



Geostationary and Extended Orbits (GEO-XO)

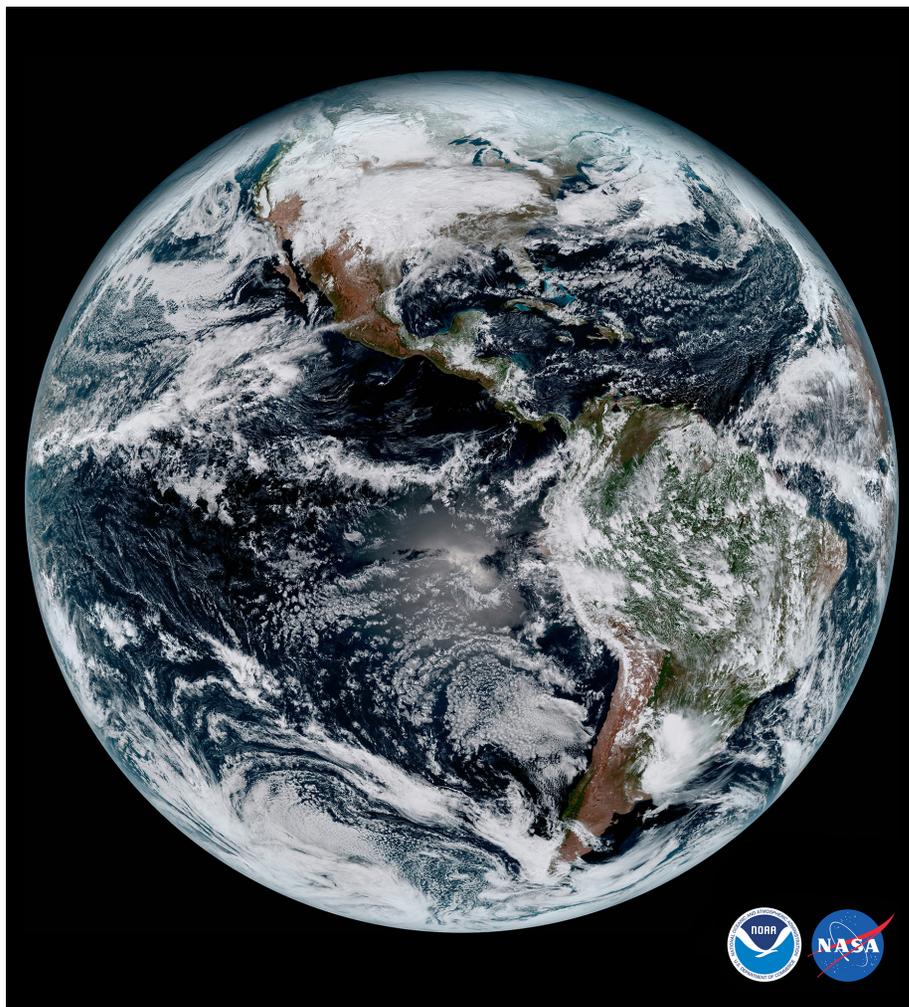


This document explains the future Geostationary and Extended Orbits satellite mission

NOAA's **Geostationary and Extended Orbits (GEO-XO)** satellite system is the ground-breaking mission that will advance Earth observations from geostationary orbit. GEO-XO will supply vital information to address major environmental challenges of the future in support of U.S. weather, ocean and climate operations. The GEO-XO mission will continue and expand observations

provided by the [GOES-R Series](#). GEO-XO will bring new capabilities to address emerging environmental issues and challenges that threaten the security and well-being of every American.

NOAA is working to ensure these critical observations are in place by the early 2030s as the GOES-R Series nears the end of its operational lifetime.



GOES-16 full disk image from January 15, 2017. GEO-XO will continue and improve these observations.

Advancing NOAA's Mission

GEO-XO will watch over the Western Hemisphere as part of a NOAA observing system that provides world-class environmental information to support both long-term planning and short-term response. This observing system will power increasingly sophisticated models that forecast climate change-driven weather patterns never seen before.

GEO-XO satellites will also host space weather instruments and its ground system will provide services for NOAA's deep space weather satellites.

With GEO-XO, made-to-order data delivery will allow users to customize data access to facilitate more accessible and usable environmental information. Multiple data delivery options will be available, including an internet storefront, mobile device access, and satellite broadcast. Cloud-based product generation will expand data access, increase community involvement, and continuously evolve service.

New and Improved Observations

New technology and scientific advancements will improve observations for weather forecasting and provide new ocean and atmospheric measurements. GEO-XO will provide real-time, high-resolution [visible and infrared imagery](#) for monitoring Earth's weather, oceans, and environment. Data from GEO-XO will contribute to weather forecast models and drive short-term weather forecasts and severe weather warnings. GEO-XO will also provide advanced detection and monitoring of environmental hazards like wildfires, smoke, dust, volcanic ash, drought, and flooding.

Additional observations are recommended to address our changing planet and evolving user needs. NOAA plans to incorporate day/night visible imagery, infrared sounding, atmospheric composition, and ocean color, as well as an improved lightning mapper in the GEO-XO system, pending program approval. These observations will provide vital data to complement those from NOAA's partners in Europe and Asia, building a critical global observing system.

User Needs Inform GEO-XO Capabilities

NOAA, its users, and industry partners conducted a number of observational capability studies, observation simulation experiments, value assessments, future scenario evaluations, societal and economic benefit evaluations, and user needs workshops, surveys, and interviews to determine which observations are the highest priority for GEO-XO to provide. NOAA evaluated a range of space architecture options to select one that will provide the highest priority observations effectively and efficiently.

