



**NOAA**

# GEO Overview & GEO-XO Introduction

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# Achieving the NESDIS Vision in Geostationary Earth Orbit



## NESDIS Vision:

A truly integrated digital understanding of our earth environment that can evolve quickly to meet changing user expectations by leveraging our own capabilities and partnerships.

## GEO Strategic Objective:

Advance terrestrial observational leadership in geostationary and extended orbits

## GEO Roles:

- Maintain and extend Earth observations from geostationary and potentially Tundra orbits
- Improve and expand our product suite
- Collaborate with partners to collect, process, and deliver relevant data to our users
- Interpret and provide data in manner that users can readily access and understand





# GOES-R in Operation

- GOES-16 in service as GOES East since December 2017
  - Recently observed partial thruster degradation
  - Performance stabilized with ops mitigations
- GOES-17 in service as GOES West since February 2019
  - ABI loop heat pipe mitigations in place
- All GOES-16 & 17 data products in operational use
  - At provisional or full maturity level



*The GOES-R Series, from Africa to New Zealand*



# GOES-R in Development

- GOES-T
  - Currently In Thermal/Vacuum test
  - Launch planned on an Atlas V in December 2021
- GOES-U
  - Integration is underway, including modifications to add the Compact Coronagraph (CCOR) for detection of coronal mass ejections
  - Launch planned in 2024



