

## **REPORT TO CONGRESS**

# GEOSTATIONARY EXTENDED OBSERVATIONS (GEOXO): DETERMINATION OF READINESS

Developed pursuant to: 33 U.S.C. § 878a(b) – Major Program Report for Satellite Development Program

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## MAJOR PROGRAM REPORT FOR SATELLITE DEVELOPMENT PROGRAM, 33 U.S.C. § 878a(b), STATES AS FOLLOWS:

- (1) NOAA shall not enter into a contract for development of a major program, unless the Under Secretary determines that—
  - (A) The technical, cost, and schedule risks of the program are clearly identified and the program has developed a plan to manage those risks;
  - (B) The technologies required for the program have been demonstrated in a relevant laboratory or test environment;
  - (C) The program complies with all relevant policies, regulations, and directives of NOAA and the Department of Commerce;
  - (D) The program has demonstrated a high likelihood of accomplishing its intended goals; and
  - (E) The acquisition of satellites for use in the program represents a good value to accomplishing NOAA's mission.
- (2) The Under Secretary shall transmit a report describing the basis for the determination required under paragraph (1) to the appropriate congressional committees at least 30 days before entering into a contract for development under a major program.
- (3) The Under Secretary may not delegate the determination requirement under this subsection, except in cases in which the Under Secretary has a conflict of interest.

THIS REPORT RESPONDS TO THE COMMITTEE'S REQUEST.

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#### I. EXECUTIVE SUMMARY

33 U.S.C. § 878a(b) requires the Under Secretary of Commerce for Oceans and Atmosphere to notify Congress on the readiness of any major program with a total life cycle cost greater than \$250 million prior to entering into contracts for development.

The Under Secretary of Commerce for Oceans and Atmosphere determined the Geostationary Extended Observations (GeoXO) program is ready to begin development activities with the National Aeronautics and Space Administration (NASA) through an Inter-Agency Agreement (IAA) and award prime development contracts for imagers, lightning mappers, sounders, atmospheric composition, and ocean color instruments; the spacecraft to host those instruments; and the associated ground services. This report documents the GeoXO program's readiness based on the satisfaction of the following criteria:

- A. Identification and management of technical, cost, and schedule risks;
- B. Demonstration of all required technologies in a relevant laboratory or test environment;
- C. Compliance with all relevant policies, regulations, and directives of NOAA and the Department of Commerce (DOC);
- D. High likelihood of accomplishing its intended goals; and
- E. Represents good value to accomplishing NOAA's mission.

#### II. PROGRAM DESCRIPTION

The National Oceanic and Atmospheric Administration's (NOAA) geostationary satellites provide the only continuous observation of weather and hazardous environmental conditions over the Western Hemisphere, protecting the lives and property of the one billion people who live and work in the Americas. The GeoXO program comprises the next generation geostationary Earth orbit observing capabilities to support the DOC Primary Mission Essential Functions (PMEF) and NOAA strategic objectives associated with terrestrial weather prediction and warning, climate adaptation and mitigation, and healthy oceans and resilient coastal communities and economies. As the latest in a multi-generational series of geostationary satellites that began in 1975, GeoXO is the follow-on to the Geostationary Operational Environmental Satellite-R (GOES-R) Series program. As with the GOES-R Series, GeoXO will be implemented jointly by NOAA and NASA. GeoXO will continue and improve the GOES-R Series observations for weather forecasting and will extend observations to include ocean, coasts, and atmospheric monitoring. The projected loss of the GOES-R Series on-orbit spare necessitates the first GeoXO satellite to be launched in 2032. The GeoXO system is planned to observe through 2055.

The GeoXO program includes satellites that host Earth-observing instruments and a Data Collection System (DCS) signal relay capability. The program scope also includes the ground segment command and control, data processing and distribution. The ground capabilities will be implemented through an architecture of program-developed, mission unique capabilities and the use of National Environmental Satellite Data and Information Service (NESDIS)-developed enterprise ground system capabilities. Program scope also includes operations, maintenance, and sustainment over the program operational lifetime.