GEO-XO Core Capabilities	
Visible/Infrared Imagery	Data continuity; spatial and spectral resolution improvements
Solar and Space Weather Monitoring	Data continuity (GEO-XO to accommodate space weather instruments)
Data Collection System Ingest	Service continuity
DCS, EMWIN, HRIT Data Rebroadcast	Service continuity; potential use of commercial services
GEO-XO Recommended Capabilities	
Lightning Mapping	Data continuity; spatial resolution improvements
Infrared Sounding	New capability for numerical weather prediction and nowcasting
Day/Night Imagery	New capability for nighttime cloud, fog, and smoke tracking
Ocean Color Imagery	New capability for ocean health and productivity monitoring
Atmospheric Composition Measurement	New capability for detection of air quality threats

Sustaining a Weather-Ready Nation

Visible and Infrared Imagery



High-resolution imagery is the backbone of Earth observations. The GEO-XO imager will improve upon the GOES-R [Advanced Baseline Imager](#) by providing more detailed observations and more precise tracking of severe

weather. GEO-XO will also detect wildfires four times smaller, potentially increasing the lead time to respond to a blaze before it gets out of control. Additional channels will better detect water vapor in the atmosphere.

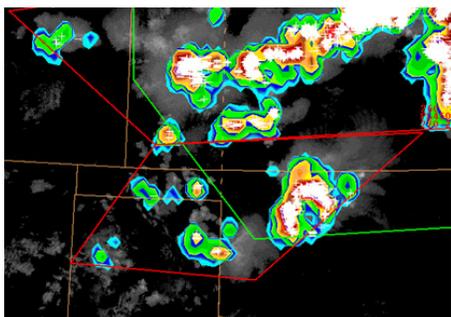
Day/Night Visible Imagery



Nighttime visible imagery from geostationary orbit will dramatically improve the ability to detect and track fog at night, characterize the formation of tropical storms, monitor power outages/recovery in real-time, provide a new lights-based search and rescue utility,

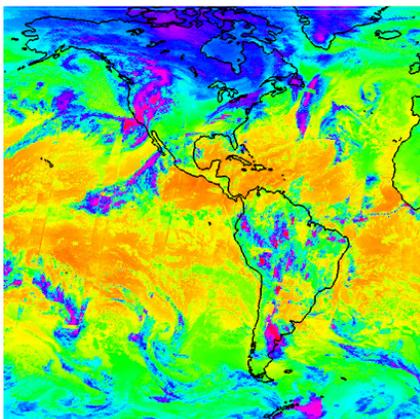
and introduce the ability to detect and track air quality and visibility hazards such as smoke and dust at night.

Lightning Mapping



Lightning mapping from geostationary orbit improves severe storm analysis, lightning hazard detection, hurricane intensity prediction, wildfire response, and precipitation estimation as well as mitigates aviation hazards. A GEO-XO lightning mapper will potentially improve resolution over the GOES-R [Geostationary Lightning Mapper](#).

Infrared Sounding



A GEO-XO infrared sounder will provide real-time information about the vertical distribution of atmospheric temperature and water vapor to feed advanced numerical weather prediction models and improve short-term severe weather forecasting.

Supporting Healthy Oceans, Resilient Coasts, and Climate Science

Atmospheric Composition



Atmospheric composition measurements from geostationary orbit will improve air quality monitoring to mitigate health impacts from severe pollution and smoke events.

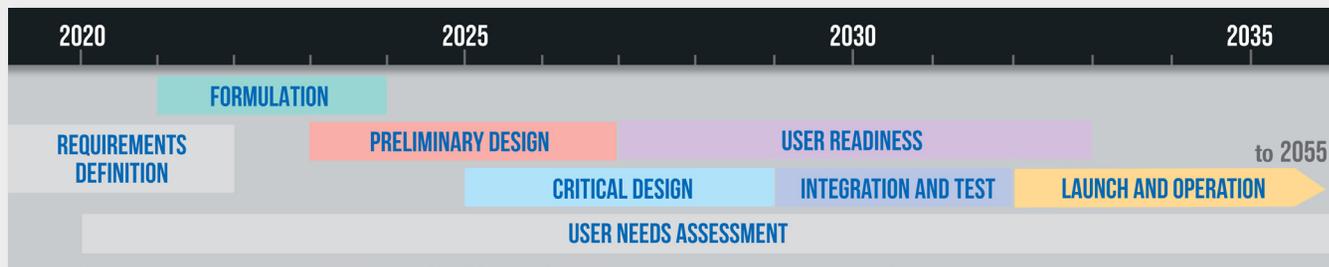
Ocean Color



A GEO-XO ocean color imager will provide observations of ocean biology, chemistry, and ecology to assess ocean productivity, ecosystem change, coast/inland water quality, and hazards like harmful algal blooms.

GEO-XO Timeline

NOAA assessed user needs and studied a variety of potential observational capabilities. These analyses will inform key decisions to be made in 2021. Once the GEO-XO requirements are defined, pilot studies will lead to the preliminary design of the spacecraft and instruments. As the program moves into the critical design stage, NOAA will begin preparing data users for new capabilities the GEO-XO system will provide. The first GEO-XO launch is planned for the early 2030s and will maintain and advance NOAA's critical geostationary observations through 2055.



Collaboration Delivers the Mission

GEO-XO is a NOAA program, supported by NASA. NASA will manage the development of the satellites and launch them for NOAA, which will operate them and deliver data to users worldwide.