National Aeronautics and Space Administration

NASA Astrophysics Research & Analysis Update

Astrophysics Advisory Committee | Oct 20, 2023

Stefan Immler

R&A Lead, Astrophysics Division
Science Mission Directorate

Astrophysics R&A Program Officers:

Manuel Bautista
Valerie Connaughton
Shawn Domagal-Goldman
Michael Garcia
Hashima Hasan
Hannah Jang-Condell
William Latter
Roopesh Ojha
Mario Perez
Eric Smith
Sanaz Vahidinia
Dominic Benford
Antonino Cucchiara
Doris Daou
Thomas Hams
Doug Hudgins
Patricia Knezek
David Morris
Joshua Pepper
Kartik Sheth
Linda Sparke
John Wisniewski

Astrophysics Research & Analysis by the NUMBERS

RESEARCH

~350 U.S. Science PIs Funded Annually
~120 Individual Institutions Selected Annually
~$130M Awarded Annually

PROPOSALS

4,766 Total Proposals in FY23
1,056 R&A Proposals in FY23
3,710 GO/GI Proposals in FY23

STUDENTS

~600 Students Supported Annually

MISSIONS

6 General Observer Programs (Fermi, Swift, NuSTAR, NICER, TESS, IXPE)

3 General Observer Programs solicited separately (JWST, HST, Chandra)

SMALLSATS/ CUBESATS

2 Science Missions Launched
8 Science Missions in Development
1 ISS-attached Science Mission

SOUNDING ROCKETS

7 Suborbital Science Missions Launched in the last 15 Months
12 In Development

BALLOONS

9 Suborbital Balloons Launched in the last 15 Months
12 Missions in Development

Astrophysics R&A FY23 Highlights

FY23 was a record-breaking year for the Astrophysics R&A Program:

- The number of ROSES Astrophysics solicitations is at an all-time high (see slide below)
- We evaluated 1,708 proposals in R&A peer reviews (ROSES programs only), 4,766 proposals including JWST, HST, and Chandra – more than ever
- Despite high proposal pressure, selection rate was 22% R&A wide
- We notified 80% of all PIs within 111 days, exceeding internal 150d/180d goals
- We disbursed ~$130M in community funding – the largest amount in APD history
- We expanded the Inclusion Plan pilot program to 6 ROSES elements
- Proposals were evaluated using dual-anonymous peer reviews for 8 ROSES elements
- Our team of R&A Program Officers grew to 22, almost twice as many as ~10 years ago
- Held R&A Offsite retreat on Oct 12+13 at the Wallops Flight Facility for better R&A team members integration, improve team communication, and to discuss strategic and programmatic topics to improve processes and to better serve stakeholders

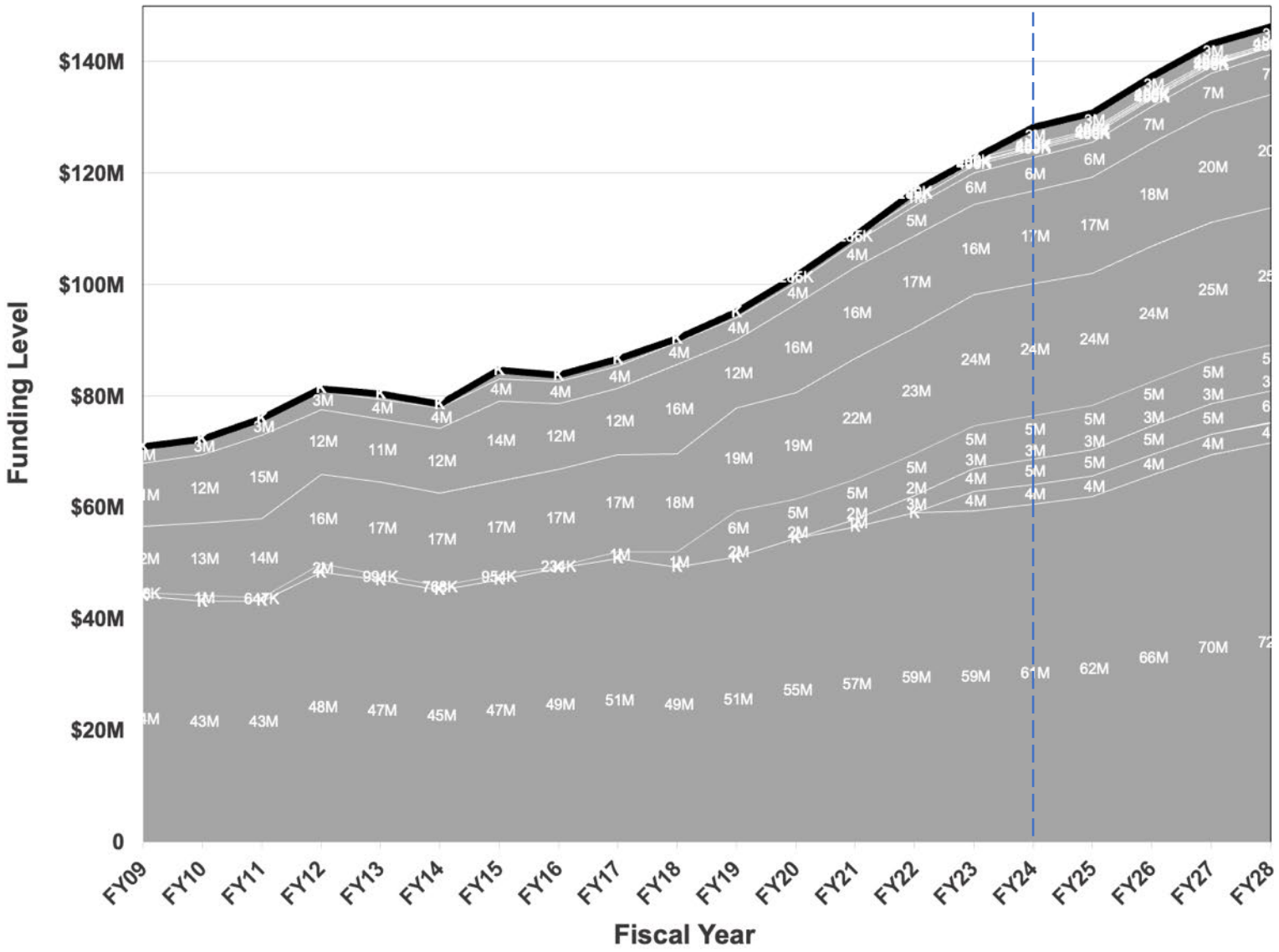
Astrophysics R&A Budget

NASA does not yet have a full FY24 appropriation, and the subsequent charts are based upon anticipated outcomes of House and Senate negotiations for the final agency budget.
The in-guide FY24 and beyond funding targets for the R&A program have been notionally set (see next slides).

The following FY24 augmentations to R&A programs are still under consideration:

- **ADAP:** augmentation to accommodate the analysis of Euclid data (31% selection rate).
- **TCAN**: double the funding allocation for theoretical and computational network opportunities to increase selection rates from currently 11% to >20%, and to address Astro2020 Decadal Survey priorities for a higher funding allocation in support of astrophysics theory.
- **XRP**: augmentation to the Exoplanets Research Program to address Astro2020 Decadal Survey priorities (22% selection rate).
- **CubeSats**: increase the $5M/year funding allocation to allow the selection and launch of one CubeSat per year despite increases costs from $5M per CubeSat at the inception of the program to current costs of $6.7M per CubeSat.

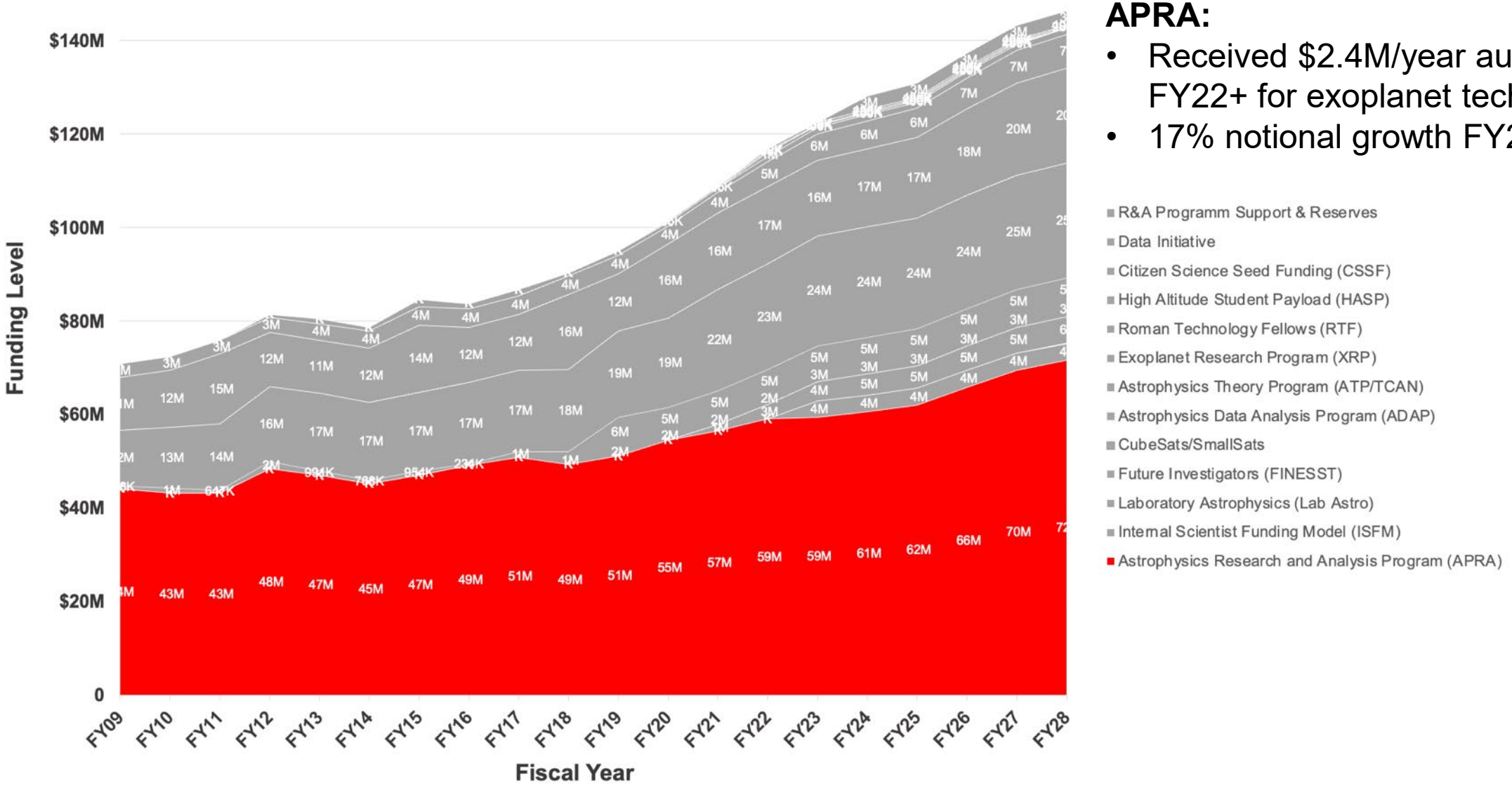
Notional Astrophysics R&A Planning Budget



Notional R&A Growth:

- Despite fiscal challenges, R&A will continue to grow.
- Net growth in each year, incl. FY25.
- 15% notional growth FY24-28.

Notional Astrophysics R&A Planning Budget



APRA:

- Received $2.4M/year augmentation in FY22+ for exoplanet technologies.
- 17% notional growth FY24-28.