The planned GeoXO instrument capabilities are shown in Table 1.

**Table 1: GeoXO Instruments** 

Instrument	Mission Needs Served
Imager (GXI)	Short-range forecasting, severe weather watches
	and warnings, and monitoring hazardous
	environmental conditions such fires, smoke,
	flooding, fog, snow, ice, and volcanic ash
Lightning Mapper (LMX)	Storm warning and nowcasting
Hyperspectral InfraRed (IR) Sounder (GXS)	Improved numerical weather prediction and local
	nowcasting
Atmospheric Composition Instrument (ACX)	Monitoring air quality and linkage with weather and
	climate
Ocean Color Instrument (OCX)	Monitoring dynamic coast/ocean features,
	ecosystem change, water quality, and hazards

GXI and LMX will continue and enhance the legacy imaging and lightning mapping capabilities that primarily support NOAA's Weather Mission Service Area. GXS, ACX, and OCX are new instrument capabilities that will extend the contributions of the geostationary satellite observations to all of NOAA's Mission Service Areas (Weather, Climate, Oceans, and Coasts).

The GeoXO flight architecture consists of identical East and West satellites, each manifesting an Imager, Lightning Mapper, and Ocean Color instrument, plus a Center satellite carrying a Hyperspectral Infrared Sounder and Atmospheric Composition instrument. The Center satellite can accommodate a third Earth-observing instrument, which is expected to be provided by a partner agency. The East and West satellites also host a DCS signal relay capability. The GeoXO ground architecture consists of program-provided satellite operations and communication systems, NOAA National Environmental Satellite, Data, and Information Service (NESDIS)-developed product generation and distribution systems, and commercial data relay services. The GeoXO system architecture is shown in Figure 1.

The GeoXO program successfully completed the Mission Concept Review on June 7-10, 2021, Key Decision Point A on July 21, 2021, the DOC Milestone 1 (MS1) on October 22, 2021, and the DOC Milestone 2/3 (MS2/3) on December 14, 2022. The Deputy Secretary of Commerce signed the MS2/3 milestone decision memorandum (MDM), included as Appendix B, on December 14, 2022, formally transitioning the GeoXO program from the Definition to the Project Development and Execution Phase.

**GeoS-Central** Vis/IR Imager (GXI) IR Sounder (GXS) Vis/IR Imager (GXI) Ocean Color (OCX) Atmospheric Composition (ACX) Ocean Color (OCX) Lightning Mapper (LMX) Partner Payload Lightning Mapper (LMX) 75W 137W 105W Fairmont WV Facility (N d and Data

Figure 1: GeoXO Architecture

#### III. READINESS CRITERIA

#### A. Technical, Cost, and Schedule Risk Management

The GeoXO program has established a risk management process, as documented in the GeoXO Risk Management Plan (RMP), 410-XO-PLN-0006. The RMP is consistent with the risk management policies and guidelines derived from ISO 17666, "Space Systems – Risk Management"; NASA Procedural Requirement (NPR) 7120.5F, "NASA Space Flight Program and Project Management Requirements"; and NPR 8000.4B, "Agency Risk Management Procedural Requirements."

#### 1. Technical Risk

No technical risk impedes the procurement of the spacecraft, instruments, and ground services. This determination is based on the heritage that the GeoXO system shares with previous NOAA and NASA missions as well as multiple recent studies of instruments, mission architectures, and data distribution systems. These studies drew upon industry expertise through Broad Agency Announcement (BAA) studies, formal Requests for Information (RFI), and Phase A studies. Studies and analyses by the Goddard Space Flight Center's (GSFC)

Mission Design Lab (MDL), The Aerospace Corporation, MIT/Lincoln Laboratories, and the NOAA/NASA GeoXO team support this determination.

