



Agency Priority Goal | Action Plan | FY 2023 – Q1

Climate Change Research

Lead: Science Mission Directorate

Goal Leader:

Dr. Karen M. St. Germain
Earth Science Division Director

Goal Overview

Goal statement

Use the global vantage point of space to advance our understanding of the Earth system, its processes, and changing climate. *By September 30, 2023, NASA will advance climate change research by delivering two new observing systems and an upgrade to NASA's primary global Earth systems model.*

Problem to Be Solved

- To establish and maintain a robust cadence of missions, including new observing systems, to enable new and updated models, observations, research, and applications.

What Success Looks Like

- After completing on-orbit checkout, commence Landsat 9 operations and release first light images, delivering the first new observing system
- Competitively select Earth Venture Mission (EVM)-3 science investigations to address important science questions and produce data of societal relevance within the Earth science field
- Develop and release Version 4 of the NASA GISS Model E, NASA's model used most extensively in assessments of climate change
- Launch the Surface Water Ocean Topography (SWOT) mission, delivering the second new observing system
- Complete related activities (e.g., mission-development milestones, solicitations to advance equity and environmental justice in NASA Earth science research and applications) that also will enable NASA to use the global vantage point of space to advance our understanding of the Earth system

Goal Team

Science Mission Directorate

Associate Administrator: Sandra Connelly, Acting
Deputy Associate Administrator: Eric Ianson, Acting

Earth Science Division

Director: Dr. Karen M. St. Germain

Goal Strategies

In May 2021, NASA announced the implementation of the Earth System Observatory (ESO) in response to the 2017-2027 Decadal Survey, consisting of a new set of Earth-focused missions to provide key information to understand the Earth's systems and processes, as well as interactions between the processes on the land, ocean, and in the atmosphere. We use our understanding of natural processes and their interactions to provide objective information on changes happening now, as well as estimates of how our environment might evolve in the future.

By September 30, 2023, NASA will further advance climate change research and the recommendations of the Decadal Survey by delivering two new observing systems, Landsat 9 and SWOT, and an upgrade to GISS Model E, NASA's model used most extensively in assessments of climate change. NASA also will complete several activities that will enable us to conduct ESO research in a way that better addresses diverse community needs and will expand our ability to use the global vantage point of space to advance our understanding of the Earth system. NASA will:

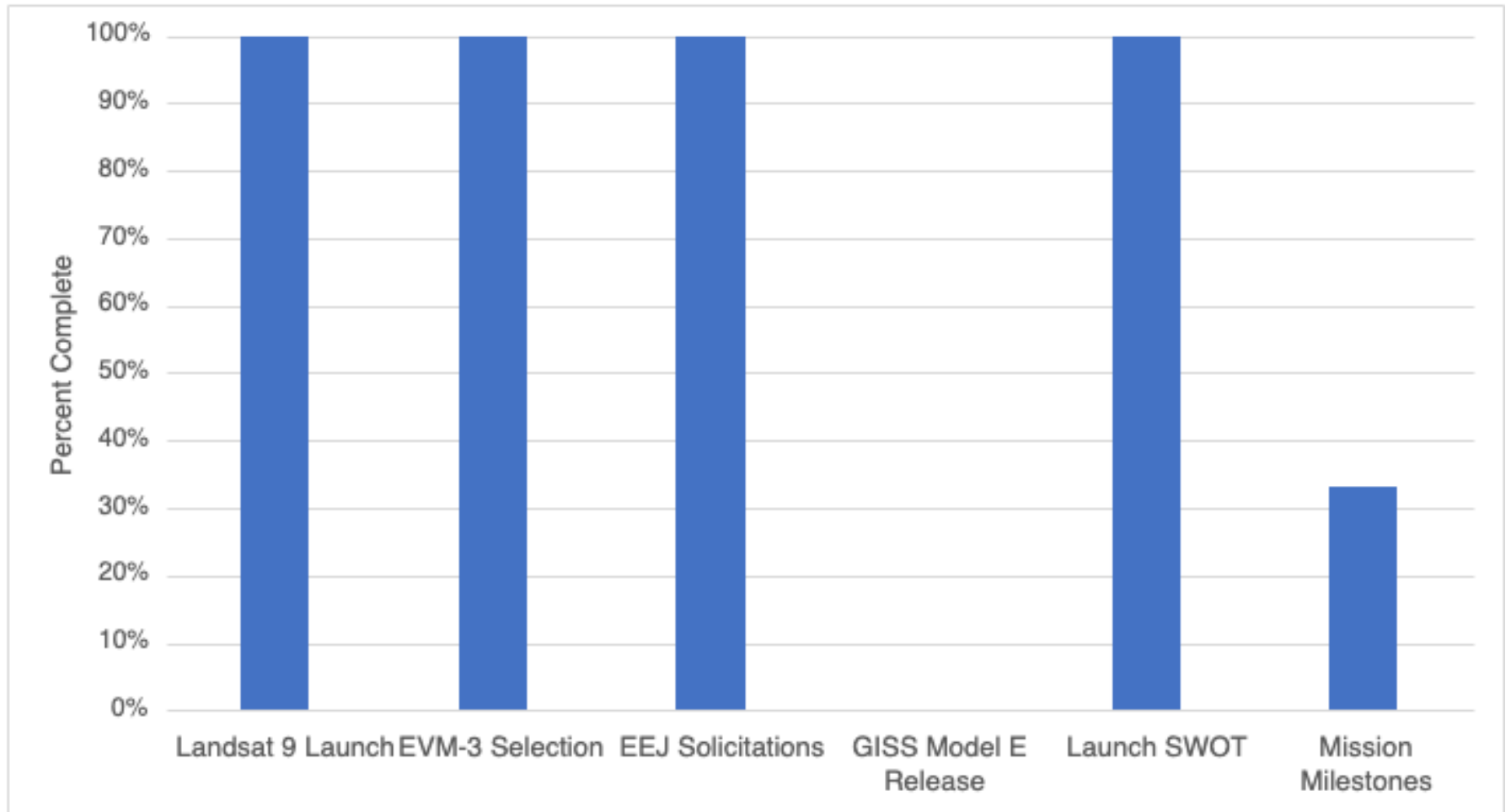
- Competitively select a low-cost, innovative Earth system mission (EVM-3)
- Deliver an investigation for the ISS that will study the role of dust in climate change and Earth science
- Deliver a set of cubesats that will study Arctic warming, sea ice loss, and ice-sheet melting
- Complete a major review in the development of the Libera instrument (planned to fly on NOAA's Joint Polar Satellite System-3), which will measure solar radiation reflected by Earth's surface and atmosphere and terrestrial radiation emitted by Earth and vented to space
- Release equity and environmental justice research opportunity solicitations to expand their role in NASA's research program

