

GEO-XO: NOAA's Next Gen Geostationary Satellite System

National Environmental Satellite,
Data, and Information Service

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NOAA's Geostationary Satellite Systems

- **Provide** the only persistent coverage of the Western Hemisphere
 - Enables forecasters to issue emergency warnings to protect life and property
- **Protect** the 1 billion people who live and work in the Americas
 - 100,000+ premature U.S. deaths/yr from extreme weather and poor air quality
- **Provide Essential Information for:** disaster preparation and prevention, transportation, energy management, agriculture, recreation, tourism, ...
- **Yield** more than a **20X** return on investment for weather observations:
 - Weather forecasting yields a **\$162 Billion/year¹** benefit to the global economy, with U.S. geostationary satellites providing an estimated **~14%** of the benefit
- **Provide** foundational Earth System data supporting the President's climate change and environmental justice objectives



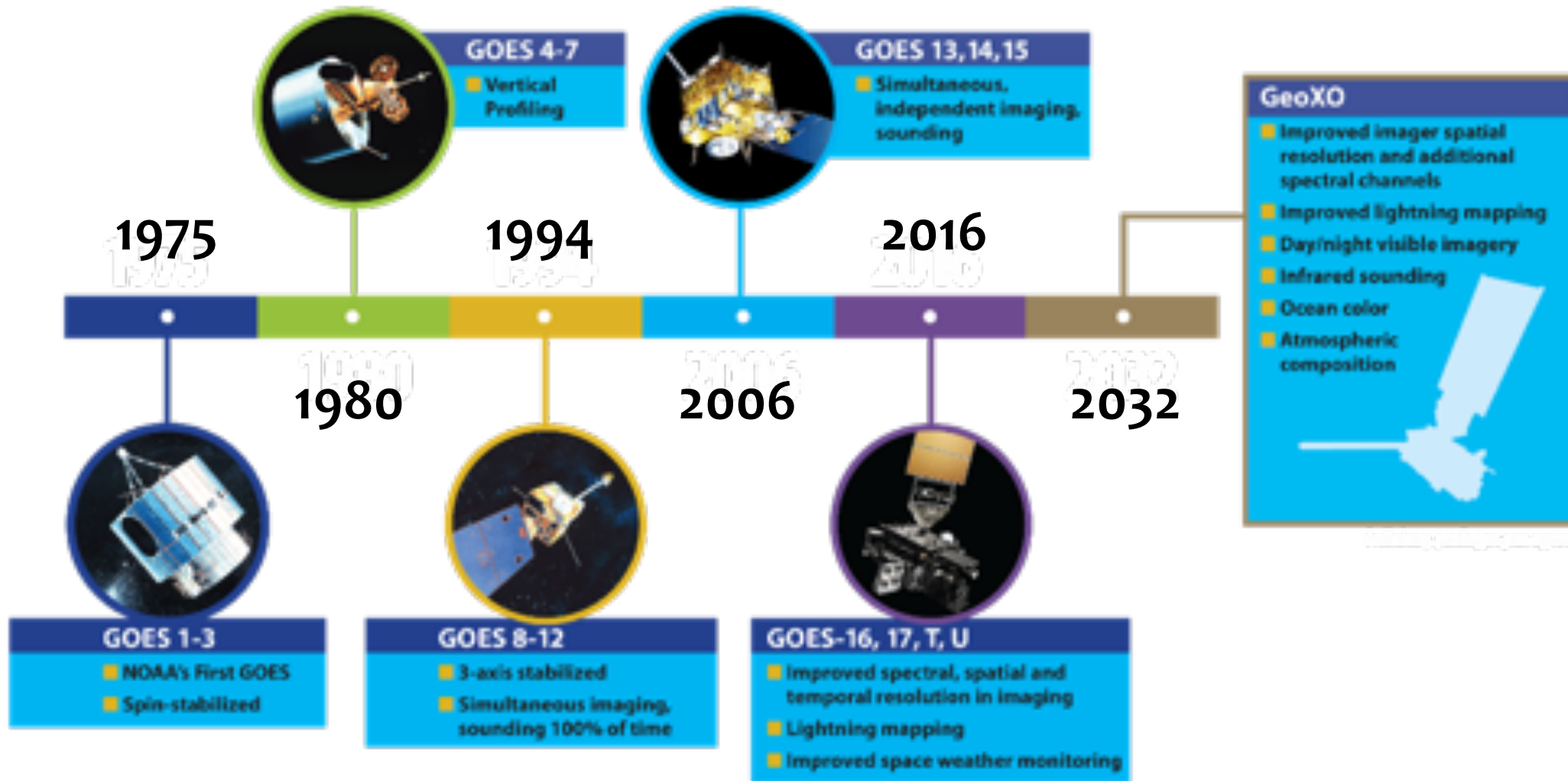
Aftermath of Galveston 1900 Hurricane

“The greatest single advancement in observing tools for tropical meteorology was unquestionably the advent of the geosynchronous meteorological satellite.”

- Former National Hurricane Center Director Bob Sheets

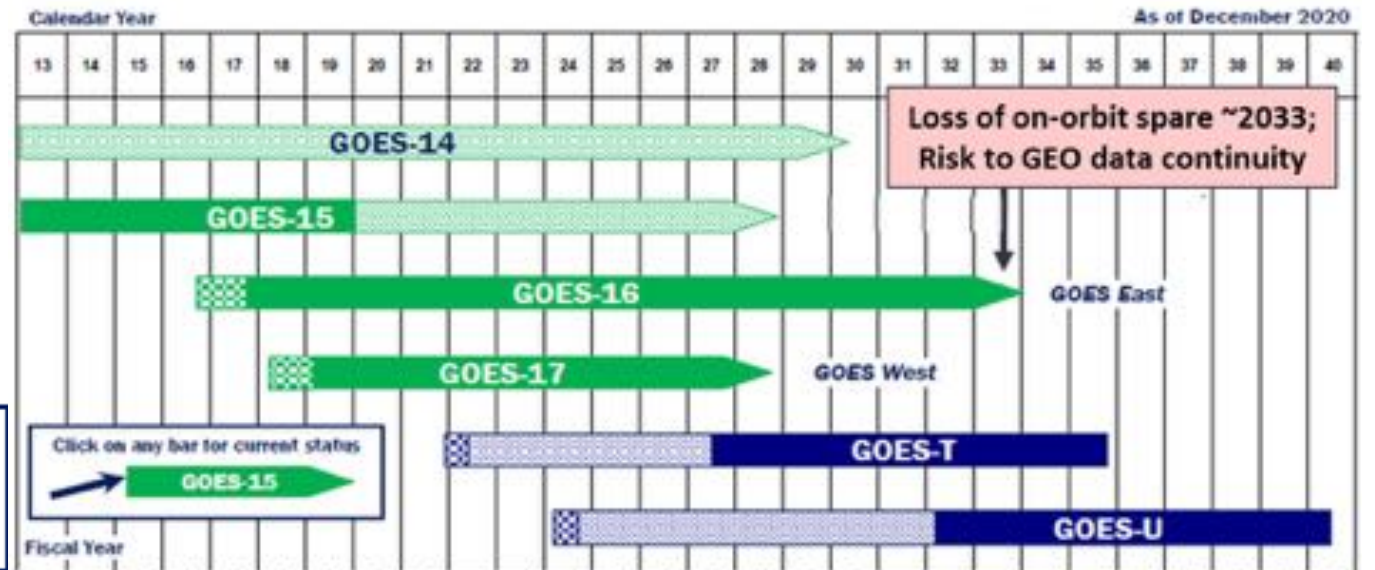
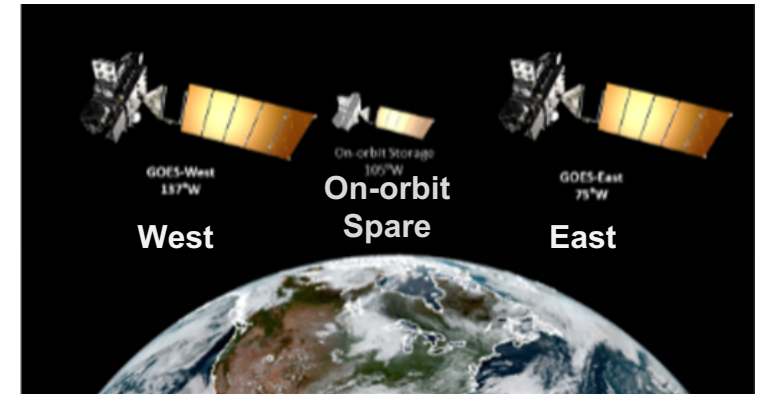