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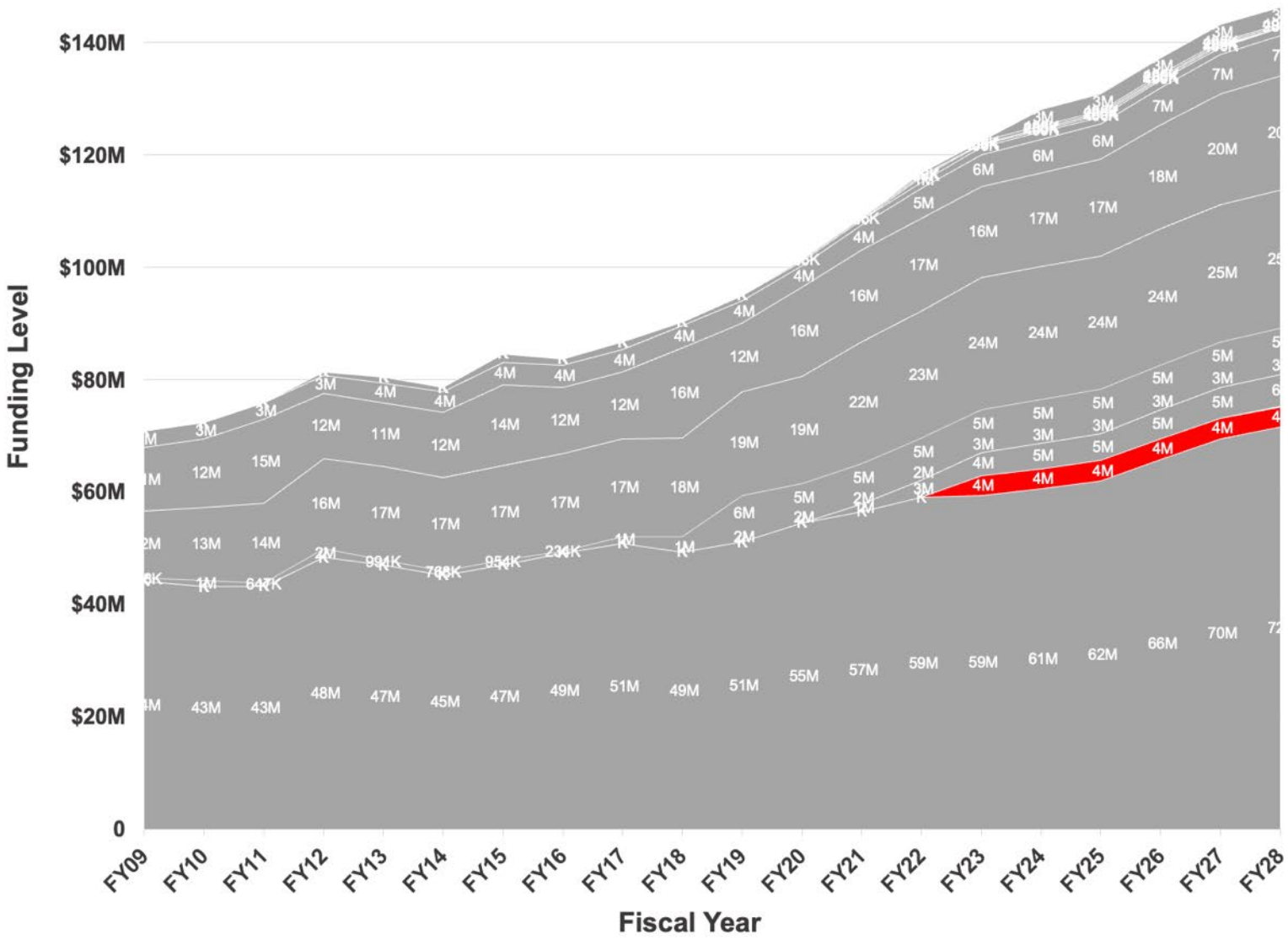

ISFM:

- Used to be a tax on APRA+ADAP+ATP and is now a separate funding line.
- 2% notional growth FY24-28 as proposed.

- R&A Programm Support & Reserves
- Data Initiative
- Citizen Science Seed Funding (CSSF)
- High Altitude Student Payload (HASP)
- Roman Technology Fellows (RTF)
- Exoplanet Research Program (XRP)
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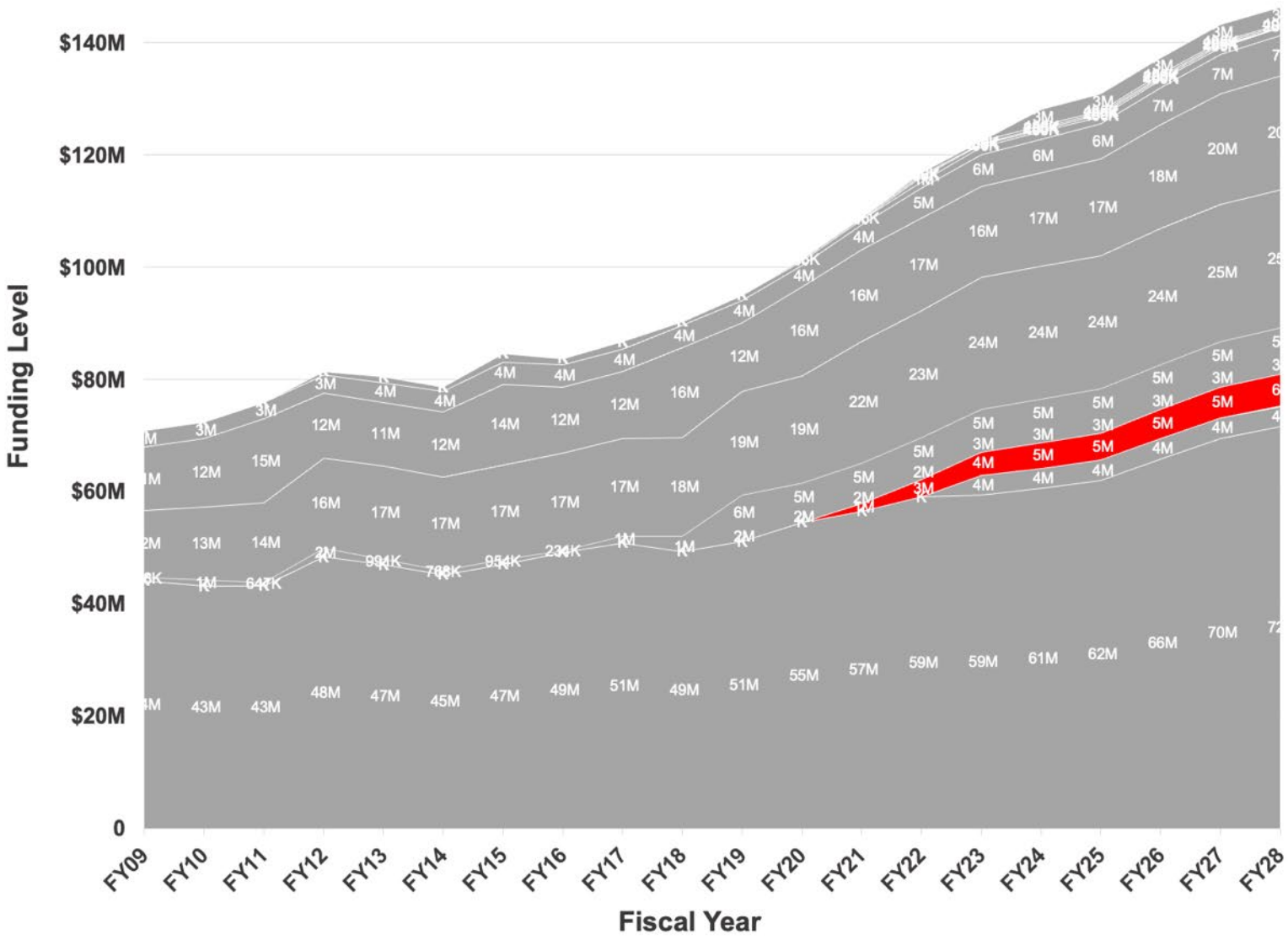

Lab Astro:

- Proposals solicited through APRA.
- Received $1.25M/year infrastructure augmentation in FY22+.
- 17% notional growth FY24-28.

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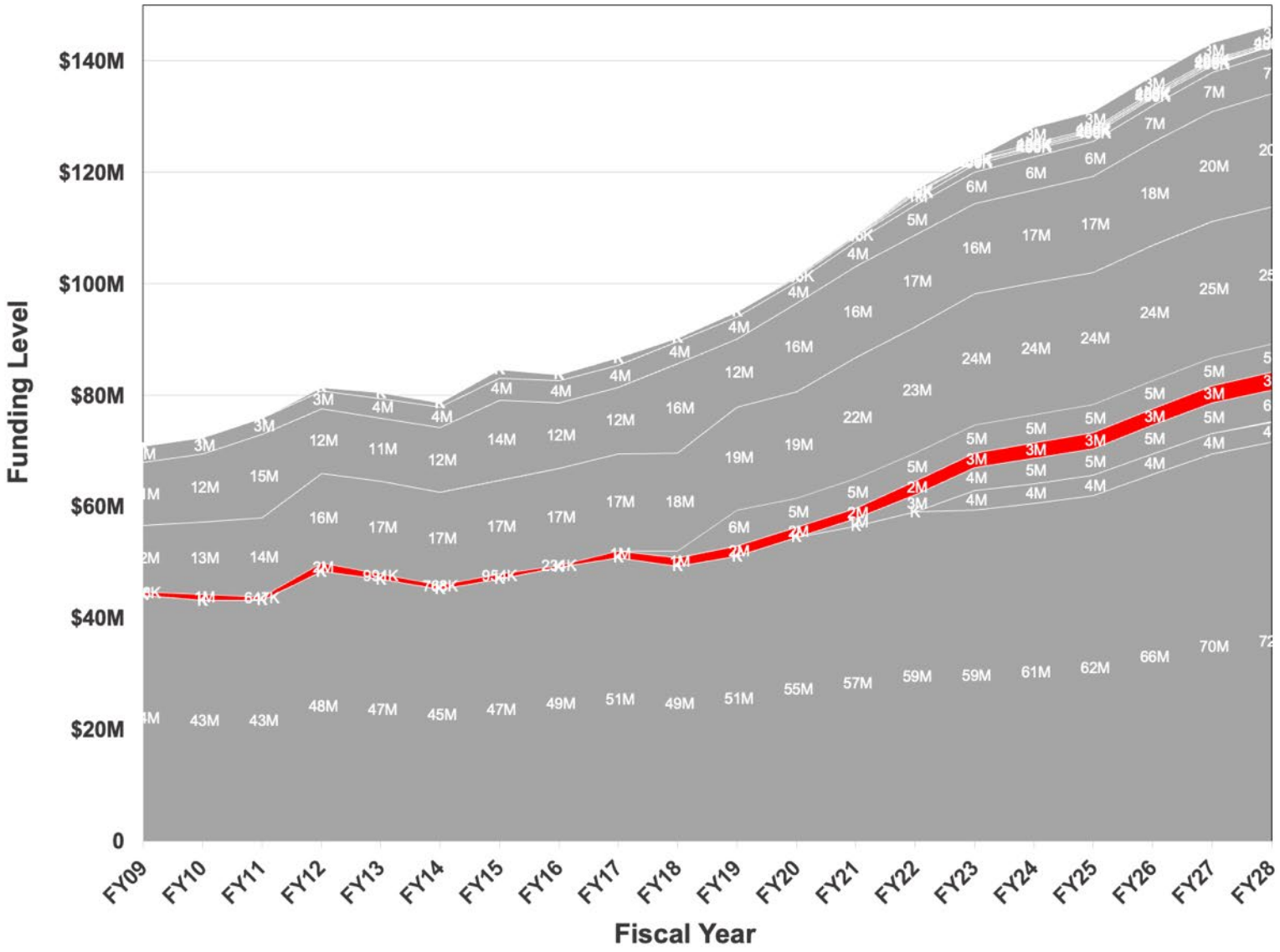

FINESST:

- See slides below.
- Received numerous augmentations over the past few years.
- 22% notional growth FY24-28.