The GeoXO instrument development will benefit from prior investments made by NOAA and NASA. The GeoXO Imager and Lightning Mapper share significant heritage with the GOES-R Series versions of these instruments. The Atmospheric Composition and Ocean Color instruments are expected to share heritage with the NASA Earth Venture instruments TEMPO and GLIMR, reducing their development risk. The Sounder instrument builds on designs and technology developed for both U.S. and international missions, in both geostationary and low Earth orbit, and based on information from the Phase A studies, many Sounder components are expected to share design commonality with the other GeoXO instruments. The GeoXO spacecraft are also expected to share significant heritage with the GOES-R Series spacecraft.

The BAA studies were performed in 2019, with both Imager and Sounder studies performed each by five experienced instrument development contractors. RFIs were employed to gain a thorough understanding of the competitive field and inform subsequent Requests for Proposals. Phase A studies have been awarded and are underway on all GeoXO instruments, increasing confidence in the design concept and manufacturability. GSFC's Mission Design Laboratory was used to assess alternative mission architectures, including an assessment of disaggregation. The Aerospace and MIT/LL efforts examined instrument concepts to identify design and cost drivers. The GeoXO program studies examined constellation options to optimize the space architecture to meet the defined observing needs and reduce development risk.

These efforts have led to the conclusion that industry instrument and spacecraft design concepts use mature technologies (i.e., Technology Readiness Level (TRL) 6 or higher, or can achieve TRL 6 by Preliminary Design Review (PDR)) to achieve required observations. TRL status will be discussed further under Technological Maturity, section B.

GeoXO ground services leverage/augment existing capabilities, including: 1) enhancing the existing GOES-R Ground System for GeoXO mission-unique elements; and 2) utilizing NOAA-provided services for higher-level data processing, distribution, and archiving.

These approaches were reviewed by an independent Goddard Systems Review Team (GSRT), including members of the Standing Review Board (SRB), at the GeoXO Mission Concept Review on June 7-10, 2021, by a DOC Integrated Product Team during the GeoXO Milestone 1 Review Board process over September – October 2021, and by the SRB at the GeoXO System Requirements Review in August 2022.

#### 2. Cost Risk

Table 2 shows the funding required to implement the GeoXO program.

Table 2: GeoXO Program Funding Requirements (\$M)\*

Prior FY	FY 2023	FY 2024	FY 2025	FY 2026	FY 2027	To Complete	Total
160.0	285.0	417.4	671.0	691.5	1,320.0	16,099.5	19,644.4

Source: Prior FY and FY 2023 are Appropriated; FY 2024 and beyond are as confirmed in DOC Milestone 2/3 review.

Cost estimates for the GeoXO program were developed using aerospace industry-standard models and methods which factor in spacecraft and instrument size, complexity, and maturity. The estimate includes the NASA guideline recommended level of cost reserves. The high level of heritage for both the Flight and Ground elements increases the confidence that the program can be implemented within estimated reserves. At the MCR, an independent cost estimate by the GeoXO GSRT determined the program's estimate was reasonable for this stage of development, and the KDP-A and Milestone 1 boards judged the program cost estimate met the expected confidence level for the formulation phase. For Milestone 2/3, an independent assessment by DOC also validated the cost estimate. NESDIS, NOAA, and DOC will continue to evaluate program performance, value, and risk against available resources on an annual basis through the budget process.

The program has identified descope options that can be executed in Fiscal Year (FY) 2024 and later, if necessary, to reduce the annual or total funding requirements, which will be considered under DOC and NOAA's prioritization process.

#### 3. Schedule Risk

Schedule estimates for the GeoXO program were developed using aerospace industry-standard models and methods which factor in satellite and instrument size, complexity, and maturity. The schedule estimates were benchmarked against the development schedules for comparable instruments, spacecraft, and satellite integration and test campaigns. The schedule includes NASA-recommended reserves. Schedule risk mitigation has been incorporated into GeoXO by manifesting the most complex instruments (i.e., GXI and GXS) on separate satellites, with GXS having a later delivery and launch date.

