



# Geostationary Littoral Imaging and Monitoring Radiometer (GLIMR)



**International Ocean Colour Science (IOCS)  
Meeting**

**NASA Earth Systems Science Pathfinder  
Program Office (ESSPPO)**

Presented by: Timothy Bennett, NASA ESSPPO  
GLIMR Mission Manager

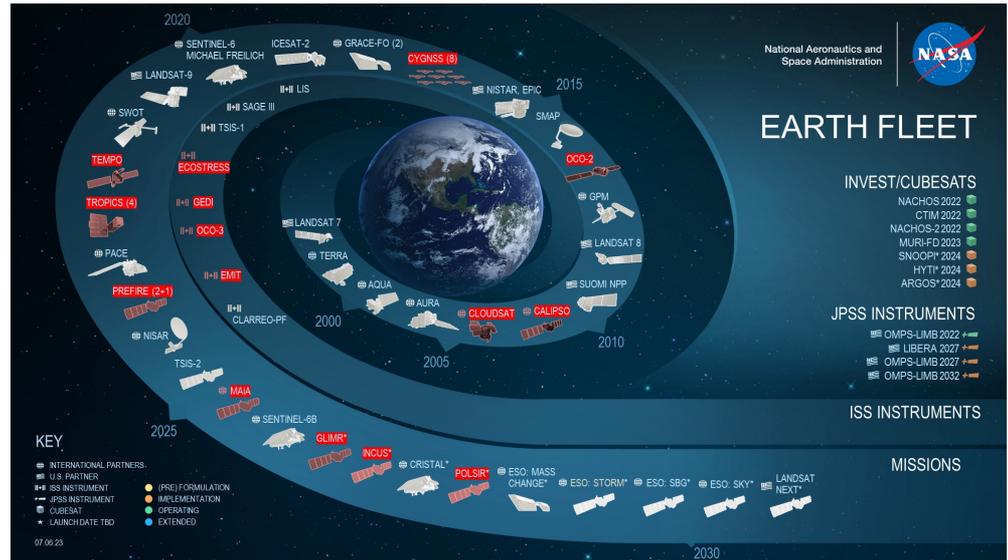
➤ **The goal is to stimulate new scientific understanding of the global Earth system by:**

- developing and operating remote-sensing missions
- conducting investigations using data from these missions
- addressing unique, specific, highly focused requirements in Earth science research

➤ **Projects in the ESSP portfolio are:**

- Science-driven
- PI-led investigations
- Competitively selected
- Orbital or sub-orbital
- Fixed cost- and schedule commitments

<https://essp.nasa.gov/latest-news/>



**ESSPPO EV projects account for a majority of NASA's Earth Fleet**



## ➤ May 2022 National Academies Paper Overview

- Restore more frequent launch opportunities, facilitate demonstration of innovative ideas and higher-risk technologies, and expand pool of well-qualified PIs and PMs.
- Competitively selected, PI-led, and implemented under strict cost- and schedule-constraints
  - Adherence to cost caps/schedule constraints critical to success.
- No single EV-class selection be an “essential” element of the ESD flight program.
- Recommend cadence of ~1 solicitation every 18 months to allow institutions to maintain proposal teams and ensure broad community engagement.

*\*Summary from May 2022 National Academies’ “Lessons-Learned in the Implementation of NASA’s Earth Venture Class” found here: <http://nap.nationalacademies.org/26499>*

EV Suborbital (EVS)	EV Mission (EVM)	EV Instrument (EVI)	EV Continuity (EVC)
<ul style="list-style-type: none"> <li>• Suborbital/airborne investigations</li> <li>• 5-year duration</li> <li>• Cost capped at ~\$150 million per solicitation</li> <li>• Solicited every ~4 years</li> </ul>	<ul style="list-style-type: none"> <li>• Small complete missions</li> <li>• 5 years to launch</li> <li>• Class D allowable</li> <li>• Small-sat or stand-alone payload as part of larger missions</li> <li>• Cost capped at ~\$190 million</li> <li>• Solicited every ~4 years</li> </ul>	<ul style="list-style-type: none"> <li>• Spaceborne instruments for flight on missions of opportunity (MoOs)</li> <li>• ≤5 years for development</li> <li>• Class C or D allowable</li> <li>• ~\$30 million to ~\$100 million total cost for development and operations</li> <li>• NASA provides access to space</li> <li>• Solicited every ~3 years</li> </ul>	<ul style="list-style-type: none"> <li>• Spaceborne instrument or missions</li> <li>• Specifically seeks to lower the cost for long-term acquisition of key “continuity” observations, rewarding innovation in mission-to-mission cost reduction through technology infusion, programmatic efficiency, and/or other means</li> <li>• Cost capped at ~\$150 million per solicitation</li> <li>• Solicited every ~3 years</li> </ul>