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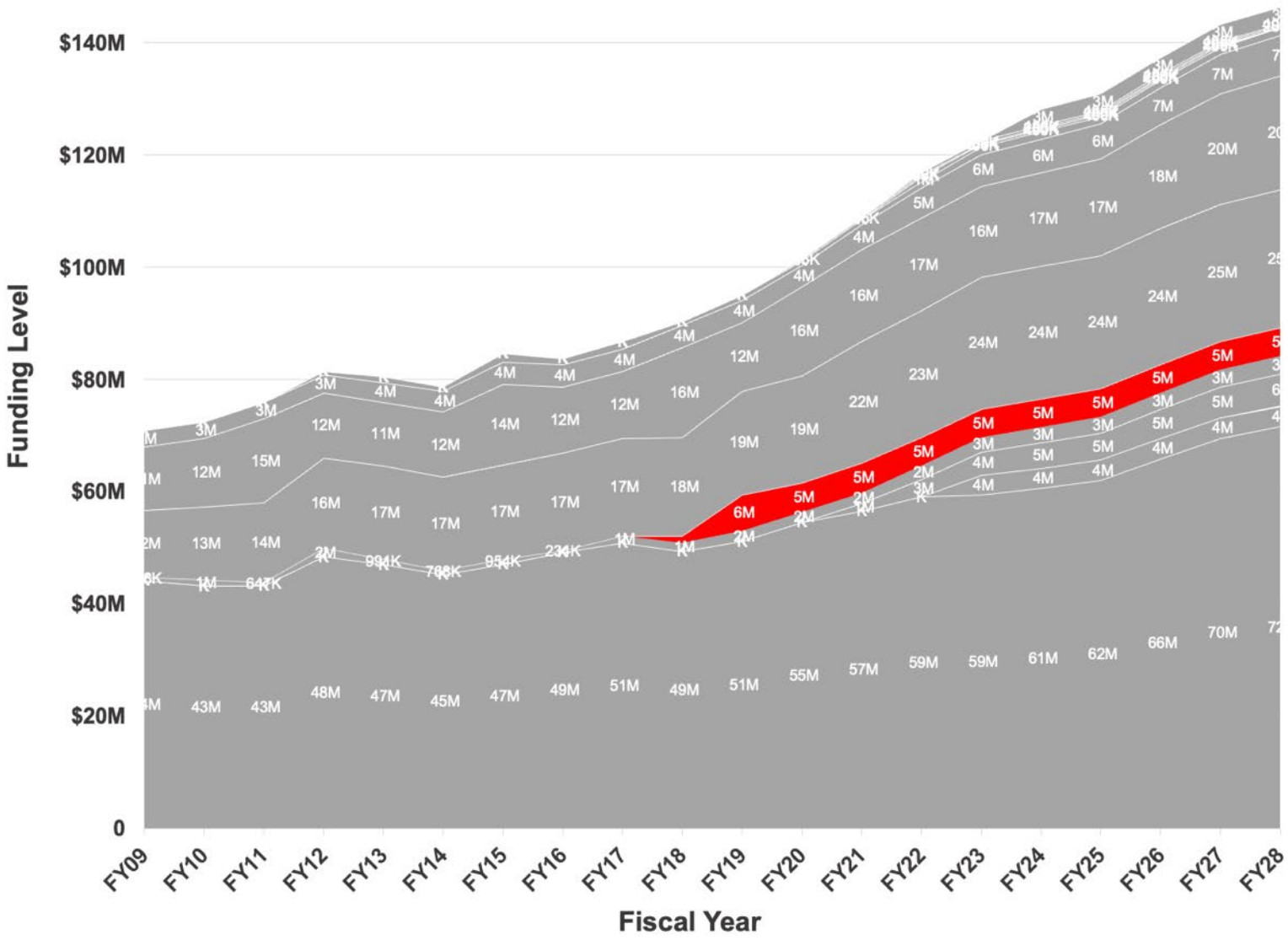

CubeSats:

- See slides below.
- $5M/year no longer sufficient for 1 new CubeSat selection per year.
- Augmentation request pending.

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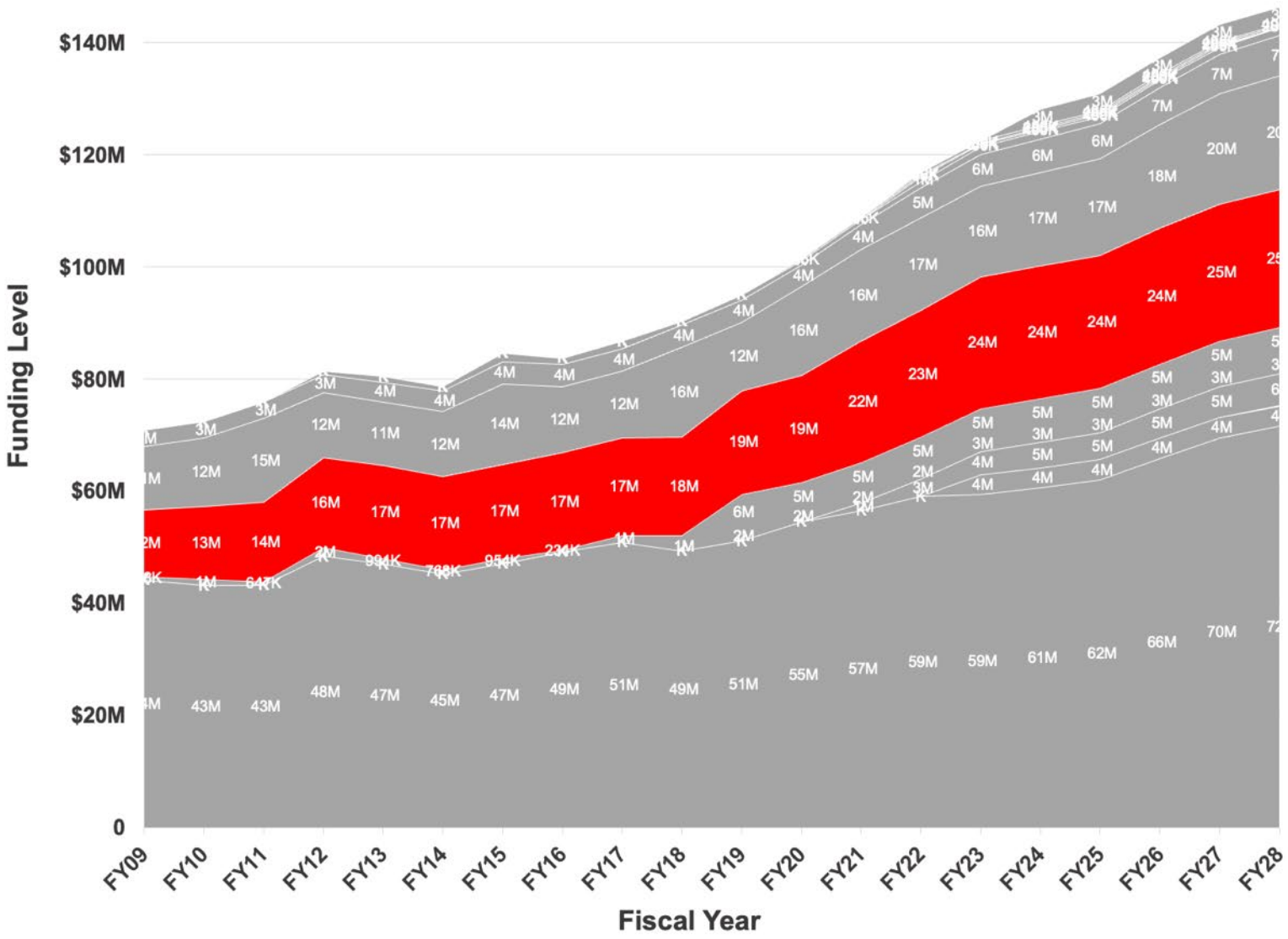

ADAP:

- Augmentation request for the analysis of Euclid data pending.
- 4% notional growth FY24-28.

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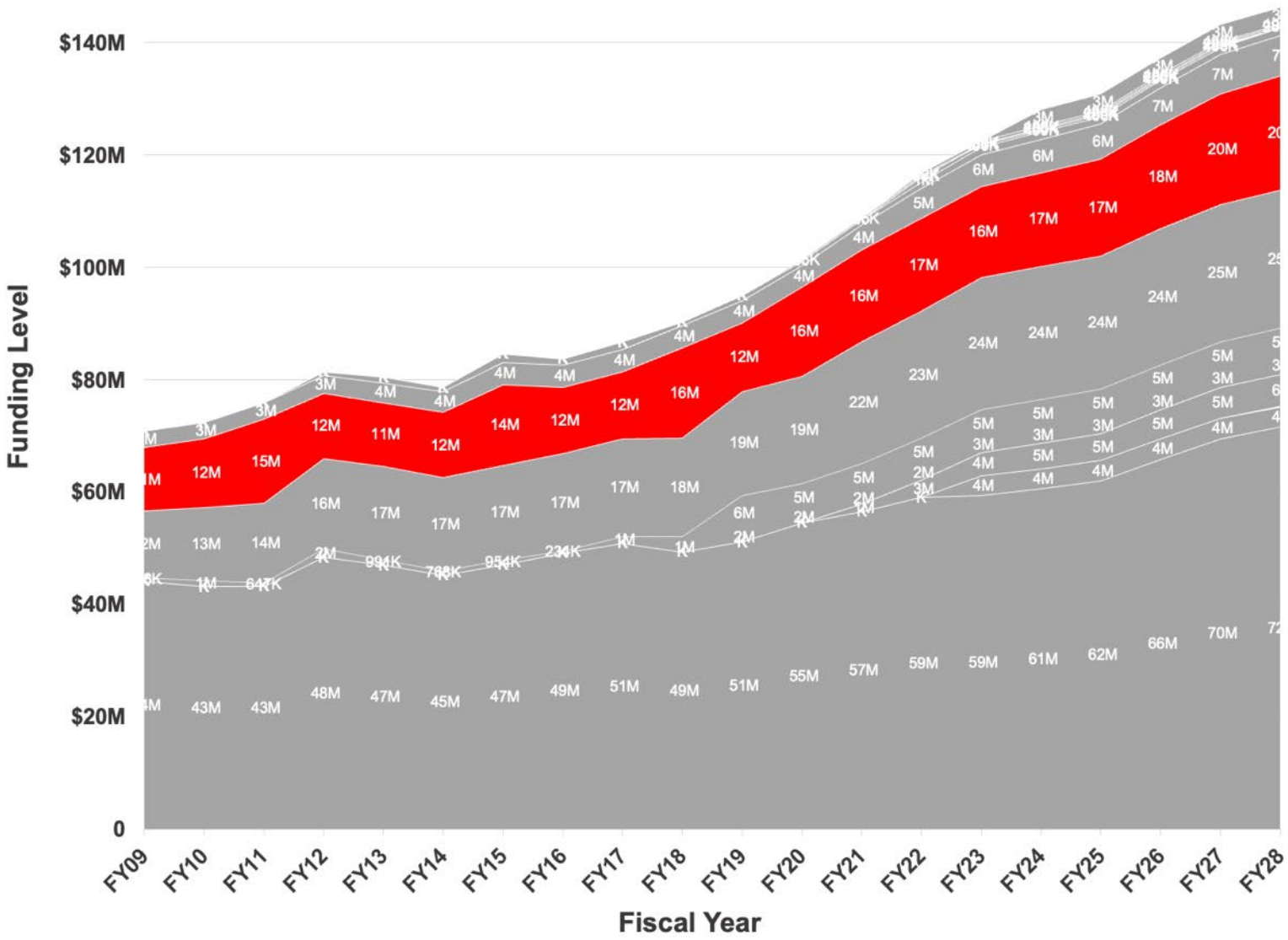

Theory (ATP+TCAN):

- See slides below.
- FY24 augmentation request to double funding of TCAN proposals pending.
- 17% notional growth FY24-28.