<sup>\*</sup>Note: The GeoXO Baseline Report, for purposes of implementing 33 U.S.C §878a(c) and (d), will be developed following the Program Preliminary Design Review (PDR) and delivered following decision authority acceptance at the Key Decision Point C (KDP-C).

At the MCR, an independent schedule estimate by the GeoXO GSRT determined the program's estimate was reasonable for this stage of development; and the KDP-A and Milestone 1 boards judged the program schedule met the expected confidence level for the formulation phase.

The significance of any GeoXO program delay is the possible discontinuity of critical geostationary imagery and data starting in 2032 with the loss of the onorbit spare GOES-R Series satellite. The GeoXO schedule assumes that funding is available to support execution of the critical path activities, including the Imager implementation phase contract award in FY 2023. Delays in the award of the Imager contract could lead to replacement satellite capability not being available when needed in 2032.

Table 3 lists the program's major milestones.

**Table 3: GeoXO Program Major Milestones** 

	GeoXO Milestones	Timeframe	Review Team/ Board		
✓	Imager Phase A Study Contracts Awarded	Mar 2021	N/A		
✓	Mission Concept Review (MCR)	Jun 2021	GSRT		
✓	Key Decision Point (KDP) A	Jul 2021	АРМС		
✓	Sounder Phase A Study Contracts Awarded	Sep 2021	N/A		
✓	DOC Milestone 1	Oct 2021	MRB		
✓	Acquisition Strategy Meeting	Nov 2021	N/A		
✓	Remaining Instrument & SC Phase A Contracts Awarded	Intu 40FYZZ N/			
✓	System Requirements Review (SRR)	Aug 2022	SRB		
✓	DOC Milestone 2/3	Dec 2022	MRB		
•	GXI Implementation Contract Awarded	ct Awarded 2QFY23			
•	Remaining Instrument and Spacecraft Implementation Contracts Awarded	4QFY23+	N/A		
•	Mission Definition Review (MDR)	4QFY24	SRB		
•	KDP B	1QFY25	АРМС		
•	PDR	4QFY25	SRB		
•	KDP C	4QFY25	АРМС		
Critic	cal Design Review (CDR)	2QFY27	SRB		

System Integration Review (SIR)	4QFY30	SRB
• KDP D	4QFY30	АРМС
Operational Readiness Review (ORR)	3QFY31	SRB
• KDP E	4QFY31	АРМС
DOC Milestone 4	4QFY31	MRB
Geo-I1 Launch Readiness Date (LRD)	1QFY33	N/A
• Geo-I2 LRD	3QFY35	N/A
• Geo-S1 LRD	1QFY36	N/A
• Geo-I3 LRD	3QFY39	N/A
Geo-S2 LRD	1QFY41	N/A
• Geo-I4 LRD	1QFY43	N/A

#### Legend:

- APMC = Joint NOAA/NASA Agency Program Management Council
- GSRT = GeoXO Goddard System Review Team
- SRB = GeoXO Standing Review Board
- Geo-I1 = First satellite with GXI, OCX, and LMX; Geo-I2 is second such satellite, etc.
- Geo-S1 = First satellite with GXS and ACX; Geo-S2 is second such satellite, etc.

The GeoXO program will baseline the Integrated Master Schedule after the PDR. Stability and timeliness of the funding profile is necessary to maintain this schedule.

#### **B.** Technological Maturity

The instrument and spacecraft design concepts have been designed to rely upon technologies that have been demonstrated in a relevant laboratory or test environment (i.e., TRL6 or higher). One exception to this is the instrument detectors, devices which measure the incoming light from an Earth scene and convert it to a digital signal for transmission. High-performance detectors are needed to meet instrument performance requirements, and they represent the main technological challenge for the program. The detectors planned for the imager, sounder, and lightning mapper are all currently at TRL 4, which means that some modification of an existing design is needed for the GeoXO application. Modifications being considered vary depending upon the instrument, but include changes to wavelength ranges, spatial resolution, redundancy, dynamic range, readout speed, and size. Efforts to mature the imager and sounder detector designs are part of the ongoing instrument study contracts, and two development efforts are underway with industry to mature the lightning mapper detectors. Also, a primary objective of the Phase A studies is to assess the current technology readiness and adjust the instrument performance requirements to ensure that the technology development is

low risk and that TRL6 is achievable by the instrument PDR, as required by NASA guidelines.