History of Geostationary Operational Environmental Satellites



Geostationary Satellite Operational Concept for Continuity

- **NOAA's Geostationary Operational Concept** requires a GOES East, GOES West, and an on-orbit spare for continuous 24/7 observations
 - Mitigates risk of catastrophic failure
 - Enables restoration of observations in days instead of years
 - Concept recommended by stakeholders and National Academies
- **Projected loss of the on-orbit spare in ~2033 sets the need date for GEO-XO replacement capability in 2032**

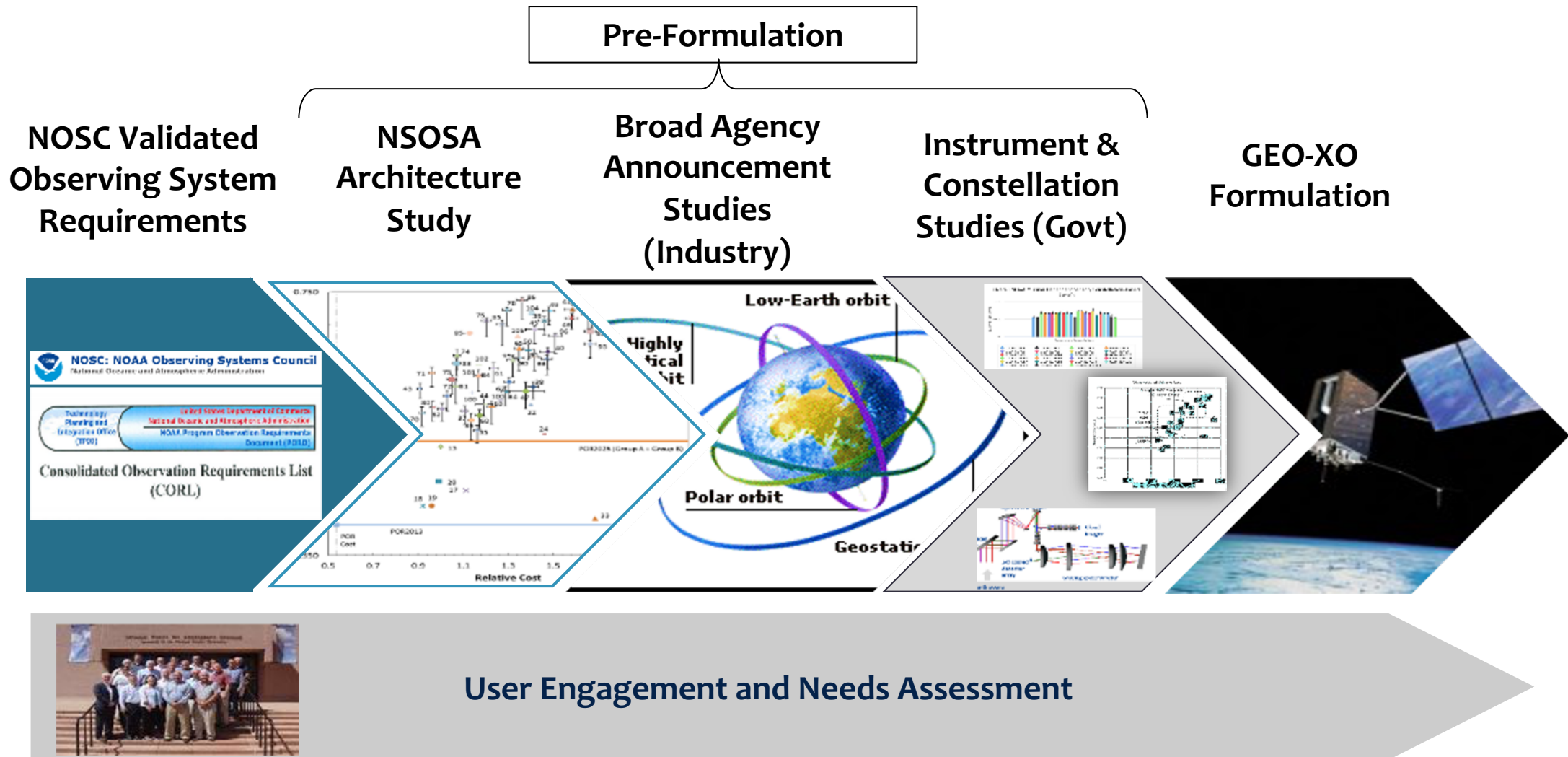


	In orbit, operational		Planned in-orbit Storage
	In orbit, storage		Planned in-orbit Checkout
	In orbit, checkout		Planned Mission Life
	Reliability analysis-based extended weather observation life estimate (60% confidence) for satellites on orbit for a minimum of one year – Most recent analysis: 1 September 2020		

Click on any bar for current status



Process to GEO-XO Program Definition



User Engagement 2020-2021

- User Needs Virtual Workshops and Surveys