Current Earth Venture Structure

**ESSPPO projects must adhere to cost and schedule constraints to facilitate frequency of opportunities including access to space**



# GLIMR Actions from Key Decision Point C



- **GLIMR project experienced greater costs during design phase than planned**
- **To stay within cost and schedule constraints NASA approves the PI**
  - The ability to pursue threshold program level requirements appendix (PLRA)
    - Project is moving forward with threshold mission operations, 2 to 1 year of operations
    - All others currently still adhering to baseline requirements
  - To execute descopes to bolster confidence of project to stay within costs
    - Includes reduction of science team efforts for GLIMR
  - The ability to change the schedule constraint while holding to the cost constraint.
- **GLIMR's access to space (ATS) acquisition is put on hold until further progress with the instrument development**
  - Allows ESSPPO to continue identifying options for GLIMR ATS, but procurement is not available until future Key Decision Point.

**NASA approved GLIMR to continue the development of the instrument**

Variable Name	Data Product	Spectral Range (nm)	Units
<i>Rrs</i>	Water-leaving remote sensing reflectance	360-720	sr <sup>-1</sup>
<i>A</i>	Total absorption coefficient	400-600	m <sup>-1</sup>
<i>A<sub>φ</sub></i>	Phytoplankton absorption coefficient	400-600	m <sup>-1</sup>
<i>a<sub>CDM</sub></i>	CDOM+detritus absorption coefficient	400-600	m <sup>-1</sup>
<i>b<sub>bp</sub></i>	Particulate backscattering coefficient	400-600	m <sup>-1</sup>
<i>K<sub>d</sub></i>	Spectral Diffuse attenuation coefficient for downward irradiance	400-600	m <sup>-1</sup>
<i>K<sub>PAR</sub></i>	Diffuse attenuation coefficient for PAR	400-700 integrated	m <sup>-1</sup>
<i>Chl-<i>a</i></i>	Chlorophyll concentration	N/A	mg m <sup>-3</sup>
<i>FLH</i>	Fluorescence line height	N/A	unitless
<i>PAR</i>	Photosynthetically Available Radiation	400-700 integrated	E m <sup>-2</sup> d <sup>-1</sup>

Table 4. GLIMR standard ocean color data products

**GLIMR required data products are different then proposal**



# GLIMR Access to Space Status



- **Market Research/Survey to define opportunity space (Ongoing)**
  - Program office continues to engage the project to mature the payload to host interface control document (ICD) and host spacecraft requirements document (HSRD)
- **Program office awarded accommodations trade studies for: - Completed**
  - GTO to GEO transfer time of up to 6 months (Radiation effects on instrument)
  - Instrument modifications needed for relaxed SC to instrument on-orbit disturbances
  - Instrument modifications needed for all GEO launch vehicles environments
  - Instrument modifications needed for reduced instrument to SC on-orbit disturbances
- **Initial request for information (RFI) from potential commercial or government access to space – Completed 9/2/22**
- **Program office to develop spacecraft to instrument trade studies (End of FY23)**
  - Identify updated opportunity space
  - Perform instrument mounting analyses for launch conditions and on-orbit jitter analyses
  - Identify the need for additional instrument modifications
- **GLIMR was selected to be a Hosted Payload**
  - Reviewing lessons learn from TEMPO access to space procurement and development

**GLIMR ATS is progressing within family of EV projects**



# GLIMR Science Opportunities



- **All earth venture projects that have been placed in orbit have had operations extended multiple times.**
  - TROPICS spacecraft 1/2 was launched unsuccessfully; TROPICS spacecraft 3-6 was launched successfully
  - GEOCarb is currently in storage at NASA
- **One year baseline operations planned for GLIMR**
  - Provides sufficient information to improve data products algorithms
  - Provides sufficient data to determine future data products and algorithms
  - Extended operations could provide funded opportunities for science team development
  - Other government agencies are interested in GLIMR and could provide funded opportunities for science team development

**While there was a need to reduce GLIMR science development costs, there could be future opportunities to recover and increase science developments**