#### C. Compliance with Policies, Regulations, and Directives

NOAA has determined that the GeoXO program is in compliance with applicable policies, regulations, and directives of NOAA and DOC. As GeoXO is being implemented as a joint NOAA-NASA program, it follows the NOAA-NASA Satellite Program Management Control Plan and applicable NASA policies and procedures. NOAA has also determined that the GeoXO program is in compliance with applicable NASA policies. Finally, compliance has been demonstrated through the successful completion of the various development activities, reviews, and approvals summarized in Table 3, above.

The GeoXO program has satisfied the requirements set forth in 33 U.S.C. §878a(b) through its compliance with the DOC Scalable Acquisition Project Management Framework and NPR 7120.5F, as discussed below.

#### 1. Documentation

There are two primary documents that govern the program. The first is the GeoXO Program Level Requirements (PLR, NESDIS-REQ-4300.1), which provides the program-level functional and performance requirements for developing and operating the GeoXO system. The PLR were derived from the NESDIS Level Requirements, reviewed by the GeoXO User Requirements Working Group and NESDIS Executive Council, and approved by the NOAA Assistant Administrator for Satellite and Information Services effective September 23, 2021. The PLR are further detailed by the GeoXO program, projects, and contractors into performance, functional, and interface specifications as needed. All those requirements are subjected to a rigorous verification process to ensure they are satisfied.

The second major document governing the program is NASA Procedural Requirement (NPR) 7120.5F, which lays out program management processes including very detailed, time-phased requirements for technical and programmatic documents, products, and reviews throughout the life cycle of the program. Ensuring the completion of this documentation is one of the main purposes of the Life Cycle Reviews required by NPR 7120.5, which will also satisfy the requirements of the DOC Scalable Acquisition Project Management Guidebook.

#### 2. Management

GeoXO is being implemented as a joint NOAA-NASA program, with NOAA as the lead agency and NASA serving as NOAA's acquisition agent for flight systems. NOAA will acquire ground systems/services. An Inter-Agency Agreement (IAA) has been approved to establish the roles and responsibilities of

the two agencies. One of key features of the IAA is its determination that the program will be managed in accordance with NOAA-NASA Satellite Programs and Projects Management Control Plan (MCP), which dictates that the GeoXO program and project management processes will follow NPR 7120.5. This approach also satisfies the requirements of DOC Scalable Acquisition Project Management Guidebook.

NOAA has responsibility for GeoXO program management, program budget, program requirements, Ground Segment Project leadership, operations, data product generation, and product distribution to the operational users. NASA has responsibility for system engineering, safety and mission assurance, Flight Project leadership, launch service acquisition, and interfaces to the Ground Segment Project. Program implementation is proceeding consistent with the Acquisition Strategy approach agreed to by NOAA and NASA on November 16, 2021.

Figure 2 illustrates the program interagency lines of authority and coordination between NOAA and NASA as provided in the MCP, with the GeoXO independent advisory bodies also depicted.