 - Topics of Fire (178 attendees), Weather (233), Agriculture (152), Health (207), Oceans (142)
 - National agencies: CDC, DHS, DoD (USA, USN, USAF, USSF), DOE, DOI, EPA, FAA, FEMA, NASA, NIST, NPS, NSF, USAID, USDA, USFS, USNRC, USGS
 - State/Local: more than 40 states, cities, counties, and tribal areas
 - International: WMO, Canada, Mexico, EUMETSAT, multiple Caribbean/So. American orgs
 - Industry: more than 70 companies and advocacy groups from weather, transportation, communications, media, aerospace, natural resource, and energy sectors
 - Academia: more than 60 universities
- Community Meeting on NOAA Satellites
 - 1013 participants representing 33 countries
 - >250 organizations including NOAA, NASA, NSF, DoD (all branches) USGS, DOE, NGA, BLM, GAO, plus international meteorological organizations, academia, and industry.
- Listening Sessions, Polls, Panels, and Presentations
 - National Weather Association
 - American Meteorological Society
 - American Geophysical Union

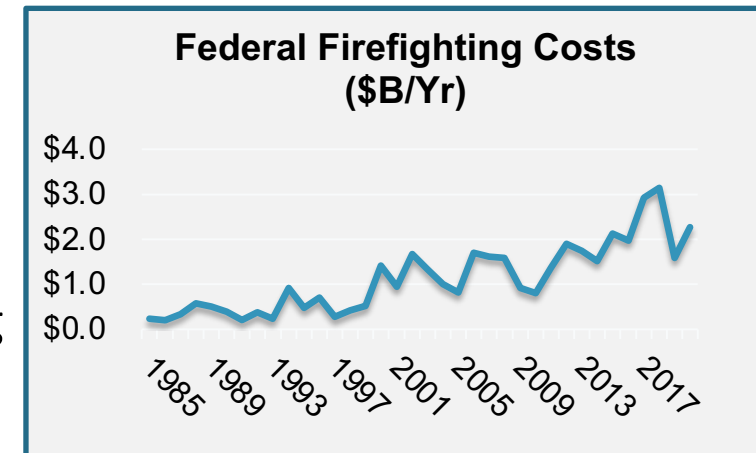
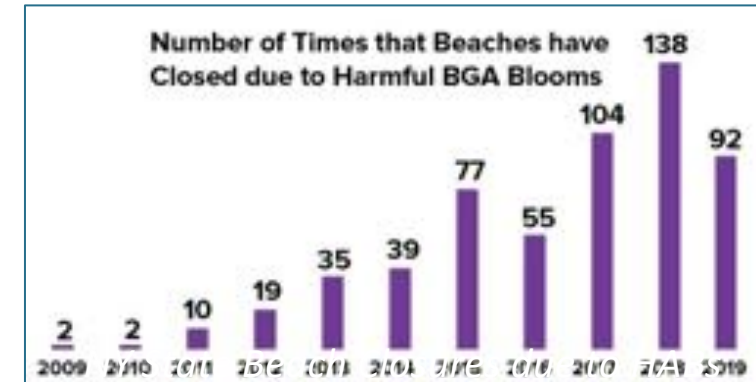


