

ACROSS

Enabling Time Domain and Multi-Messenger Astronomy

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Motivation

- The Astro 2020 Decadal Survey identified Time Domain and Multi-Messenger (TDAMM) Astrophysics as the highest-priority sustaining activity in space.
 - Space-based follow-up observations of Targets of Opportunity are often ad hoc, inefficient, and less scientifically effective than it could be
- NASA's mission development and operations funding structures ensure focused and lean science teams, but have unintended consequences
 - It is difficult for missions to allocate resources for capabilities that are not directly aligned with their primary science cases
- NASA's competitive general observing programs are not well suited for some important science cases
 - For example, rare events and sources that are rapidly evolving, panchromatic or multimessenger, among others

Background

- The PhysCOS Time-Domain and Multi-Messenger (TDAMM) Initiative responds to a top priority of the Astro2020 decadal report recommendation and has been tasked with:
 1. Organizing or supporting TDAMM workshops,
 2. Conducting a three-year TDAMM Study investigating policy, processes and technical coordination mechanisms to enable TDAMM science,
 3. Recommending one or more potential implementations for enabling TDAMM science support
- The Astrophysics Cross-Observatory Science Support (ACROSS) pilot project is an outcome of the first year of the TDAMM study, which identified needs for:
 1. Software & data systems to facilitate TDAMM science workflows,
 2. TDAMM help desk to provide expertise & facilitate coordination, and
 3. TDAMM community grant program to incentivize scientific innovation

Vision & Mission

- To enable effective TDAMM science cases by providing NASA's fleet-wide coordination infrastructure
- Partner with missions, observers, and science teams across multiple astrophysics domains to maximize the scientific return of NASA's contributions to the diverse, global, and evolving TDAMM ecosystem



ACROSS Core Activities

- ✦ How will ACROSS enable effective TDAMM science?
 1. Science Feasibility Tools
 2. Modern Target of Opportunity Resources
 3. TDAMM Web portal
 4. Funding Opportunity
 5. Community Support

ACROSS Activities - Science Feasibility Tools

Science Feasibility Tools	Requirements / Objectives
Pointed Instruments	• Long- and short-term observing plans • Target visibility & observability • Constraints on planning / scheduling feasibility • Mission target histories
Wide-Field Instruments	• Whether event of interest was coincidentally detected • When was a source last within FoV • When will a source next be within FoV
Ground Observatories	• Opportunity to prototype interfaces with ground-based facilities

Fleet State and Status Information Streams

ACROSS Activities - Modernize ToO Resources

Target of Opportunity Resources	Requirements / Objectives
ToO API	• The development of a comprehensive ToO submission API
ToO Webpages	• Front end webpages to submit and interface with the ToO API • Display ToO submission history by mission and user • Incorporates cross-observatory science feasibility information streams and follow-up decision support tools.
ToO Toolkit	• A python software toolkit to assist in the programmatic planning and execution of ToO requests

Modernize NASA's ToO Infrastructure

ACROSS Activities - TDAMM Web Portal

Web Portal	Requirements / Objectives
Mission State and Status	• TDAMM-relevant mission capability summaries • Mission status dashboard and observing schedules
Tools & Resources	• Links to ACROSS and community-developed tools
ToO Infrastructure	• Custom ToO pages for participating missions • User sign-on for ToO management
Funding Opportunities	• Links to upcoming ACROSS and funding opportunities • Summary of joint observing opportunities
Conferences and Workshops	• Past and future TDAMM related conferences and workshops

Single Point of Entry for TDAMM Community Support

ACROSS Activities - Funding Solicitation

Funding Solicitation

Requirements / Objectives

Funding Opportunities

Subject to availability
of funding!

- Targeted at development of tools or observing modes that enable new science cases
- An opportunity for funding of DDT observations made by smaller missions (analogous to flagship DDT opportunities).
- An overarching TDAMM science call for proposals, designed to streamline or fill the gaps between existing joint observing calls, remove the risk of double jeopardy, and explicitly support observing programs which require coordination between two or more observatories.

Sustained Support for TDAMM Research & Infrastructure Development

ACROSS Activities - Community Support

Community Support	Objectives / Objectives
Conferences & Workshops	• Tutorials and training workshops • TDAMM conferences
Help Desk	• Subject matter experts to assist in coordinating “ACROSS” multiple observatories

Continued Engagement with the TDAMM Community

4th TDAMM Workshop

- Theme

- Developing community observing plans for rapid follow-up of explosive transients

- Motivation

- Define and prioritize science cases, triggering criteria, and the essential follow-up observations – ground and space – public and private – desired by the community so that observatory science teams can pre-coordinate plans and efficiently execute community-driven observations.