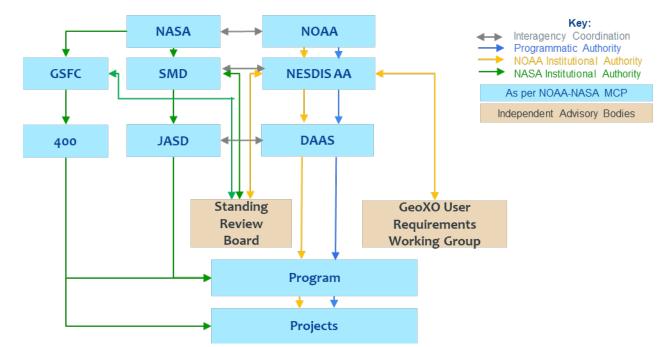


Figure 2: Interagency Lines of Authority and Coordination

Figure 3 shows the governance structure provided in the MCP. There are three joint NOAA-NASA management councils. The APMC is chaired by the NOAA Assistant Secretary of Commerce for Environmental Observation and Prediction, who is the decision authority, with a NASA agency-level co-chair. The NESDIS-level PMC is chaired by NOAA's Assistant Administrator for Satellite and Information Services, who is the decision authority, with a co-chair from NASA's

Science Mission Directorate. The GSFC Center Management Council (CMC) is chaired by the Deputy Center Director, who is the decision authority, with NESDIS Deputy Assistant Administrator for Systems the co-chair.

The GeoXO program is reviewed monthly by the GSFC CMC and NOAA-NASA APMC. The CMC and APMC also review the program at KDP milestones, as does the NESDIS/NASA Science Mission Directorate (SMD) PMC. The DOC conducts independent review of the SMD program at DOC Milestone Reviews, where the Deputy Secretary of Commerce serves as the decision authority.

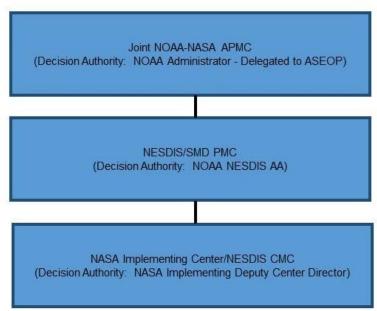


Figure 3: Governance Structure

#### D. Likelihood of Program Meeting Goals

NOAA needs GeoXO to maintain continuity of observations currently being made by the GOES-R Series. NOAA has assessed the technical maturity, evaluated the cost and schedule, and mitigated risk elements leading to high probability of meeting program goals. The program has been established with requisite cost and schedule reserves. In developing the program, NOAA has defined and documented a rigorous set of mission requirements in the Program-Level Requirements. NOAA and NASA have set up the appropriate management structures to execute the program. As stated above regarding Cost Risk, the program has identified descope options that can be executed in FY 2024 and later, if necessary, to reduce the annual or total funding requirements.

#### E. GeoXO Program Contribution to NOAA's Mission

NOAA and NASA have established the GeoXO program to sustain a foundational set of geostationary imaging and lightning detection observations used continuously by NOAA's National Weather Service (NWS) to accomplish its mission, provide

observations to meet mission requirements for NOAA's NWS, National Marine Fisheries Service, Oceanic and Atmospheric Research, and National Ocean Service with the hyperspectral sounding, ocean color, and atmospheric composition observations.

#### The GeoXO program will:

- Provide the only persistent coverage of the Western Hemisphere;
- Provide data to protect the one billion people who live and work in the Americas;
- Provide essential information for disaster preparation and prevention, transportation, energy management, agriculture, recreation, tourism, etc.;
- Provide foundational Earth System data supporting the President's climate change and environmental justice objectives; and
- Continue to ensure NOAA and the U.S.A. are leaders defining the necessary earth observations for weather and environment worldwide, meeting international expectations, and matching or exceeding planned meteorological observations by Europe and Asia.

The program is directly aligned with DOC PMEF and NOAA strategic objectives associated with terrestrial weather prediction and warning, climate adaptation and mitigation, and healthy oceans and resilient coastal communities and economies. GeoXO furthers the NOAA strategic principles of commitment through continuity of products and services; community through combining internal strengths with contributions and collaborations and partnerships; and capabilities through leverage of observing system integrated architecture and use-inspired science.

The GeoXO program is a good value to accomplishing these objectives through its leveraging of the prior NOAA investment in GOES-R, the prior NASA investment in TEMPO and GLIMR, and by continuing the multi-decadal NOAA-NASA partnership to implement the GeoXO system.

