTEGRATED DROUGHT INFORMATION SYSTEM
REAUTHORIZATION ACT OF 2018 (PUBLIC LAW 115-423) INCLUDED THE
FOLLOWING LANGUAGE

(1) IN GENERAL.—Not later than 90 days after September 30 of each fiscal year through September 30, 2023, the Under Secretary shall submit to the Committee on Commerce, Science, and Transportation of the Senate and the Committee on Science, Space, and Technology of the House of Representatives a report on the use of additional transaction authority by the National Oceanic and Atmospheric Administration during the previous fiscal year.

(2) CONTENTS.—Each report shall include—

(A) for each transaction agreement in effect during the fiscal year covered by the report—

(i) an indication of whether the transaction agreement is a reimbursable, non-reimbursable, or funded agreement;

(ii) a description of—

(I) the subject and terms;

(II) the parties;

(III) the responsible National Oceanic and Atmospheric Administration line office;

(IV) the value;

(V) the extent of the cost sharing among Federal Government and non-Federal sources;

(VI) the duration or schedule; and

(VII) all milestones;

(iii) an indication of whether the transaction agreement was renewed during the previous fiscal year;

(iv) the technology areas in which research projects were conducted under that agreement;

(v) the extent to which the use of that agreement—

(I) has contributed to a broadening of the technology and industrial base available for meeting National Oceanic and Atmospheric Administration needs; and

(II) has fostered within the technology and industrial base new relationships and practices that support the United States; and

(vi) the total value received by the Federal Government under that agreement for that fiscal year; and

(B) a list of all anticipated reimbursable, nonreimbursable, and funded transaction agreements for the upcoming fiscal year

THIS REPORT RESPONDS TO THE COMMITTEES' REQUEST.

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I. EXECUTIVE SUMMARY

As part of the National Drought Information System Reauthorization Act of 2018 (Public Law 115-423) and as amended by the National Oceanic and Atmospheric Administration (NOAA) Commissioned Officer Corps Amendments Act of 2020 (Public Law 116-259), Congress provided NOAA authorization to use Other Transaction Authority (OTA) agreements. OTA enables NOAA to partner with commercial, academic, and non-profit organizations to enhance the effectiveness of its data, satellites, and observing systems. In September 2020, NOAA entered into an OTA agreement (parent agreement) with Google to explore the benefits of artificial intelligence (AI) and machine learning (ML) to enhance weather prediction and environmental monitoring and issued an initial Official Funding Order (OFO) from October 2020 to March 2022 with the possibility of extension. The 3-year parent agreement under the OTA provides a cost-sharing arrangement between Google and NOAA. This report includes an updated status of the continuing agreement between NOAA and Google – and is based on the Fiscal Year (FY) 2021 NOAA OTA report delivered to Congress in December 2021. FY 2022 outcomes for NOAA were seen in areas of: employee training, data infrastructure, data assimilation, and post-processing.

II. OVERVIEW

In September 2020, NOAA’s National Environmental, Satellite, Data, and Information Service (NESDIS) entered into an OTA 3-year agreement with Google to explore the benefits of AI and ML. Under the agreement, Google, NOAA, and NOAA affiliates work collaboratively to jointly develop software leveraging AI/ML for improved use of satellite data for new applications for weather forecasting improvement, research, and innovation. If realized, the end goal of this OTA is to produce an AI-based system that fully utilizes NOAA’s large and diverse environmental data sets to advance weather prediction and environmental monitoring for society as a whole. The OTA was designed to be executed in three phases:

- Phase 1 – Planning phase: Collaborative sessions between NESDIS and Google to jointly determine which projects will be executed (October 2020 – January 2021)
- Phase 2 – Execution of Projects: Joint NESDIS and Google teams’ execution of phase 1 projects (February 2021 – September 2023)
- Phase 3 – Prototyping: Demonstrate operability if Phase 2 projects yield positive results (TBD)

Phase 1 has been executed and Phase 2 is nearing completion. Section VII of this report provides additional information regarding future plans and opportunities to extend the OTA.

III. TERMS OF AGREEMENT

The intent of the agreement is for both parties (NESDIS and Google) to jointly develop and deliver software. Both parties agree to waive potential copyright in such Jointly Developed Software worldwide through the Creative Commons Zero (CC0) 1.0 Universal Public Domain Dedication.