- Date/Location

- Oct 27-30, 2025 in Huntsville, Alabama

- Sponsors/Organizers

- ACROSS, PhysCOS, NSF NOIRLAB, USRA, UAH



Questions?

- ✦ To enable effective TDAMM science cases by providing NASA's fleet-wide coordination infrastructure.
- ✦ We partner with missions, observers, and science teams across multiple astrophysics domains to maximize the scientific return of NASA's contributions to the diverse, global, and evolving TDAMM ecosystem.
- ✦ “Doing what we must, because we can”

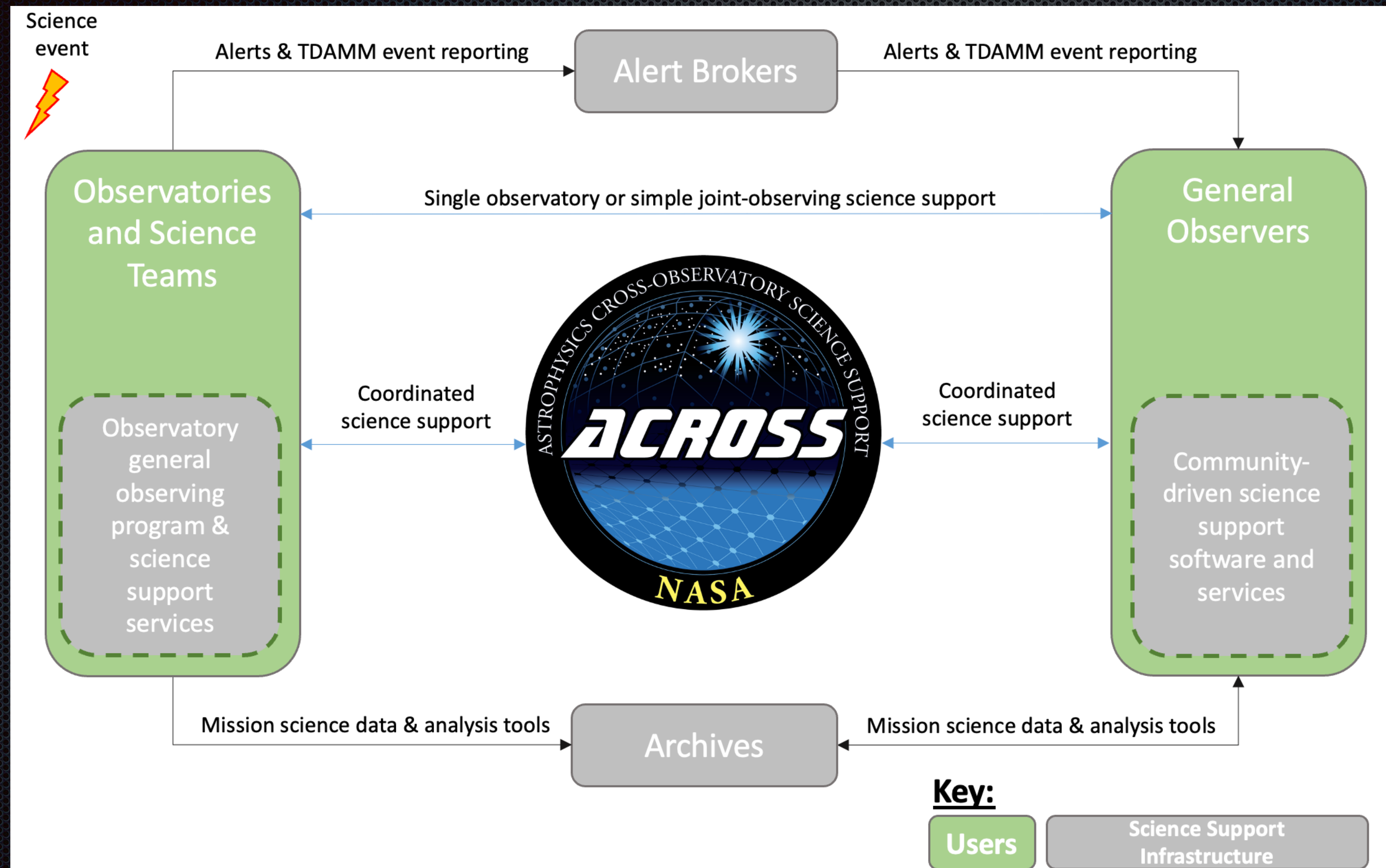


“NASA’s astrophysics cross-observatory science support (ACROSS) initiative: enabling time-domain and multimessenger astrophysics,”
Frontiers in Astronomy and Space Sciences, vol. 11, Nov. 2024