#### IV. Conclusion

The Under Secretary of Commerce for Oceans and Atmosphere has determined with respect to the GeoXO program's readiness:

- A. The technical, cost, and schedule risks of the program are clearly identified and the program has developed a plan to manage those risks;
- B. The technologies required for the program have been demonstrated in a relevant laboratory or test environment;
- C. The program complies with all relevant policies, regulations, and directives of NOAA and the DOC;
- D. The program has demonstrated a high likelihood of accomplishing its intended goals; and
- E. The program represents a good value to accomplishing NOAA's mission.

#### Appendix A: Acronym List

ACX GeoXO Atmospheric Composition Instrument

APMC Agency Program Management Council

ASEOP Assistant Secretary of Commerce for Environmental Observation and

Prediction

BAA Broad Agency Announcement CDR Critical Design Review CMC Center Management Council

DAAS Deputy Assistant Administrator for Systems

DCS Data Collection System

DepSec Deputy Secretary

DOC Department of Commerce

DPMC Directorate Program Management Council

GEO Geostationary Earth Orbit

GeoXO Geostationary Extended Observations

GOES Geostationary Operational Environmental Satellite

GSFC Goddard Space Flight Center GSRT Goddard Systems Review Team

GXI GeoXO Imager

GXS GeoXO Hyperspectral IR Sounder

IAA Inter-Agency Agreement

IR Infra-Red

KDP Key Decision Point LCC Life Cycle Cost LCR Life Cycle Review

LMX GeoXO Lightning Mapper
LRD Launch Readiness Date
MCP Management Control Plan
MCR Mission Concept Review
MDL Mission Design Laboratory

MDM Milestone Decision Memorandum

MDR Mission Definition Review

MS Milestone

NASA National Aeronautics and Space Administration

NESDIS National Environmental Satellite Data and Information Service

NOAA National Oceanic and Atmospheric Administration

NPR
OCX
GeoXO Ocean Color Instrument
OMB
Office of Management and Budget
ORR
Operational Readiness Review
PDR
Preliminary Design Review
PLR
Program Level Requirements

PMEF Primary Mission Essential Functions

RFI Request for Information RFP Request for Proposal

Risk Management Plan
System Integration Review
Science Mission Directorate
Standing Review Board
System Requirements Review
Technology Readiness Level

#### **Appendix B: GeoXO Value Assessments**

The value of the Lightning Mapper, Ocean Color, Atmospheric Composition, and Sounder instruments have been evaluated and documented in the following value assessment reports, which are available on the NOAA library website at the links below:

Geostationary Lightning Mapper Value Assessment

• https://repository.library.noaa.gov/view/noaa/27429

Value of Geostationary Ocean Color:

• https://repository.library.noaa.gov/view/noaa/33278

A Value Assessment of an Atmospheric Composition Capability on the NOAA Next-Generation GEO-XO Missions

• https://repository.library.noaa.gov/view/noaa/27224

Geostationary Extended Observations Hyperspectral InfraRed Sounder Value Assessment Report

• https://repository.library.noaa.gov/view/noaa/32921

#### **Appendix C**: Signed Milestone 2/3 Decision Memorandum



December 14, 2022

## MEMORANDUM FOR DR. RICHARD W. SPINRAD, UNDER SECRETARY OF COMMERCE FOR OCEANS AND ATMOSPHERE & NOAA ADMINISTRATOR

FROM: Don Graves

Deputy Secretary of Commerce

SUBJECT: Milestone Decision Memorandum (MDM) Approval of Milestone 2/3 for the

Geostationary Extended Observations Program

GeoXO is the follow-on to the Geostationary Operational Environmental Satellite R (GOES-R) program series and will continue and improve the GOES-R series observations for weather forecasting. Additionally, GeoXO will extend observations to include ocean, coasts, and atmospheric monitoring. The GeoXO program adds a new Infrared (IR) sounding capability that has demonstrated in studies to provide very substantial increases (due to the persistent staring capability) to the numerical weather prediction models over the currently available sensor data in existing orbits. The program will field the next generation geostationary earth orbit capabilities to support Department of Commerce (DOC) Primary Mission Essential Functions and National Oceanic and Atmospheric Administration (NOAA) mission associated with terrestrial weather prediction and warning, climate adaption and mitigation, and healthy oceans and resilient coastal communities and economies. The technologies developed will invigorate the space industrial base and maintain NOAA's leadership in geostationary coverage.