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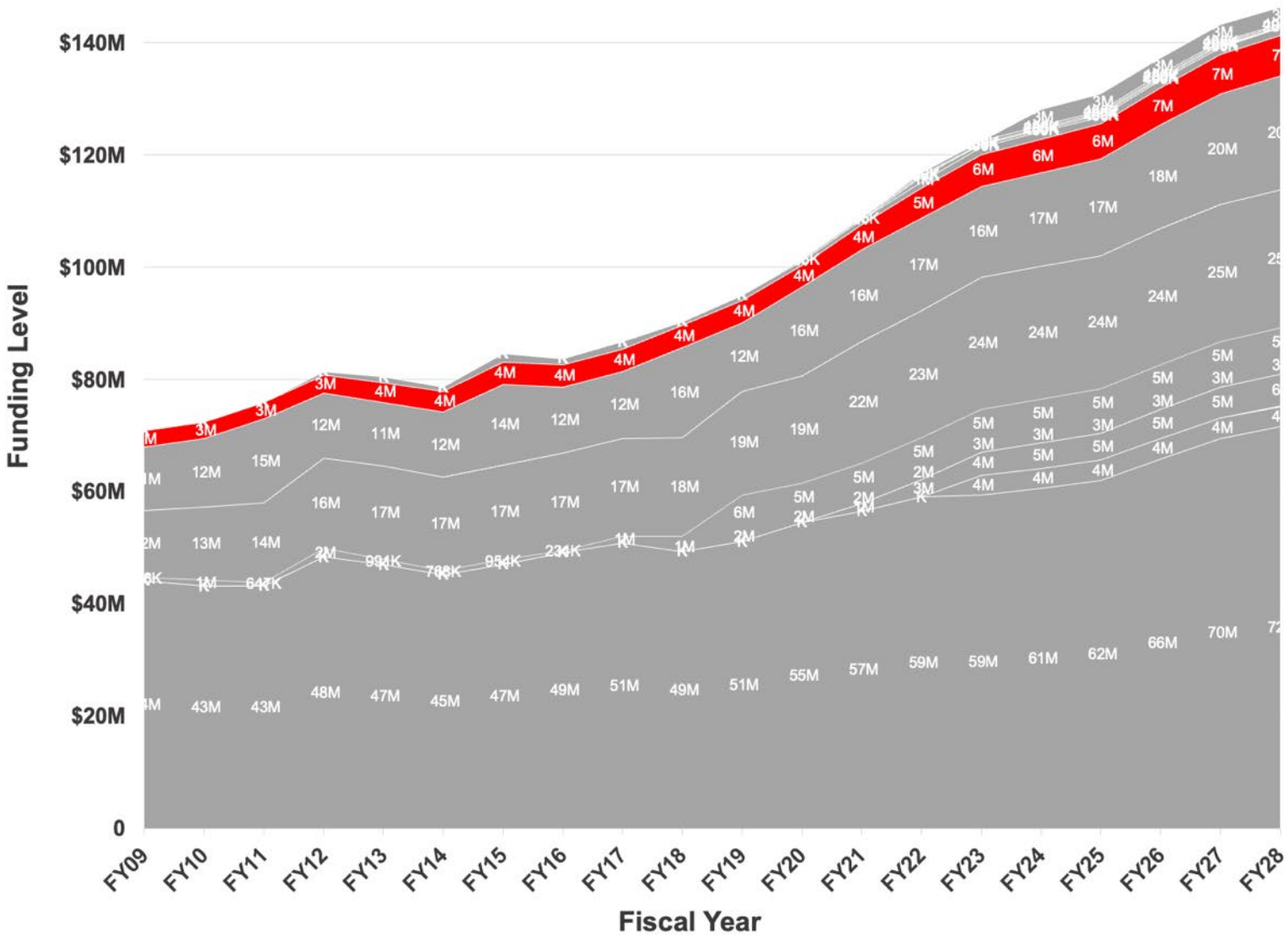

XRP:

- FY24 augmentation request pending.
- 23% notional growth FY24-28.

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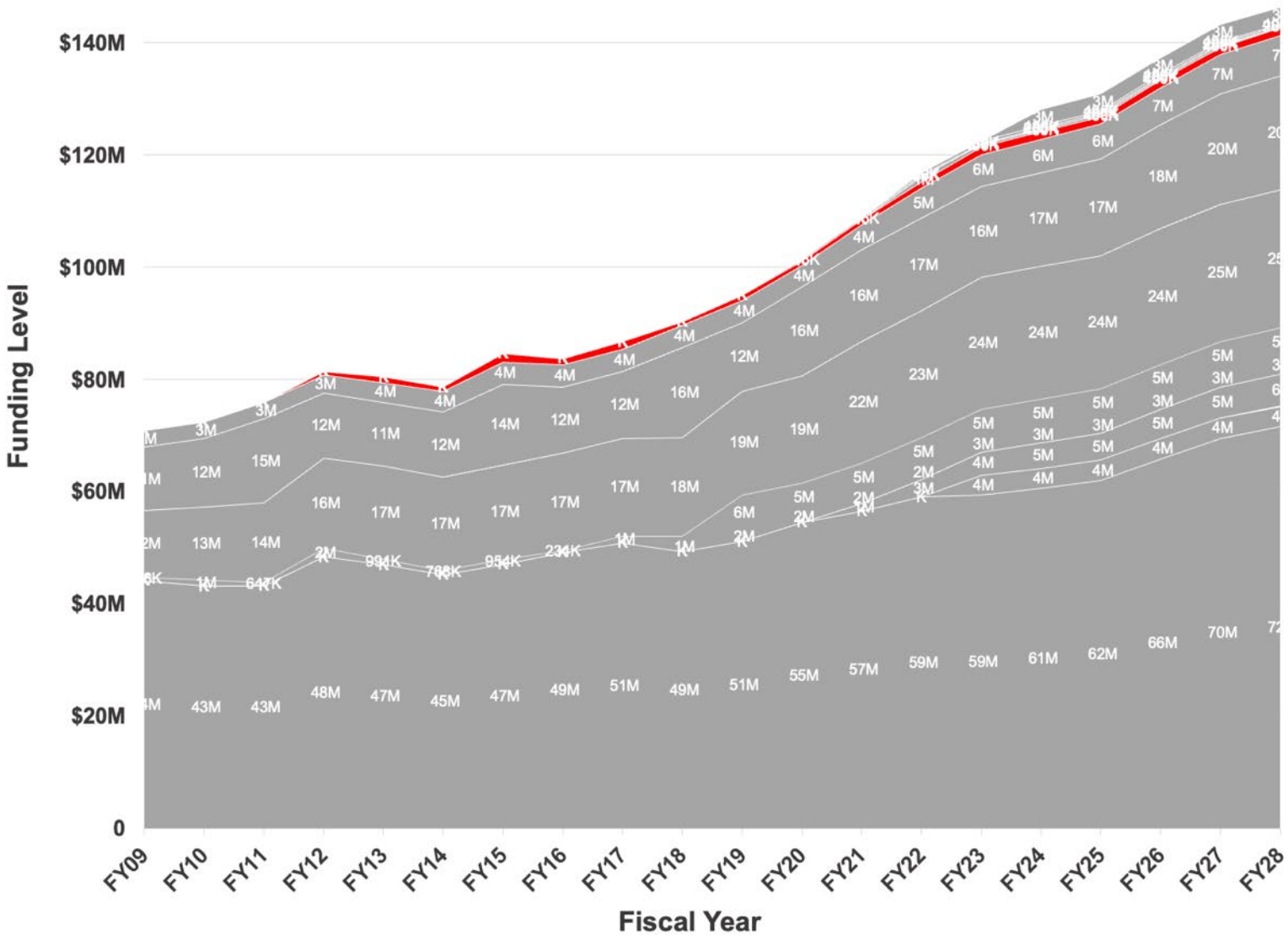

RTF:

- Proposals solicited through APRA+SAT.
- Received $300k/year augmentation from $1M to $1.3M at PPBE-24.

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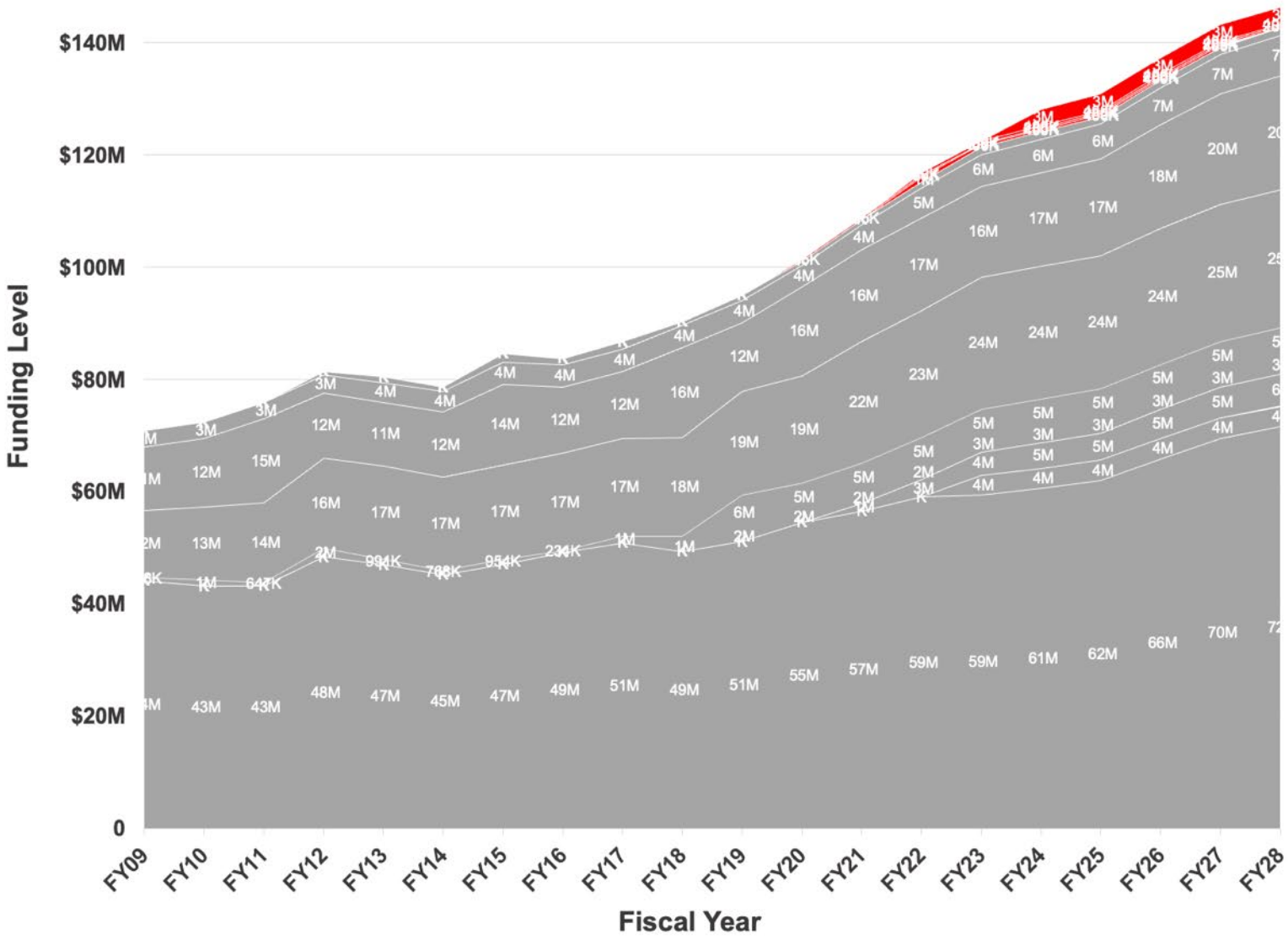

Others:

- Other smaller R&A programs have no pre-planned growth and can be adjusted as needed.