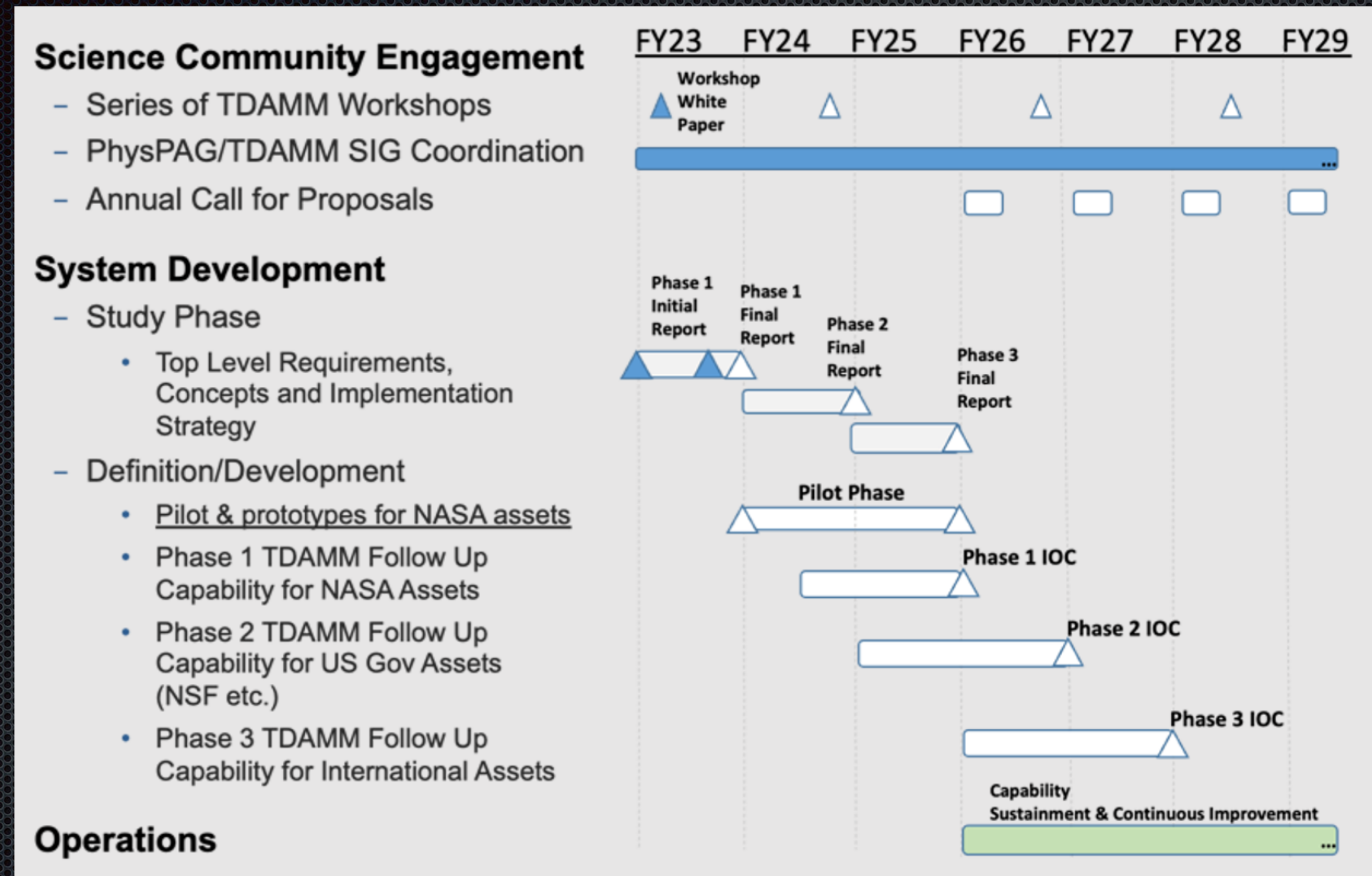


Backup

TDAMM Ecosystem Model



ACROSS Timeline



- Phases 2-3 of the study (2024-25) will address aspects of NASA space-based mission coordination with ground-based and international facilities