*GOES-T going into TV Chamber at Lockheed*



*CCOR Concept*



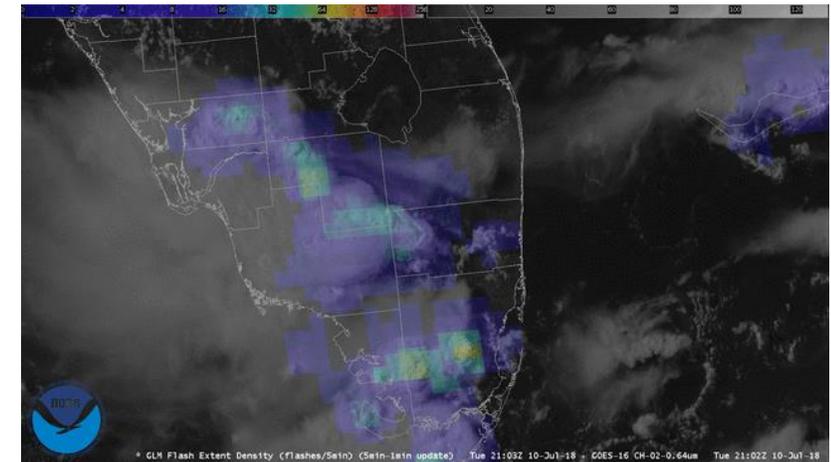
*CCOR Optical Tube Assy*



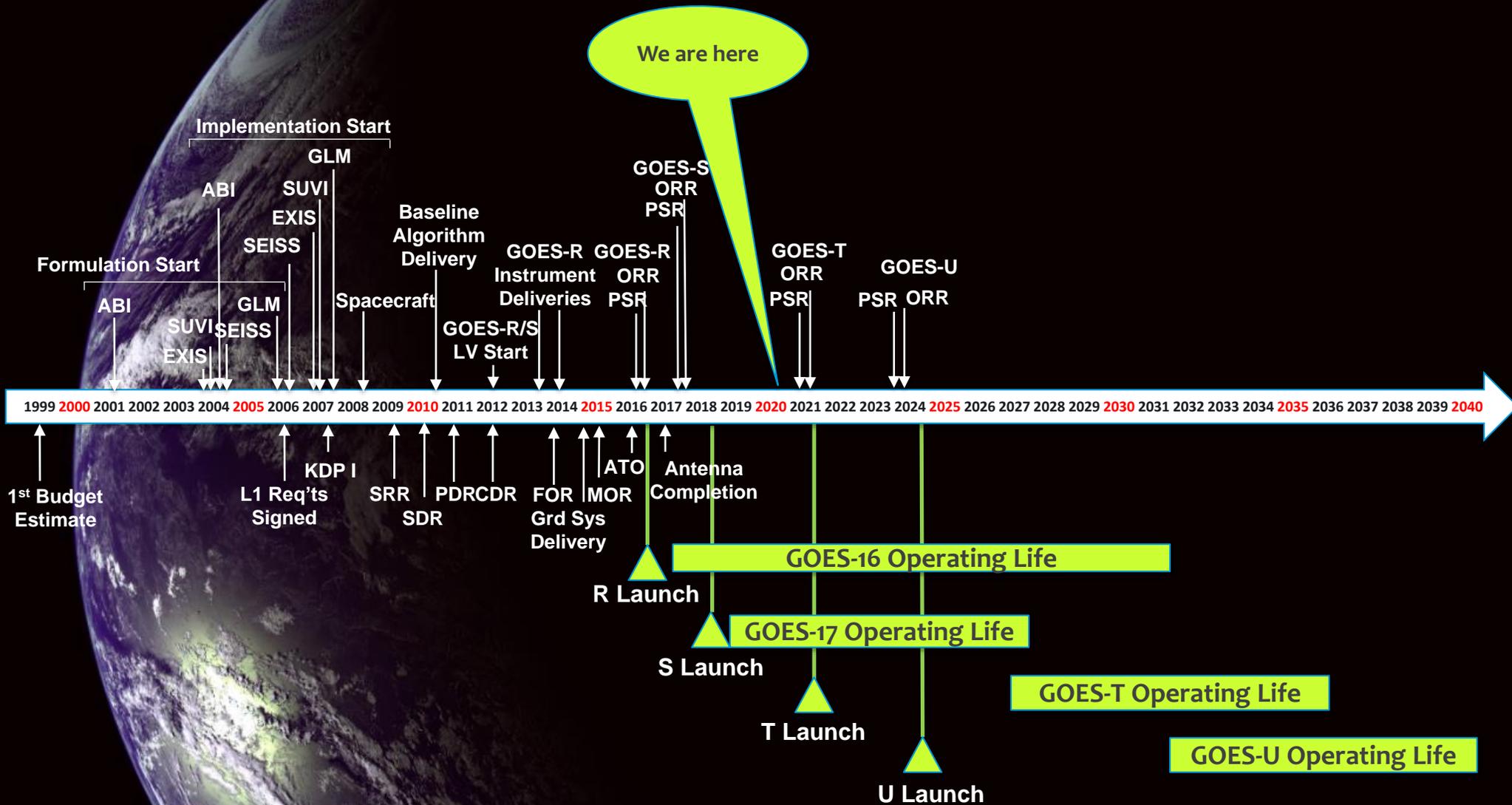
# GOES-R in Sustainment

- Continuing to evolve and expand the data product suite based on user feedback
  - Converting ABI L2 products to enterprise versions
  - Adding new products:
    - Ice Concentration & Extent, Age & Thickness, Motion
    - All Sky and Clear Sky Radiances
    - Aerosol Particle Size
    - Cloud Cover Layer
    - DMW BUFR
    - Automated Surface Observing System
    - Low Cloud / Fog
    - GLM Gridded products
  - Researching new products
    - 18 new ROSES product proposals funded in Fy20
- Ground System Server Replacement underway, after C19-related pause
- Preparing for follow-on ground sustainment contract to support 2023-2027
- Evaluating candidate functions for migration to the Cloud
  - Level Zero Storage System prototyping in process