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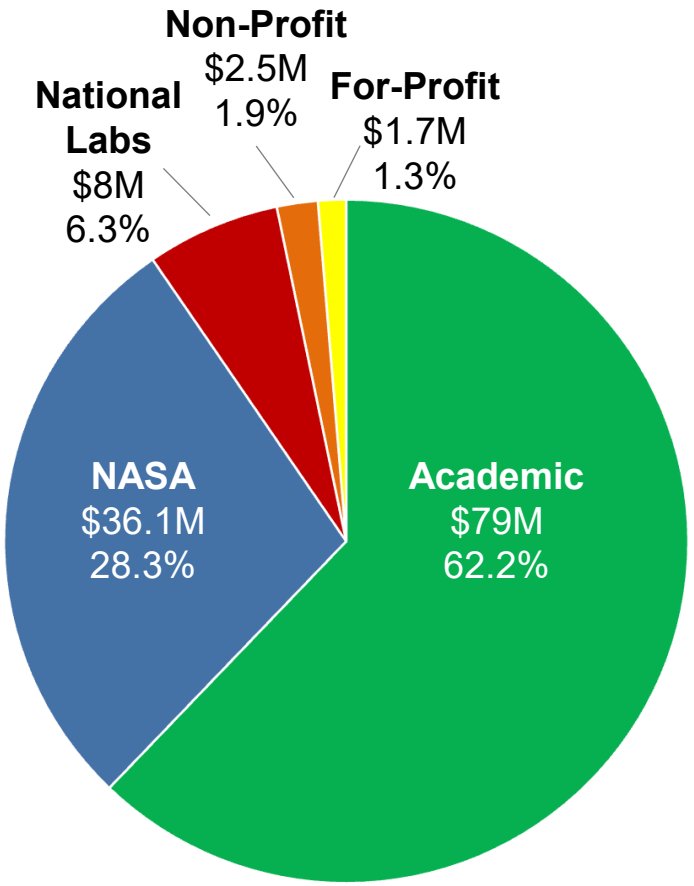
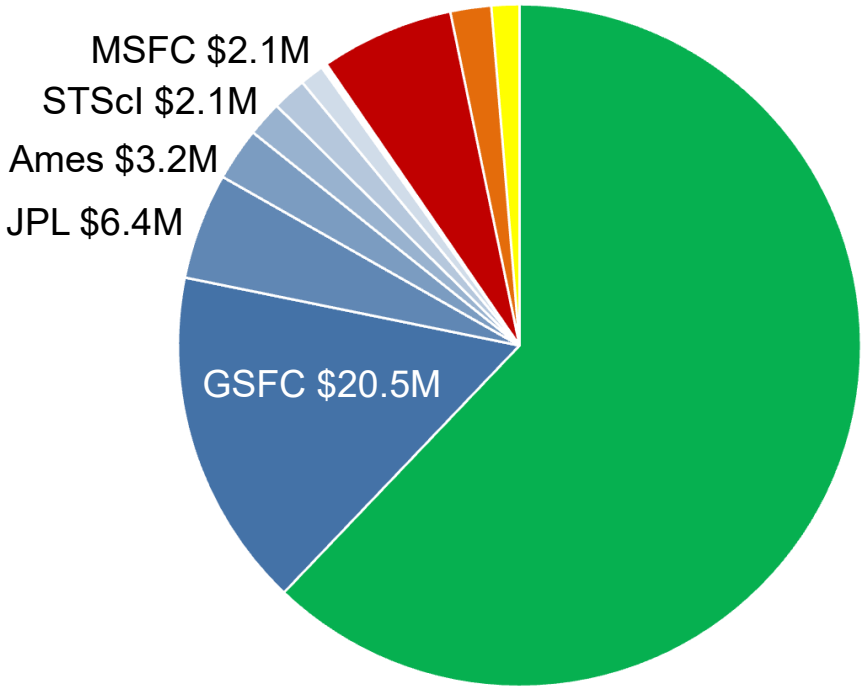
Astrophysics R&A Funding by Institution

All Institutions



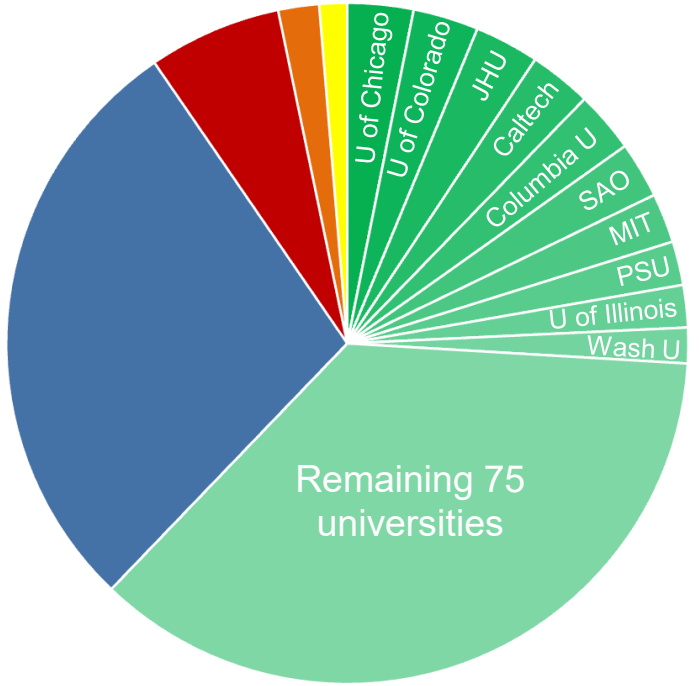
* $128M FY23 total

NASA Centers



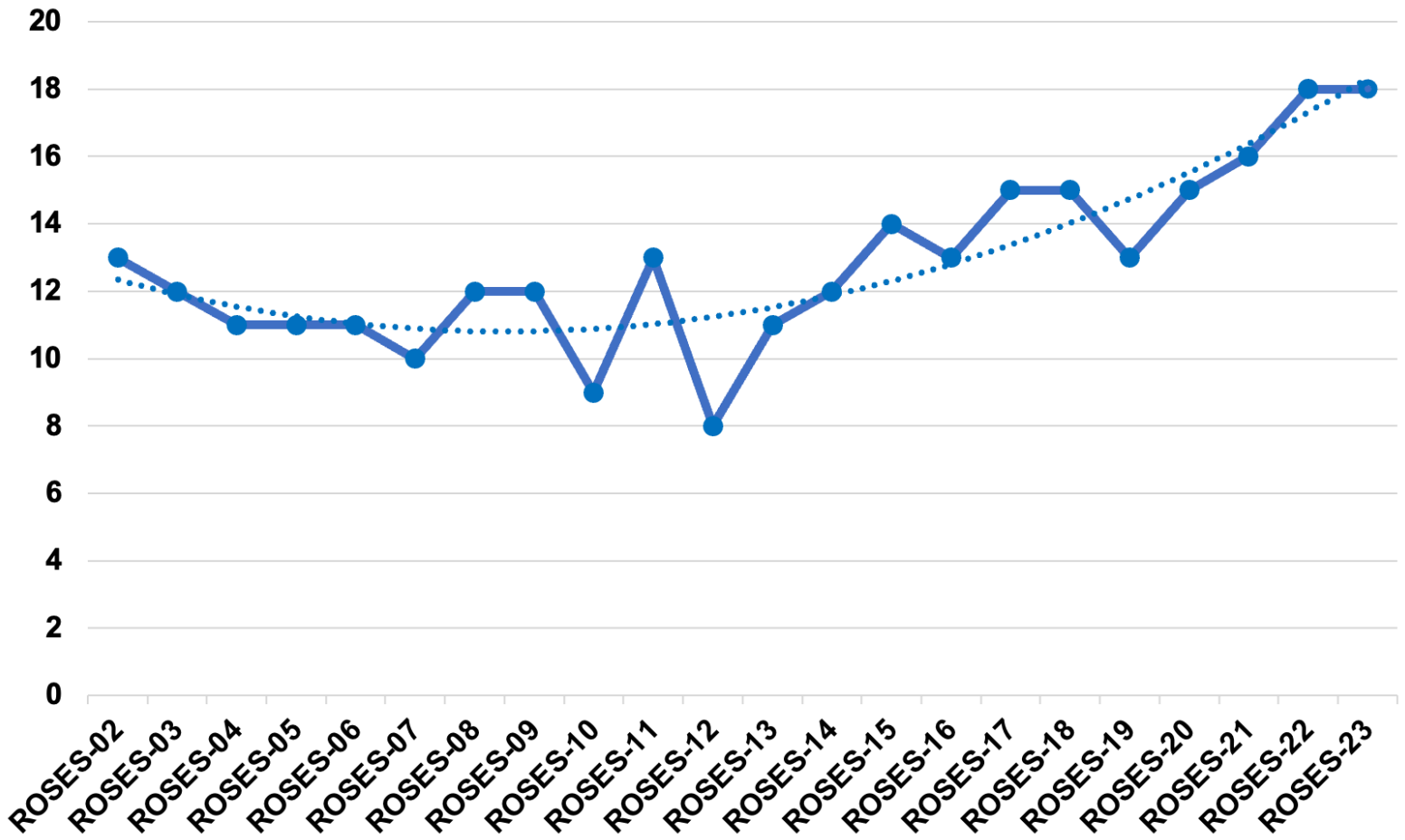
57% of NASA funding goes to GSFC

Academic Institutions



The top ten universities receive 40% of the funding

Number of Astrophysics ROSES Solicitations
(not including cross-divisional solicitations)



18 Astrophysics solicitations.

Additional Cross-divisional solicitations with Astrophysics support:

- **Topical Workshops, Symposia and Conferences (TWSC)**
- **Exoplanets Research (XRP)**
- **Citizen Science Seed Funding (CSSF)**
- **Graduate Student Research Awards (FINESST)**

ROSES-23 includes an upcoming solicitation that will be released by Amendment within the next few weeks:

- **XRISM GO Cycle 1**

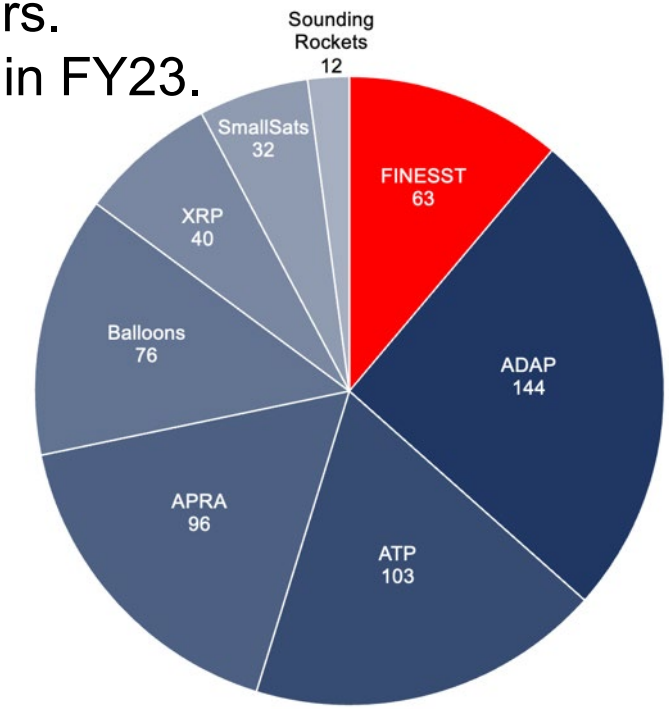
FINESST Student Research Grants

- FINESST is a cross-divisional solicitation for student research grants. All five SMD Divisions participate in FINESST (Astrophysics, Heliophysics, Planetary Science, Earth Science, and Biological and Physical Sciences Divisions).
- Previous FINESST recipients have very successful careers leading diverse projects and people in academia and the private sector.
- Proposal submission rate has steadily increased over the past few years.
- Funding increase from $400k at the inception of the program to $2.6M in FY23.
- Keeping selection rates >10% is a challenge.
- Large institutions submit multiple proposals, which makes a diverse selection of FINESST recipients challenging.