Goal target(s)

Achievement statement Repeat the achievement statement from the goal statement on the previous slide		Key indicator(s) A "key performance indicator" measures progress toward a goal target	Quantify progress These values enable us (and you!) to calculate % complete for <u>any</u> type of target*			Frequency When is there new data?
By...	We will...	Name of indicator	Target value	Starting value**	Current value	Update cycle
12/31/2021	Launch Landsat 9 <ul style="list-style-type: none"> • Launch Landsat 9 • Complete on-orbit checkout • Release first light images 	Landsat 9 Launch	100%	0%	100%	quarterly
12/31/2021	Competitively select Earth Venture Mission (EVM)-3 science investigations <ul style="list-style-type: none"> • Issue Announcement of Opportunity • Select EVM-3 investigations 	EVM-3 Selection	100%	0%	100%	quarterly
03/31/2022	Release Equity and Environmental Justice (EEJ) solicitations <ul style="list-style-type: none"> • Release Earth Science Applications: Equity and Environmental Justice • Release Environmental and Climate Justice using Earth Observations 	EEJ solicitation	100%	0%	100%	Quarterly
12/31/2022	Release NASA GISS Model E <ul style="list-style-type: none"> • Develop model • Test model • Release model 	GISS Model E Release	100%	0%	0%	quarterly
06/30/2023	Launch SWOT <ul style="list-style-type: none"> • Complete Operational Readiness Review • Deliver SWOT to launch site • Complete integration with launch vehicle • Launch SWOT 	Launch SWOT	100%	0%	100%	quarterly
09/30/2023	Complete mission development milestones <ul style="list-style-type: none"> • Deliver EMIT for launch • Complete Libera Critical Design Review • Deliver PREFIRE cubesats 	Mission milestones	100%	0%	33%	quarterly

Key Indicators

FY 2023 Q1



Key Milestones

Milestone Summary			
Key Milestone	Milestone Due Date	Milestone Status	Comments
Release Landsat 9 first light images to continue the program's critical role in monitoring, understanding and managing the land resources needed to sustain human life	FY 2022 Q1	Completed	First images were obtained on 10/31/2021
Competitively select Earth Venture Mission (EVM)-3 to enable low-cost, innovative capability to better understand the Earth system	FY 2022 Q1	Completed	Selections announced on 11/5/2021
Release Equity and Environmental Justice research opportunity solicitations to expand the role of EJ and Equity in NASA's research program	FY 2022 Q2	Completed	Selections expected for Applications solicitation in 2022, R&A in 2023.
Deliver Earth Surface Mineral Dust Source Investigation (EMIT) for launch on ISS to explore the role of dust in climate change and Earth science	FY 2022 Q3	Completed	Delivered 5/3/22 in preparation for launch. Installed on ISS in July.
Initiate Phase A for at least two of Earth System Observatory missions addressing four designated observables from the 2017 Decadal [Atmosphere Observing System (AOS); Surface Biology and Geology (SBG); and Mass Change (MC)] to create a 3D, holistic view of Earth, from bedrock to atmosphere	FY 2022 Q4	Delayed	SBG Key Decision Point A (KDP-A) held in November; AOS KDP-A scheduled for January; MC KDP-A scheduled for March..
Develop and release Version 4 of the NASA GISS Model E Earth system model to improve assessments of climate change	FY 2023 Q1	Delayed	FY 2023 Q2 release anticipated.
Complete Libera Critical Design Review (CDR) to enable continuity in the vitally important Earth radiation budget climate data record	FY2023 Q2		
Launch the Surface Water Ocean Topography (SWOT) mission to make the first global survey of Earth's surface water and measure how water bodies change over time	FY 2023 Q3	Completed	SWOT launched 12/16/2022
Deliver Polar Radiant Energy in the Far InfraRed Experiment (PREFIRE) CubeSats to understand Arctic warming, sea ice loss, and ice-sheet melting	FY2023 Q4		