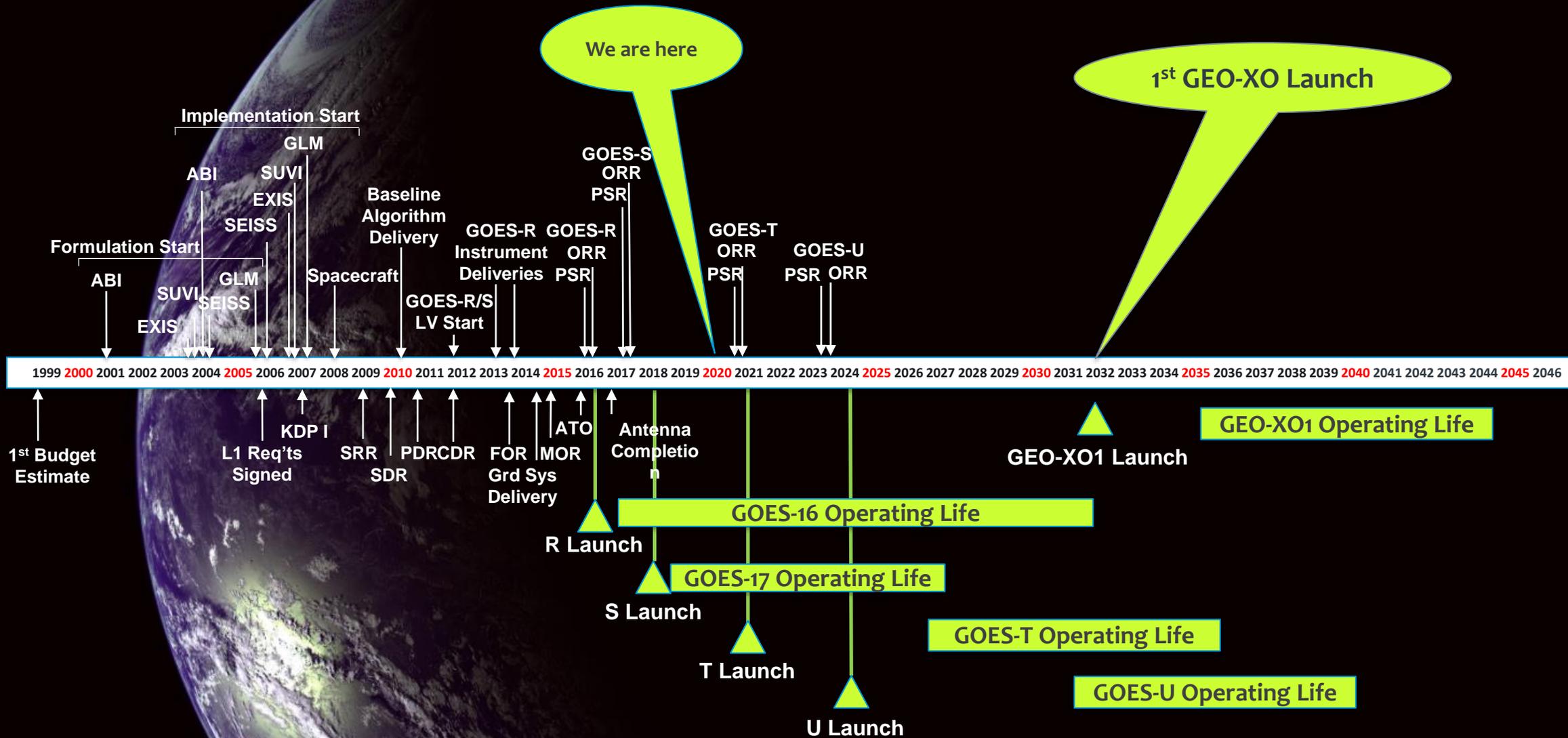
GLM Gridded Product



# GOES-R Program Timeline



# GOES-R to GEO-XO Timeline



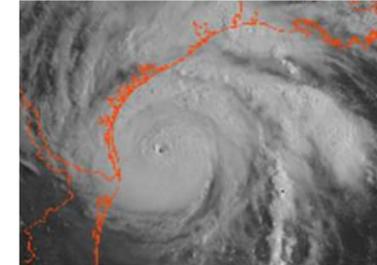
# GEO-XO Introduction



- GEO-XO = *Geostationary and Extended Orbits*
  - The mission to follow GOES-R and provide continuity for GEO observations
  - Considering expanding to include observations from “Tundra”
  - Anticipate providing space & ground services for Space Weather mission including L1 spacecraft
- GEO-XO includes all NOAA Earth-observing assets deployed above LEO:
  - Government spacecraft
  - Potential payloads hosted on commercial/partner spacecraft
  - Potential use of commercial services and observational data
- Operational in the 2030-2050 timeframe
  - Currently in pre-formulation:
    - Instrument and constellation studies underway
    - User needs assessment underway
    - Requirements definition underway
  - Approximate Program Schedule
    - Mission Concept Review, 2021
    - System Requirements Review, 2022
    - System Preliminary Design Review, 2025
    - 1st GEO Launch FY32