R&A Offsite Decision:

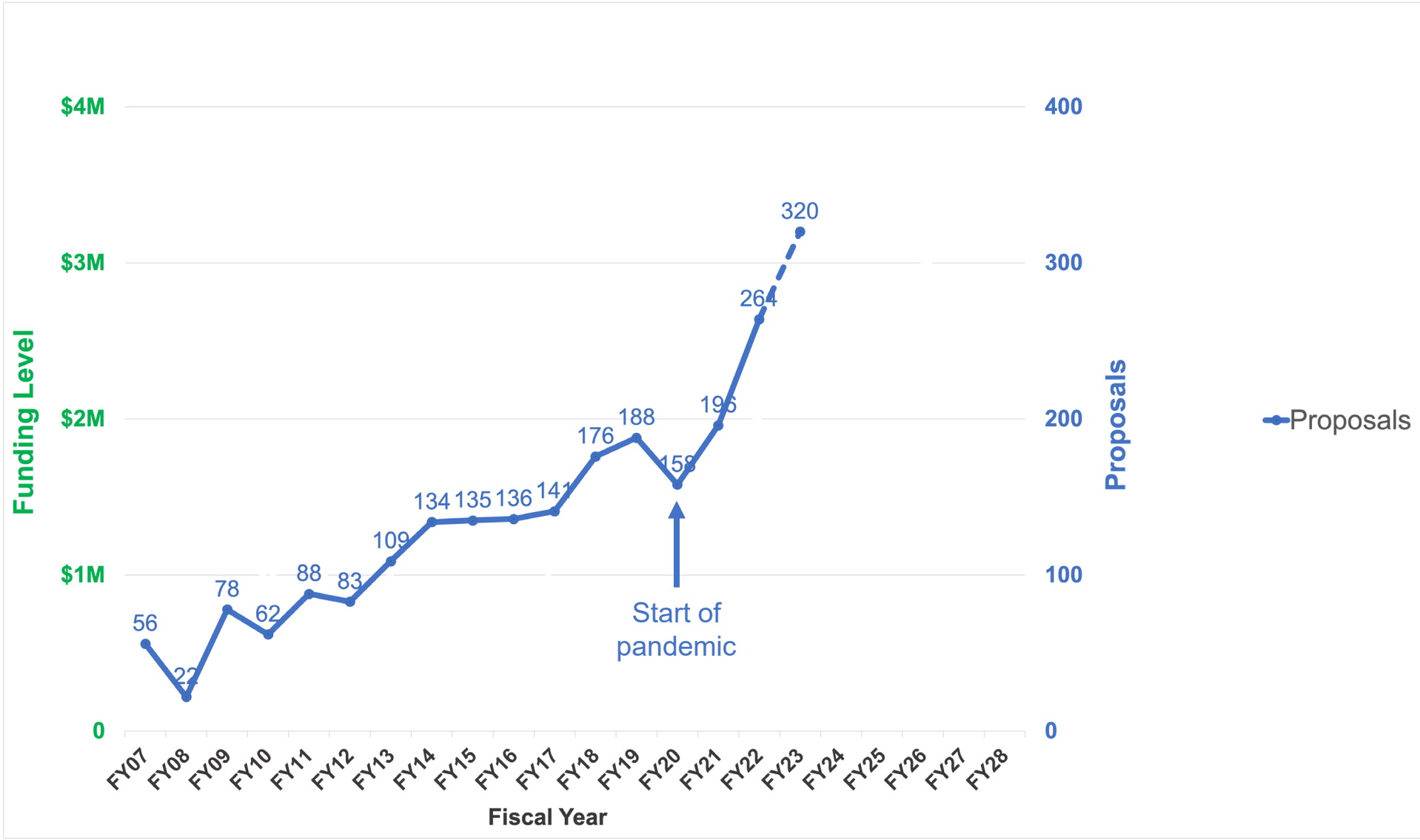
Forming working group to make recommendation a) to change the FINESST solicitation, b) design a graduate student program that works better for Astrophysics, with a possible withdrawal from SMD FINESST in ROSES-25.

Will present findings at the next APAC meeting in the Spring.

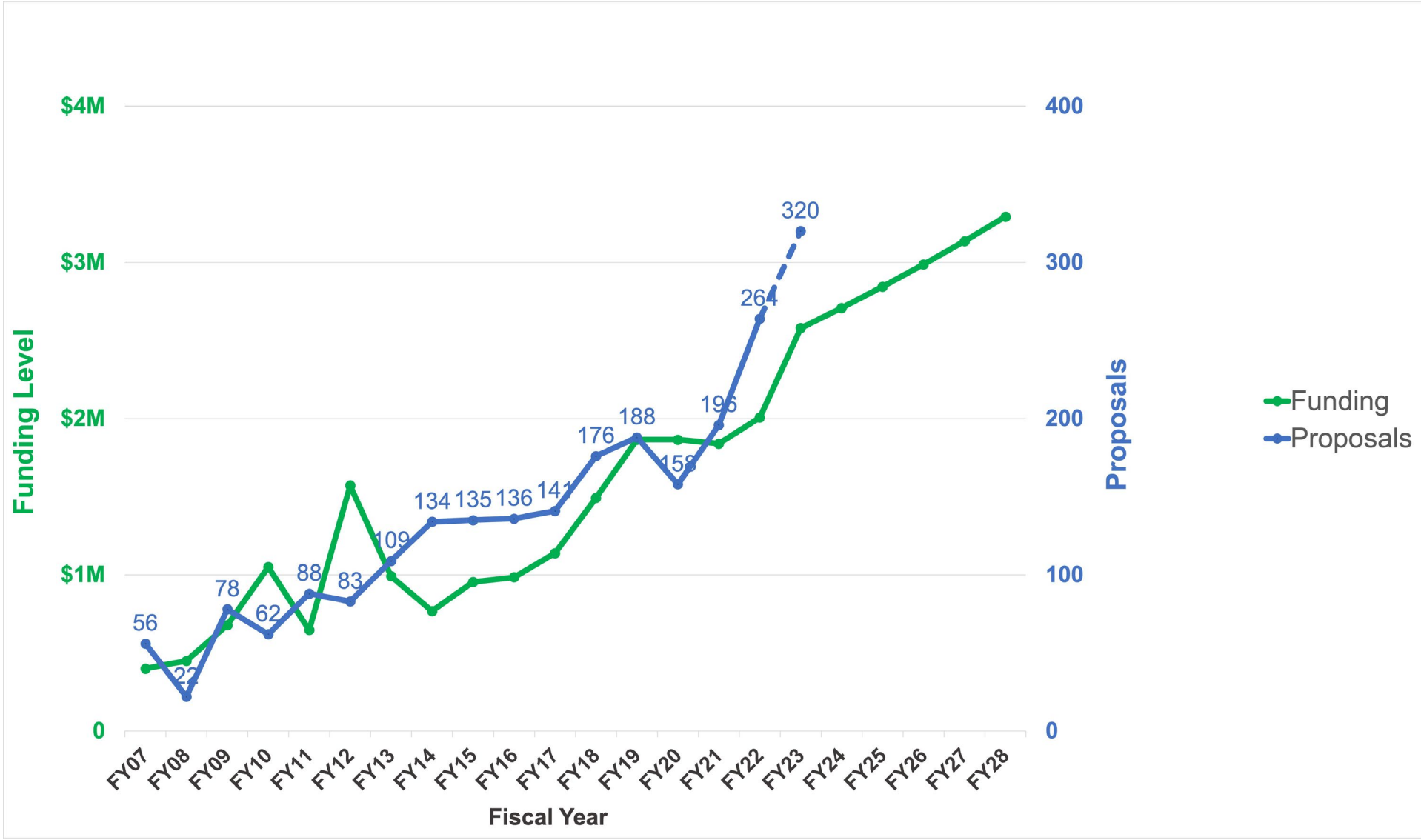


Astrophysics supports ~600 students annually through R&A programs.