User engagement begun in 2020 will continue through GEO-XO development



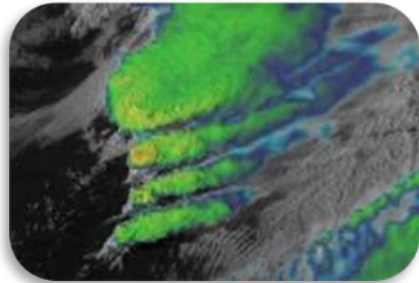
Planning for the Planet in 2030 & Beyond

- **Beach closures are increasing**: ocean color observations will more precisely and more frequently monitor the presence of harmful algal blooms
- **Wildfires are growing in size and frequency**: higher spatial resolution imagery will detect fires earlier, and atmospheric composition measurements can track where dangerous smoke travels
- **Link between air pollution and mortality more clearly understood**: real time measurements of air quality will enable more accurate warnings and improve controls
- **Hurricanes are becoming stronger**: improved imagery will more rapidly detect tropical storm generation and intensification
- **Forecast needs are increasing**: real time hyperspectral sounding data, along with advanced numerical models and high performance computing, will enable more accurate, more timely, and longer-range forecasts



Highest Priority Geostationary Observations

Ongoing Needs: Imagery and Lightning data are essential for short-range forecasting, monitoring hazardous environmental conditions, and issuing severe weather watches and warnings



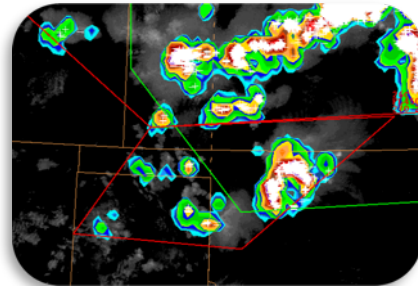
Severe Storms



Wildfire Detection



Hurricane Tracking

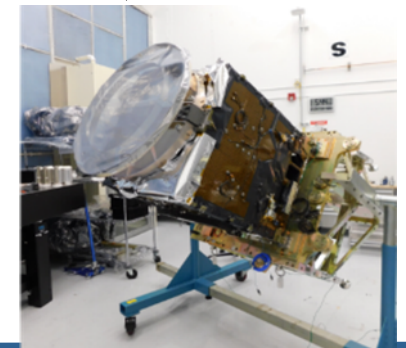


Lightning

Emerging Needs: Users expect NOAA to make operational observations that are currently planned by NASA and international agencies:

- **Hyperspectral IR Sounder** for numerical weather prediction and local nowcasting
- **Ocean Color Instrument** for monitoring dynamic coast/ocean features, ecosystem change, coastal/inland water quality, and natural and anthropogenic hazards
- **Atmospheric Composition Instrument** for monitoring air quality and the linkage between air quality, weather, and climate

*NASA TEMPO
Atmospheric
Composition
Instrument,
Launch 2022*

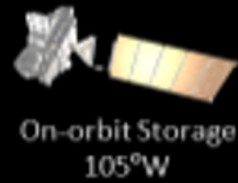


Recommended GEO-XO Constellation

(Preliminary, pending program approval)