On November 9, 2021, the National Oceanic and Atmospheric Administration (NOAA)/National Environmental Satellite, Data, and Information Service (NESDIS) Geostationary Extended Observations (GeoXO) program presented Milestone 1 (MS 1) to the Milestone Review Board (MRB). The MRB approved for MS 1 and outlined activities to be completed as entrance criteria for the MS 2/3 review process, which have all been satisfied.

The MRB Executive Secretary, from the Office of Acquisition Management (OAM), facilitated a multi-bureau Integrated Product Team (IPT) to review the GeoXO program. The IPT identified forty (40) substantive issues to which the program office provided detailed responses, which the IPT found satisfactory and alleviated open questions on the topics of interest. However, there were issues raised by the IPT that require further action to ensure program success. Therefore, in my capacity as the Milestone Decision Authority for the DOC Milestone Review Board, I authorize NOAA to proceed to the project development and execution phases of the program. The MS 2/3 is hereby approved allowing initiation and execution of necessary for program procurements in upcoming phases. In addition, this decision memorandum sets forth my expectations for NOAA officials as they transition from the assessment of available options to the implementation phase of the program life cycle with the schedule and cost profile reflected in Table 1 below. The below resources are aligned to the Launch Availability (LA) requirement for the first imager space vehicle in 2032 to maintain mission continuity.

White the state of the state of	PY	FY23	FY24	FY25	FY26	FY27	TC	Total
GeoXO Required Funding	\$160	\$285	\$417	\$671	\$692	\$1,320	\$16,099	\$19,644
Profile (TY\$M)								

Table 1

The MS 2/3 approval establishes the Department's program baseline. The program shall report cost, schedule, and performance execution against the baseline to OAM in the prescribed and agreed to format on an annual basis each January starting in 2024.

I also task NOAA with the following actions during program execution:

- The IPT identified potential synergies in numerical weather prediction models regarding how these new geostationary IR sounder payloads could compliment planned Low Earth Orbit (LEO) program constellation recapitalization investments. Therefore, NESDIS shall execute a study led by the LEO program (in conjunction with the geostationary program) on its overall architecture, considering the addition of the new central IR sounder. Additionally, the study should inform the potential of future microwave sounding recapitalization and the potential for improvements. The study plan, to include affordability constraints, shall be worked with OAM with results expected within one (1) year.
- The GeoXO program has a requirement on the Data Collection Platform Command downlink
  capability to support the U.S. Geological Survey and U.S. Army Corps of Engineers. Adding this
  on-orbit functionality will cost NOAA between \$200-300M while the cost for alternatives is
  estimated to be \$7M annually to those agencies. NESDIS is directed to execute a return-oninvestment trade study with our federal partners and report back to OAM within 30 days on the
  findings to ensure that unnecessary costs are not incurred by the GeoXO program.
- The decision point on partner payload for the center IR sounder satellite creates risk uncertainty.
   The GeoXO program shall identify the partner payload for the center satellite prior to Preliminary Design Review (PDR) and provide the details of this partnership to OAM.
- The GeoXO program must continue to collaborate with National Telecommunications and Information Administration (NTIA) and the user community regarding its plans to extend the usage of X-band as well as any adjustments pending the outcome of the phase A study with spacecraft contract vendors.

Based on the above and in my capacity as Milestone Decision Authority (MDA) for the Department, I authorize Milestone 2/3 approval for the GeoXO program.

cc: GeoXO MRB Members