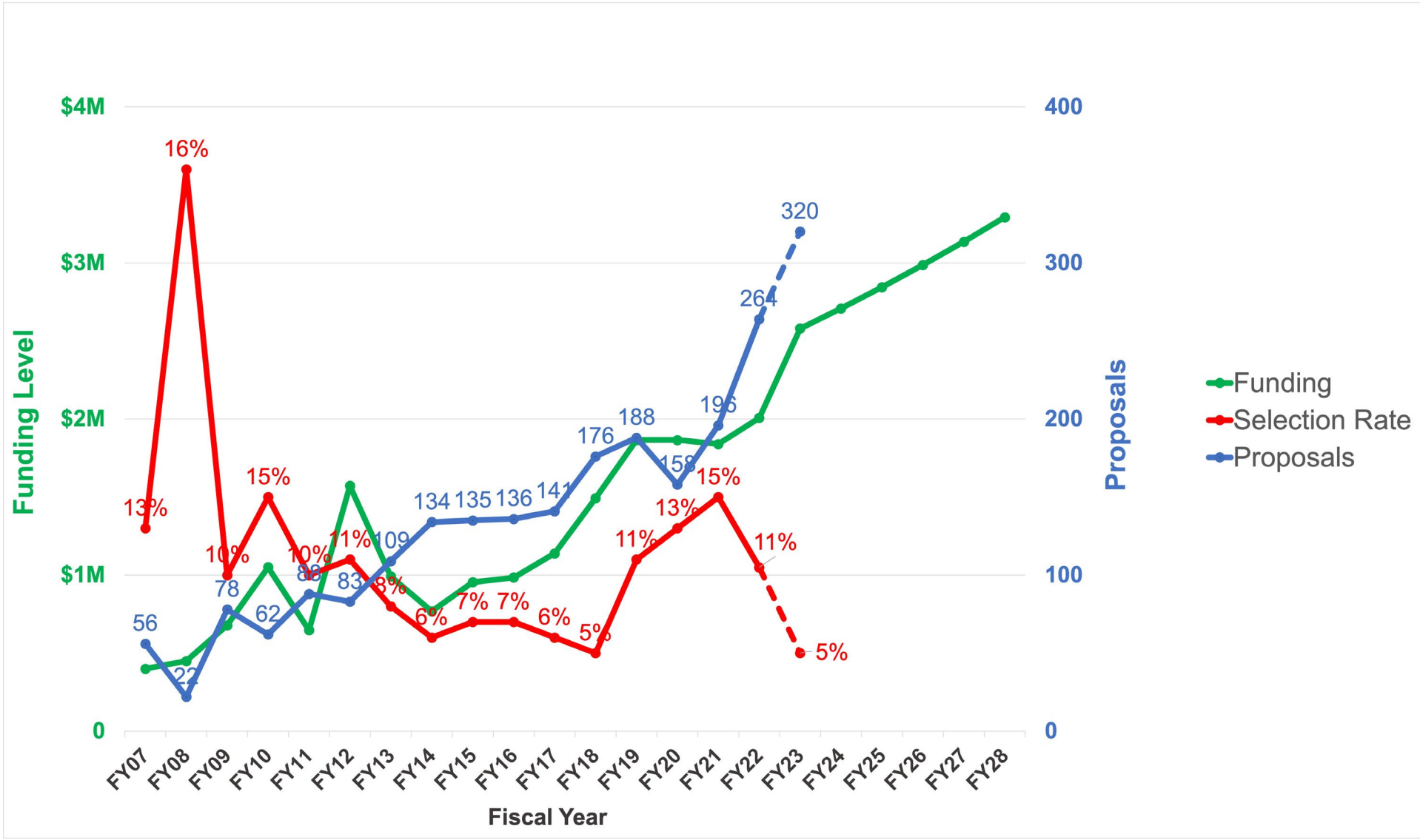
FINESST Student Research Grants



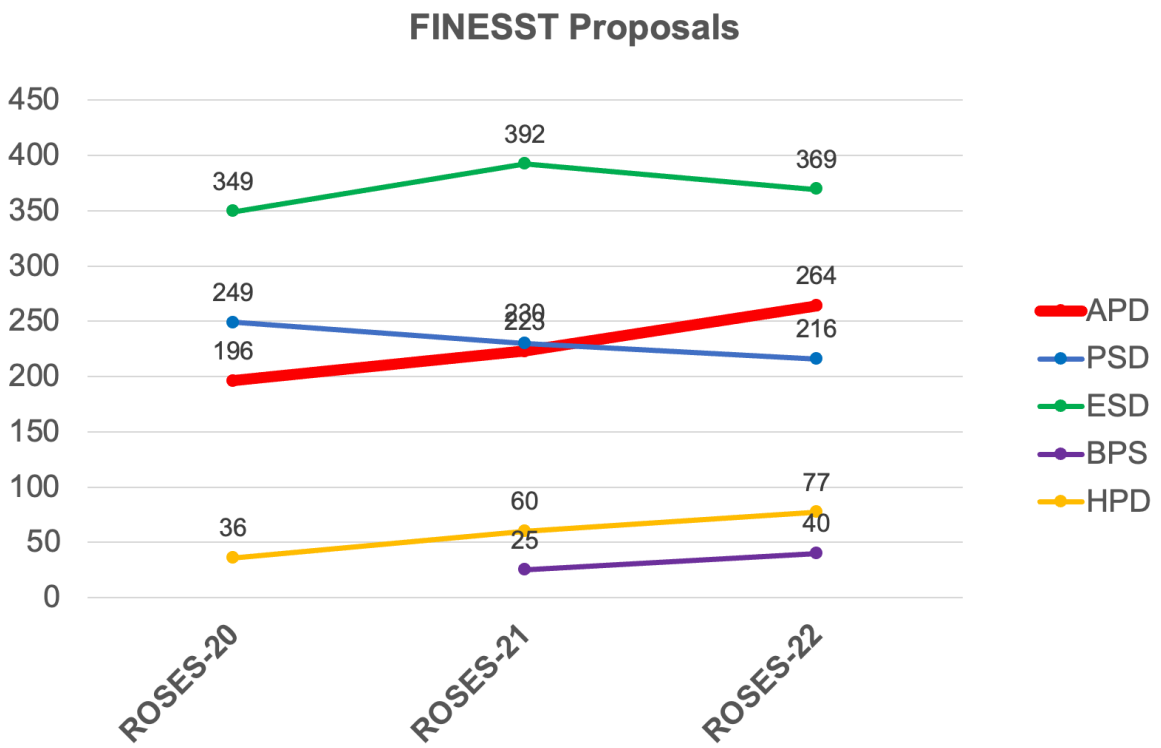
FINESST Student Research Grants

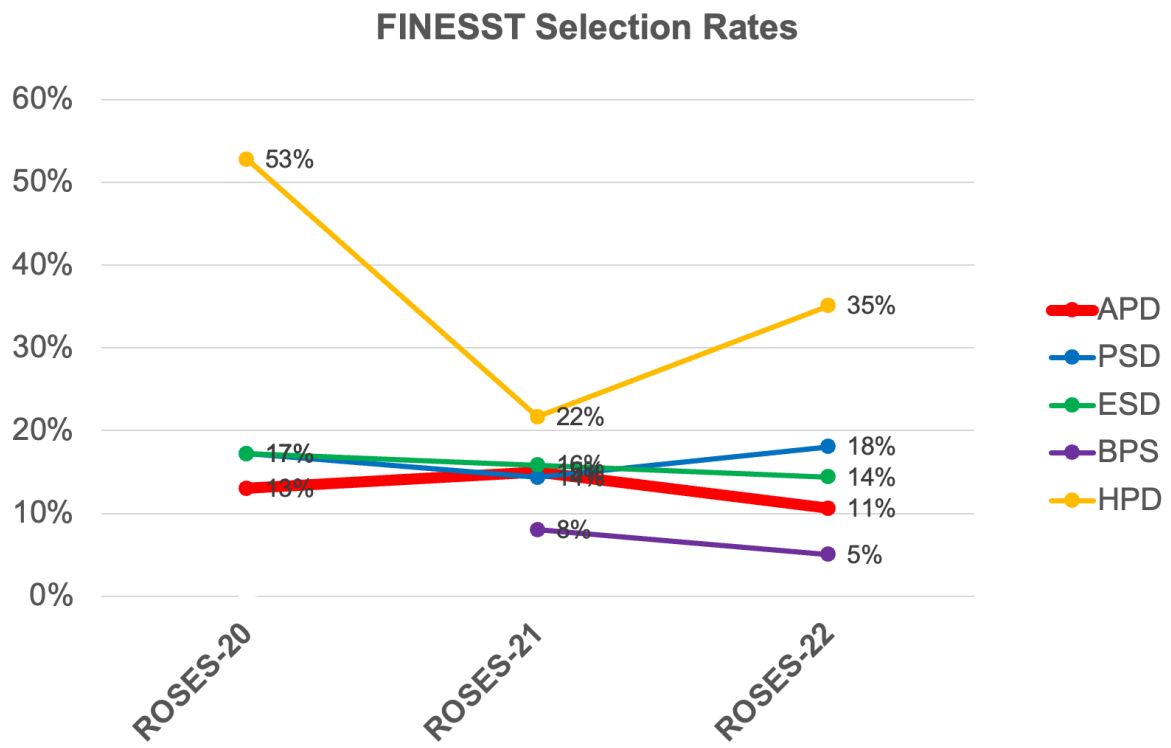


FINESST Student Research Grants



FINESST Student Research Grants





2023 Astrophysics Research Solicitations

Supporting Research and Technologies			
Astrophysics Research & Analysis	APRA	IP	
Strategic Astrophysics Technology	SAT	IP	
Astrophysics Theory Program	ATP	IP	DAPR
Nancy Grace Roman Technology Fellowships	RTF		
Astrophysics Decadal Survey Precursor Science	ADSPS		DAPR
Data Analysis			
Astrophysics Data Analysis	ADAP		DAPR
Fermi, Swift, NuSTAR, NICER, TESS, IXPE, XRISM	GO/GI		DAPR
Mission Science and Instrumentation			
Astrophysics Pioneers (suborbital science)	Pioneers		DAPR
Suborbital payloads solicited through APRA	APRA	IP	
Roman Research and Opportunities	Roman	IP	DAPR
Cross Divisional			
Exoplanets Research Program	XRP		DAPR
Topical Workshops, Symposia and Conferences	TWSC		
Citizen Science Seed Funding Program	CSSFP		
Graduate Student Research Awards	FINESST		

Solicited Separately			
JWST, Hubble, Chandra GO/GI/Archive/Theory programs	GO/GI		DAPR
NASA Hubble Fellowship Program	NHFP		
NASA Postdoctoral Program	NPP		
Support for XMM-Newton U.S. PIs (selected by ESA)	XMM GO		
Not Solicited in ROSES-23			
Theoretical and Computational Astrophysics Networks, every other year	TCAN	IP	

IP: Proposals require an Inclusion Plan for creating and sustaining a positive and inclusive working environment.

The assessment of IP is not part of adjectival rating and does not inform selection of proposals. However, funding can be withheld until after a satisfactory Inclusion Plan is accepted.

Inclusion Plan pilot program will continue in future years but will not expand until the outcome of the pilot programs was studied.

DAPR: Proposals are evaluated using dual-anonymous peer reviews where panelists do not know the identities of the proposing teams and institutions.

New ROSES elements are given in red.

IXPE GO Cycle 1 Program

Proposals for investigations based upon IXPE observatory are solicited and executed on an annual basis. IXPE Cycle 1 proposals were due on Oct 18, 2024. Observations will be initiated on Feb 1, 2024, and will last for approximately 12 months.

The relative time allocations for the various categories of Cycle 1 observing time are:

- 11 Msec for general (time constrained, not constrained, ToOs, joint observations)
- 4 Msec additional allocation for Large Programs

Types of proposals:

- Unconstrained observations
- Time-constrained observations
- Target of Opportunity observations (incl. unanticipated ToOs)
- Joint NICER observations (300 ksec NICER observing time allocation)
- Large Programs
- Theory investigations

- Anticipated **$3M program budget** available for Cycle 1 awards
- Anticipated **~30–40 observing** investigations awarded

IXPE launch 12/09/2021

XRISM GO Cycle 1 Program

Proposals for investigations based upon XRISM observatory will be solicited and executed on an annual basis. XRISM Cycle 1 observations will be initiated ~July 1, 2024, and will last for approximately 12 months.

The relative time allocations for the various categories of Cycle 1 observing time are:

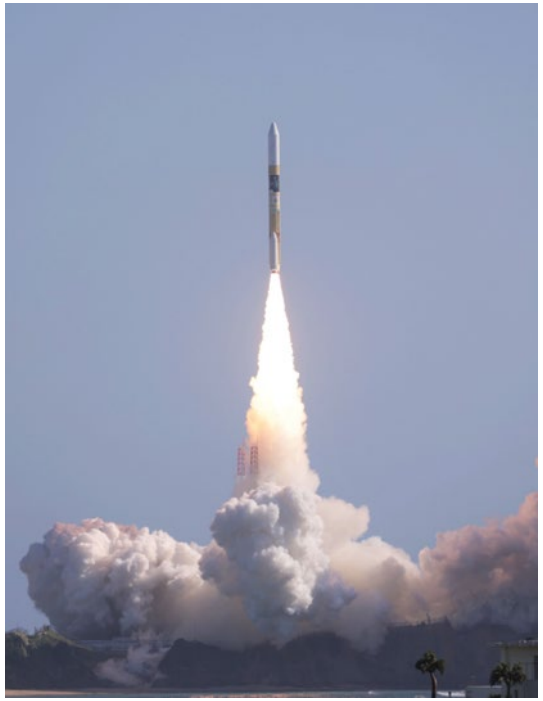
- 10% Observatory time (Calibration, Director's Reserve, Target of Opportunity)
- 15% Science Team (Carryover of remaining PV observations from Phase 1)
- 75% GO time

The Cycle 1 allocation of GO time among the mission partners is:

- 44% U.S. investigations (including Canadian partners)
- 8% ESA investigations
- 48% Japanese investigations (including all other partners)

Two types of proposals:

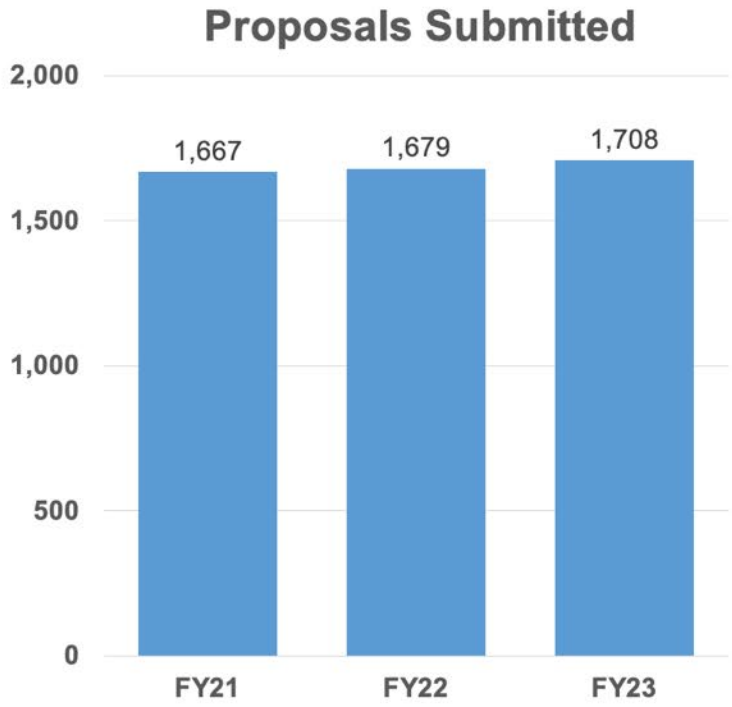
- Type 1: Observing proposals (1-year)
- Type 2: Laboratory/theory investigations (3-year awards)

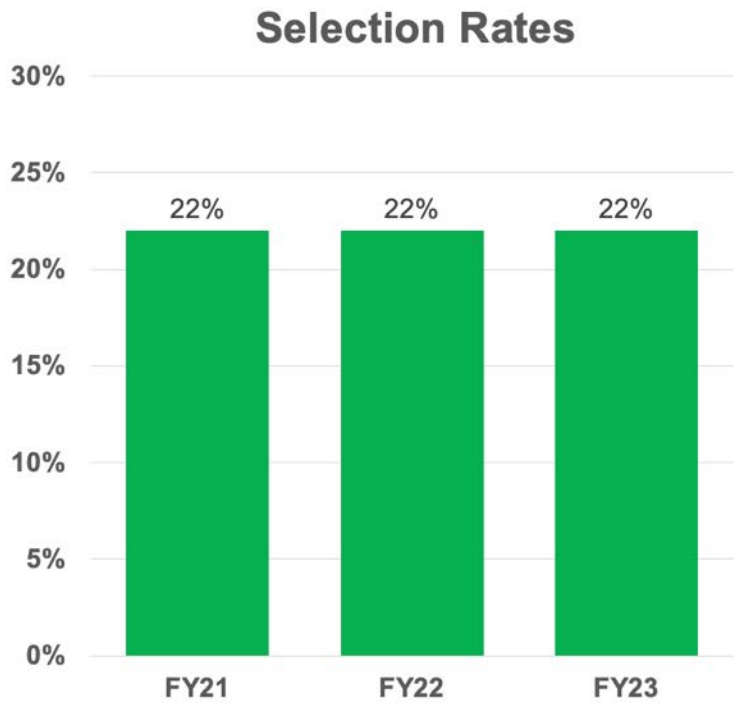


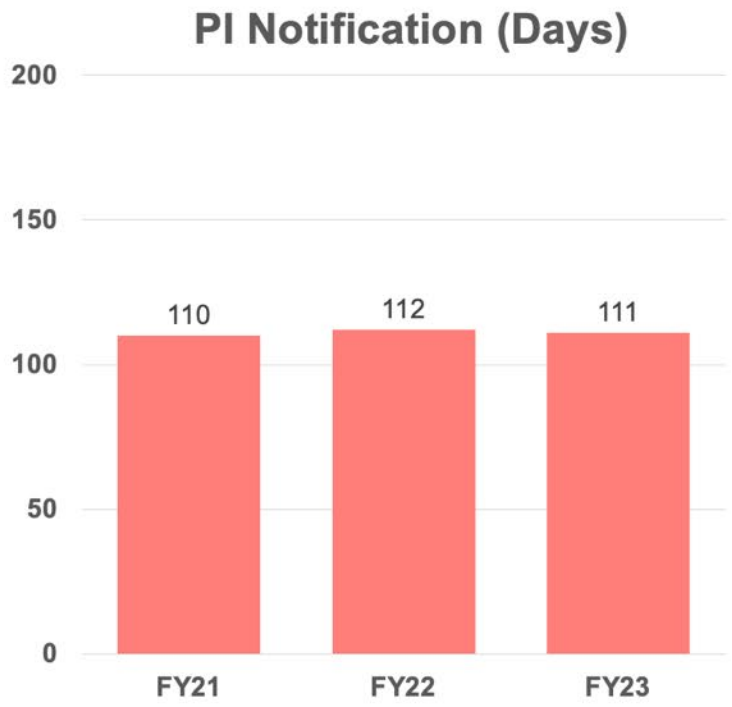
XRISM launch 09/07/2023

- Anticipated **$6.5M program budget** available for Cycle 1 awards
- Anticipated **~40–70 Type 1 observing and ~2–4 Type 2 lab/theory** investigations awarded