## Data Continuity, and Potential New Observations

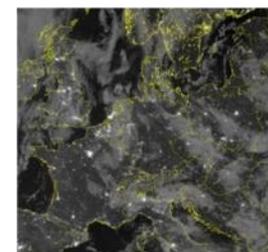
Visible & Near-IR Imagery



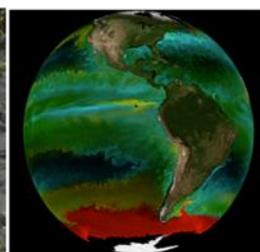
Lightning Mapping



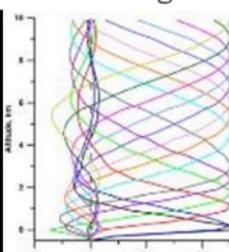
Day/Night Imagery



Ocean Color



Sounding



# ICYMI: GEO-XO Pre-Formulation thru FY20



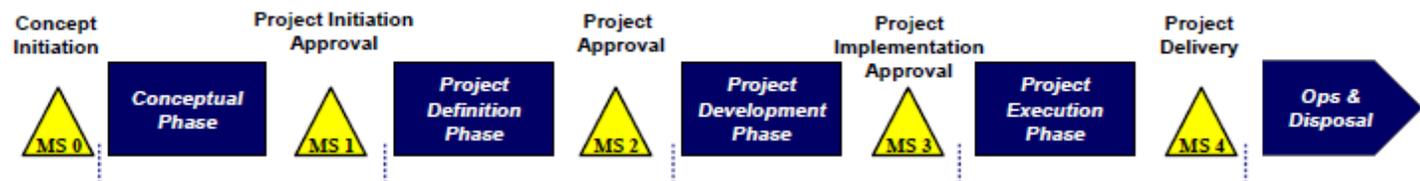
GEO-XO Pre-Formulation Event/Activity	Timeframe	Status
NOAA Satellite Observing System Architecture Study	Pre-FY20	Complete
<b>Program Milestone Zero Review</b>	<b>Dec 2019</b>	<b>Approved</b>
GEO-XO User Requirements Working Group Established	Feb 2020	Reqs input Nov 20
User Facing Communications IPT Established	Mar 2020	Work Underway
GEO Broad Agency Announcement Study Contracts	Spring 2020	Awarded; ECD Fall/Winter 20/21
Instrument Concept Studies (w/Aerospace Corp) Initiated	April 2020	Underway; ECD Feb 21
Constellation Study Started	May 2020	Underway; ECD Dec 20
Requirement Definition Plan Briefed to NOSC	May 2020	Complete
Formulation Authorization Document	Jun 2020	Approved
NOAA-NASA Inter-Agency Agreement	Aug 2020	Approved
User Needs Workshops (on subjects of Fire, Weather, Health, Oceans, & Agriculture/Land Use)	Summer 2020	4 Complete; 5 <sup>th</sup> planned Oct 21
Program Level 1 Requirements	Sep 2020	Drafted; ECD Mar 21
Formulation Agreement	Fall 2020	Drafted; ECD Mar 21

# GEO-XO Milestone Zero Recap



- Demonstrated that proposed GEO-XO program initiative met the criteria for Milestone Zero as defined by DOC and NESDIS
  - As required by DOC, mission need for GEO observational capability was shown
    - Driven by U.S Code, Public Law, DOC Primary Essential Functions, and DOC Strategic Plan
      - 15 U.S. Code § 313. The Secretary of Commerce shall have charge of the forecasting of weather, the issue of storm warnings
    - Demonstrated that replacement GEO Imager required by 2031 to ensure data continuity
  - As required by NESDIS, initial concept study completed and plans for detailed concept study were defined
    - NSOSA study served as initial concept study
    - Detailed concept plans were laid out through the GEO-XO Mission Concept Review and Milestone 1 gate
- GEO-XO Program was approved to transition into the conceptual phase