GEO-West
Vis/IR Imager
Lightning Mapper
Ocean Color
Space Wx Suite*



GEO-Central
Hyperspectral IR Sounder
Atmospheric Composition
Partner Payload

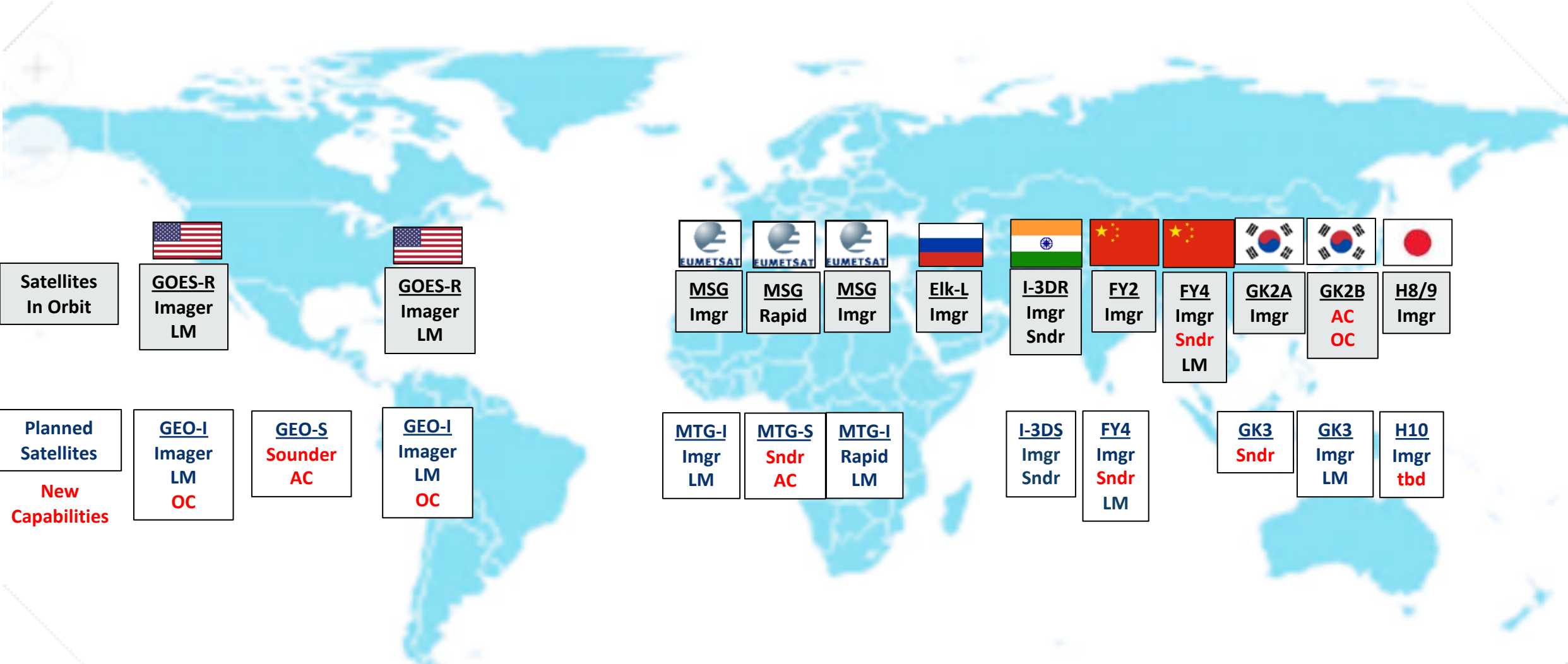


GEO-East
Vis/IR Imager
Lightning Mapper
Ocean Color
Space Wx Suite*



**Solar and In-Situ
instruments provided by
Space Weather Program
under separate initiative*

U.S. in the GEO Ring of Meteorological Satellites



GEO-XO Next Steps

GEO-XO Formulation Event/Activity	Timeframe	Note
Imager Phase A Study Contracts Awarded	April 2021	2 Contracts
Mission Concept Review	June 2021	
NOAA-NASA Key Decision Point A	July 2021	
DOC Milestone 1 Review (DOC DepSec Approval)	Sept 2021	Program Initiation
Remaining Phase A Contracts Awarded	1QFY22	Up to 3 per Instr. Type
System Requirements Review	2QFY22	Requirements Baselined
Implementation Phase Acquisition Strategy Meeting	2QFY22	
Update Program Cost Estimate and Perform ICE	2QFY22	
DOC Milestone 2 Review (DOC DepSec Approval)	3QFY22	Program Approval
Report of Readiness to Congress	3QFY23	
Implementation Phase Contracts Awarded	3QFY23+	



Planning has begun for NOAA's next gen GEO system

- Now preparing for formal GEO-XO program initiation at Milestone 1 in 2021
- Formulation Phase A/B is planned over 2021-2025 and will include:
 - Industry studies for candidate instruments
 - Finalization of partnerships for system elements
 - Initiation of major flight element acquisitions
 - Benchmarking and pilot projects to inform Ground system definition
 - Continued user needs assessments to define system, products, services
- We look forward to working with the community to develop GEO-XO

GEO-XO will maintain and advance NOAA's observational capabilities through 2050

For more info: <https://www.nesdis.noaa.gov/GEO-XO>