Narrative – FY 2023 Q1

NASA delivered a new observing system on December 16, 2022, with the launch of Surface Water Ocean Topography (SWOT), a collaborative mission with the French space agency, Centre National d'Etudes Spatiales (CNES) (with contributions from the Canadian Space Agency (CSA) and the UK Space Agency). SWOT will survey nearly all water on Earth's surface for the first time, measuring the height of the world's oceans, rivers, and lakes, helping scientists track how fresh and saltwater bodies change over time. The satellite will help scientists investigate how the oceans absorb atmospheric heat and carbon, moderating global temperatures and climate change. A global inventory of water resources will help scientists better understand where the water is, where it's coming from, and where it's going. The observations will benefit people on Earth by helping improve flood forecasts, improving the models used to monitor droughts, and improving predictions for sea level rise. The observations also will benefit industries like shipping by providing measurements of water levels along rivers, as well as information about tides, currents, and storm surges in the ocean.

NASA also commenced Key Decision Point-A (KDP-A) reviews for Earth System Observatory missions, conducting the first, for the Surface Biology and Geology (SBG) mission, in November, with reviews for the Atmosphere Observing System (AOS) and Mass Change (MC) missions scheduled for FY 2023 Q2. The observatory seeks to implement recommendations from the 2017 Earth Science Decadal Survey by the National Academies of Sciences, Engineering and Medicine, which lays out ambitious but critically necessary research and observation guidance for our changing planet. Successful completion of the KDP-A reviews will initiate the concept and technology development phase – known as Phase A – resulting in proposed mission architectures. NASA delayed the reviews from Q4 FY 2022 in order to incorporate Independent Review Board recommendations, which resulted in adjustments to the AOS mission. NASA uses independent reviews for early-stage strategic missions to put these important and complex science missions on the path to success.

NASA's work on Version 4 of the NASA GISS Model E Earth system model has continued, with progress on the coupling of the atmosphere to the higher resolution ocean model, which is required to consistently represent surface fluxes at higher resolutions. Atmospheric composition treatment within the new atmospheric cloud routines is now complete. Ocean simulations with eddy-resolving resolution (~1/8th degree) show promising results compared to observations. Some work remains to be done on the sea ice dynamics, but code integration and testing is underway, for an anticipated release in Q2 FY 2023, one quarter later than initially planned.

Data Accuracy & Reliability

Verification and Validation:

- NASA monitors and tracks its progress towards this goal using various Agency documents and reports, including Directorate Program Management Council (DPMC) materials, monthly reports from projects and partners, and other program-internal documents.

Data Source(s):

- Emails and program-internal documents indicating progress toward advancing our understanding of the Earth system, its processes, and changing climate.

Level of Accuracy Required for Intended Use:

- Using the documents and reports referenced above, the Agency is able to accurately report at the end of each quarter on whether or not it has met its planned milestones.

Data Limitations:

- Materials may include export-controlled technical information or industrial partner proprietary information, which could not be released publicly.

How the Agency Compensates for Data Limitations:

- NASA has not identified any data limitations that would preclude it from reporting accurate, reliable, and timely performance information.

Additional Information

Organizations

International Partners

- SWOT: Centre National de Etudes Spatiales (CNES), Canadian Space Agency (CSA), United Kingdom Space Agency

Interagency Partners

- Landsat 9: U.S. Geological Survey (USGS)

Contributing Programs

Program Activities:

- Applied Sciences; Earth Science Data Systems; Earth Science Research; Earth Science Technology; Earth System Explorers; Earth System Science Pathfinder; Earth Systematic Missions; Suborbital programs

Stakeholder / Congressional Consultations

NASA provides periodic updates on progress to the Office of Management and Budget and Office of Science and Technology Policy. NASA also consults regularly with the science community and experts from industry and academia, such as the Earth Science Advisory Committee (ESAC) and the Committee on Earth Science and Applications from Space (CESAS) of the National Academies.