**DOC Program Life Cycle:**  
*M/S0 starts Conceptual Phase*



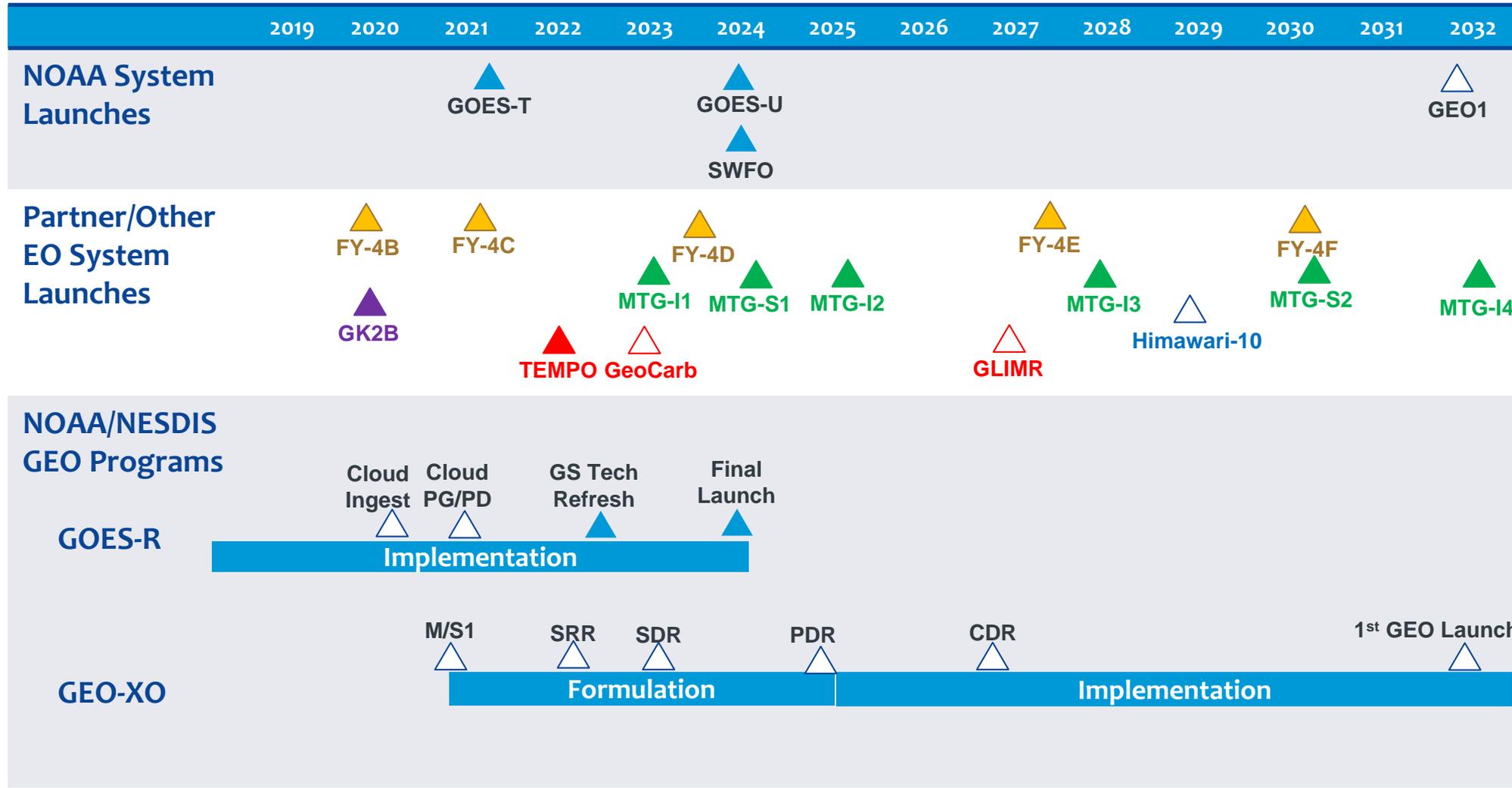


# Road to Milestone 1

- Currently completing detailed concept activities and planning for formulation phase
- Detailed Concept Design Phase activities now underway:
  - Industry and program studies of candidate instruments and architecture options
  - User needs assessments led by GEO-XO User Requirements Working Group (XORWG)
    - User needs workshops and conference listening sessions
    - OSSEs/other quantitative assessments of value for observational capabilities
    - Consulting with partner agencies on GEO-XO relevant plans
    - Generation of observational priorities and requirements
  - Data service needs assessment through User Facing Comm IPT
  - Initial L1 requirements drafted
  - Refinement of program scope, ConOps, ROM cost and schedule
- Activities in process to prepare for FY21 Formulation
  - NOAA-NASA Inter-Agency Agreement for Phase A/B complete
  - Formulation Agreements (FAD) complete
  - Program Office established and being populated
  - Program Plans needed for formulation phase are in draft
  - Contract documentation for industry Phase A studies in draft
- Planning for Mission Concept Review in March 2021 and DoC Milestone 1



# The Next Decade of GEO Earth Observation Launches



▲ EUMETSAT  
▲ CMA  
▲ JMA  
▲ KMA  
▲ NASA  
▲ Published Date  
△ Notional Date

ALL DATES SUBJECT TO APPROVAL BY FUNDING AUTHORITIES; PARTNER DATES ARE FROM INTERNET SOURCES AND MAY NOT BE CURRENT





# GEO Summary



- GOES-R Series will continue to provide operational service into mid-2030s
  - Continuing to evolve data products based on user input
- Planning has started for the next generation satellite system, GEO-XO
  - Currently underway:
    - User needs assessments
    - Observational value assessments
    - Requirements development
    - Industry studies of instruments, architecture concepts, and commercial services
    - Program studies of instruments and constellation options
  - Preparing for formal program initiation following Milestone 1 decision gate in 3Q FY21
- Continuing partnership activities to inform program plans and toward vision of GEO Ring