IV. BENEFITS AND GOALS

The OTA provides the following benefits to NESDIS:

- NESDIS will gain direct exposure and training from Google AI/ML subject matter experts that will enable NOAA personnel to apply those tools and techniques across the organization on additional AI/ML efforts.
- The OTA may produce usable open source code that NOAA and partners (e.g., international, weather enterprise, research scientists) have unlimited use of for applications that may enhance how NOAA executes its scientific research and address challenges with big data in “nowcasting” and numerical weather prediction.
- The OTA directly aligns with NESDIS strategic objectives to develop agile, scalable satellite capabilities for ingesting data from new sources (e.g., partner and commercial data) and providing new service deliverables (e.g., products).

The OTA directly aligns with the [NOAA Artificial Intelligence Strategy](#) goals to advance AI research and innovation (Goal 2) and strengthen and expand AI partnerships (Goal 4).

NESDIS and Google jointly developed a set of overarching goals to drive project planning and execution activities:

- Combine AI and physics to improve forecast skills (including global model, hurricanes, storms, etc.)
- Use AI to increase the rate of data assimilation in NOAA models from 3% (current) to 30%
- Use AI to increase spatial resolution of forecast models (for example from county level to block level)
- Use AI to generate added-value information for society (help with drought, fire, flood, coastal human activity, etc.)
- Use AI to help ingest crowd-source and citizens’ data to improve forecast skills

V. COSTS

The 3-year agreement under the OTA provides a cost-sharing arrangement between Google and NESDIS. Each Funding Order issued under the OTA is negotiated individually based on the nature of work and will comply with the overarching cost sharing arrangement. The agreement itself does not obligate funds but sets an OTA maximum ceiling amount of \$23,628,318 for combined NESDIS and Google contributions. Of the initial Funding Order ceiling, the agreed upon commitment of dollars is outlined in the table below.

	Dollars Committed for FY 2020, 2021*	Funds to Google**	
		FY 2020	FY 2021
Google	\$10,482,000		
NOAA	\$5,059,318	\$1,271,000	\$374,000
Total	\$15,541,318		

* Includes Google and NESDIS labor

** Does not include labor or AGO fees. FY 2020 and FY 2021 reflect actual obligations to Google.

The first Funding Order of the OTA was originally projected to last 12 months (September 25, 2020 – September 24, 2021), and was extended for six months (September 2021 – March 2022).

Of the second Funding Order ceiling, the agreed upon commitment of dollars is outlined in the table below.

	Dollars Committed for FY 2022*	Funds to Google**	
		FY 2022	
Google	\$5,290,000		
NOAA	\$2,797,000		\$800,000
Total	\$8,087,000		

* Includes Google and NESDIS labor

** Does not include labor or AGO fees. FY 2022 reflects actual obligations to Google.

The second Funding Order was originally projected to last approximately 9.5 months (April 8, 2022 – January 25, 2023), and has been extended to September 30, 2023. The total ceiling may increase at a later date if both parties agree to other projects and/or to pursue developing a prototype.

VI. OUTCOMES IN FISCAL YEAR 2022

Notable outcomes are broken down into four areas: Training; Data & Infrastructure; Data Assimilation; and Post-Processing.

- Training: The NOAA workforce continued to receive extensive training on the Google Cloud Platform (GCP), focused on cloud utilization for data processing, AI algorithm training, and AI algorithm output validation. The training serves as a foundation to enable future exploitation of AI/ML technologies independently of vendor/commercial support.
- Data Assimilation: Established an AI-based system, known as the Large-scale Enhancement for AI Processing (LEAP), to assimilate satellite data: a) ported prototype AI-based data assimilation system (LEAP-DA) to GCP, and trained new ML algorithms that combine satellite observations with model forecasts to

produce geophysical analyses; b) developed an evaluation pipeline for rapid assessment of ML models that assimilate simulated single-sensor and produce multiple geophysical analyses. Expanded the machine learning data assimilation (ML DA) model to assimilate simulated observational data from multiple satellite and conventional sources, and transitioned the ML DA model to real data - with results consistent with simulated data. These outcomes and accomplishments serve as a foundation that could maximize the return on investment of our Nation's environmental satellite assets and improve numerical weather prediction analyses and forecasts.

- Drafted manuscript “A Machine Learning Outlook: Post-processing of Global Medium-range forecasts” (Journal submission imminent)

VII. UPCOMING FISCAL YEAR 2023 PLANS

NESDIS will continue supporting these Google-NOAA OTA activities with the ultimate goal to build upon existing outcomes and build a prototype AI-based system in the cloud that can then be used to execute a large-scale run with comparison of impacts against existing on-premise systems.

If any additional OTAs are put into place during or beyond FY 2023, NOAA will make the agreements available on a public web-site in lieu of the NOAA's Annual Report to Congress on OTAs.

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