Proposals, Selections, PI Notifications



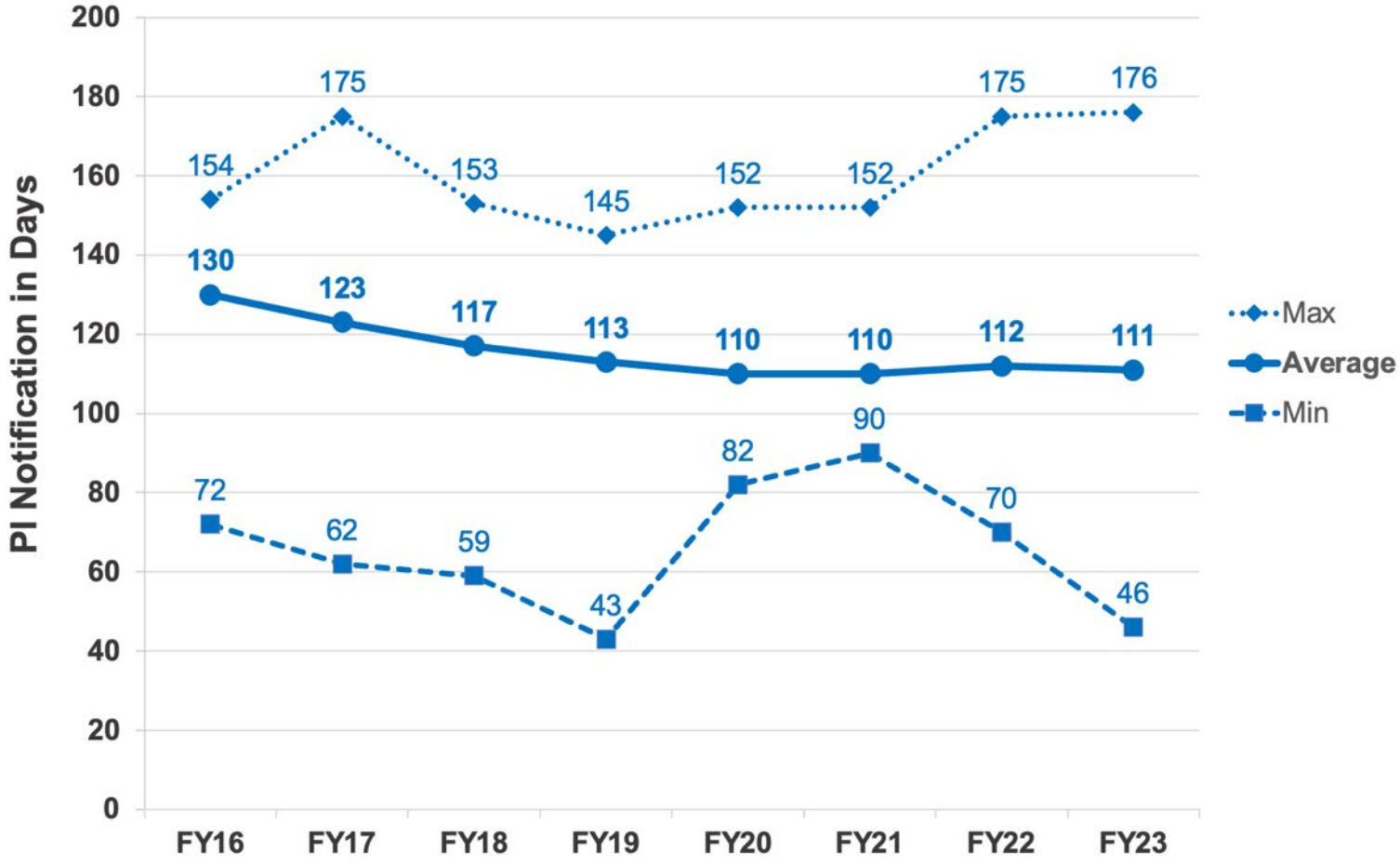




- The proposal submission rate to the Astrophysics Research and Analysis program has been stable over the last 3 years.
- The selection rate across the Astrophysics Research and Analysis program has been at 22% over the last 3 years.
- 80% of all Principal Investigators are notified about the selection status around 111 days after proposal submission.

* ROSES Programs

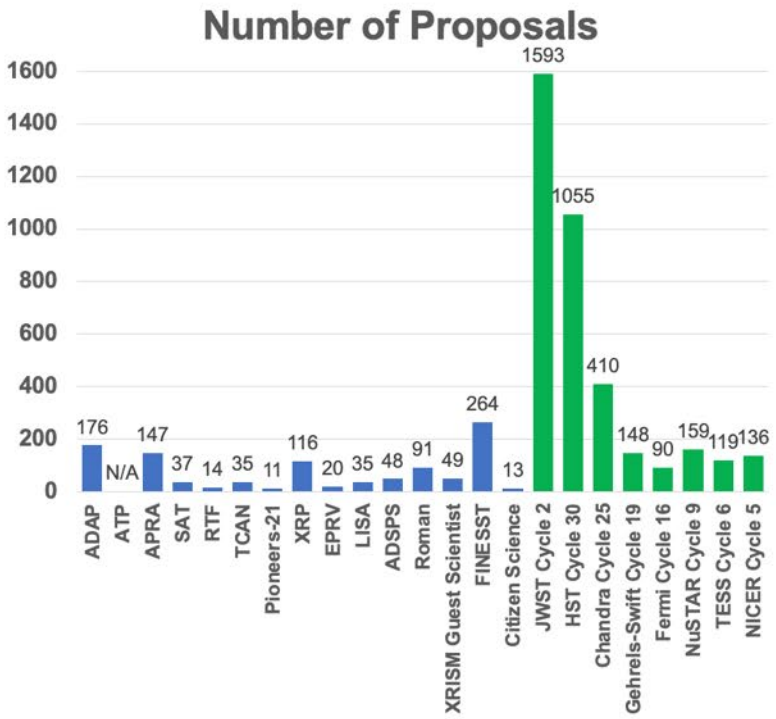
80% PI Notification after Proposal Submission



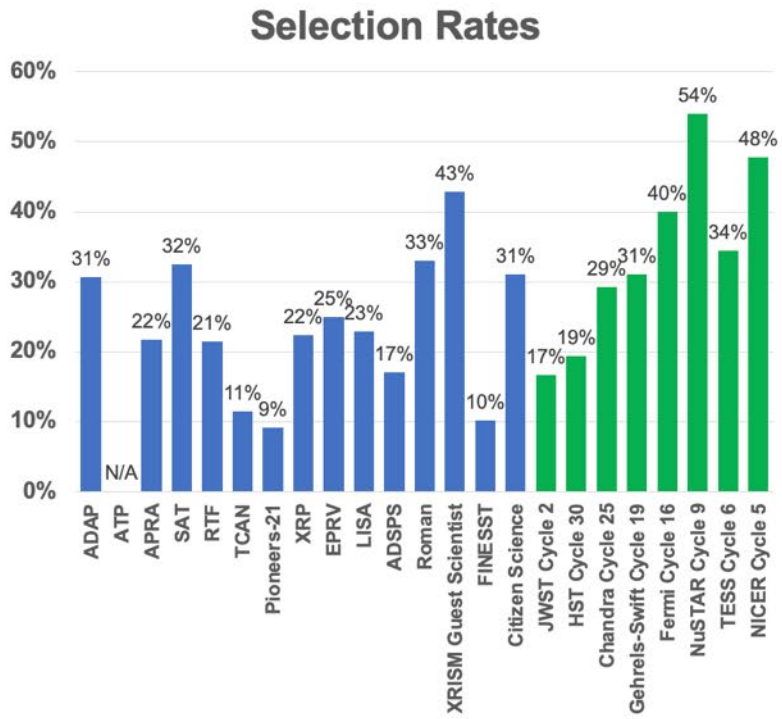
The Astrophysics Division is notifying PIs about the outcome of R&A proposal selections well below the internal Astrophysics goal of 150 days, and the SMD goal of 180 days.

Astrophysics R&A Selection Rates

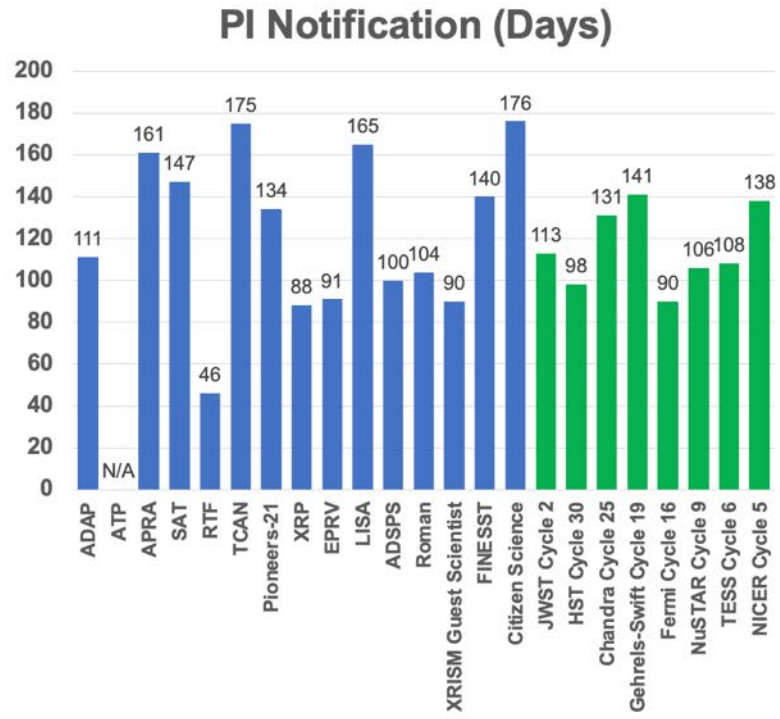
September 2022-2023



R&A: 1,056 proposals
GO/GI: 3,710 proposals
Total: 4,766 proposals



R&A: 22%
GO/GI: 23%
Average: 23%

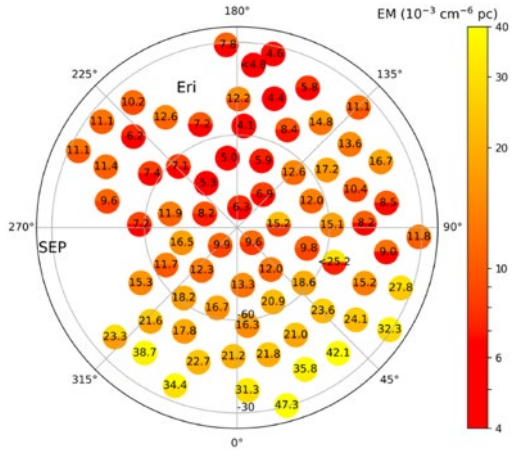


80% of PI notification:
R&A: 111 days
GO/GI: 105 days

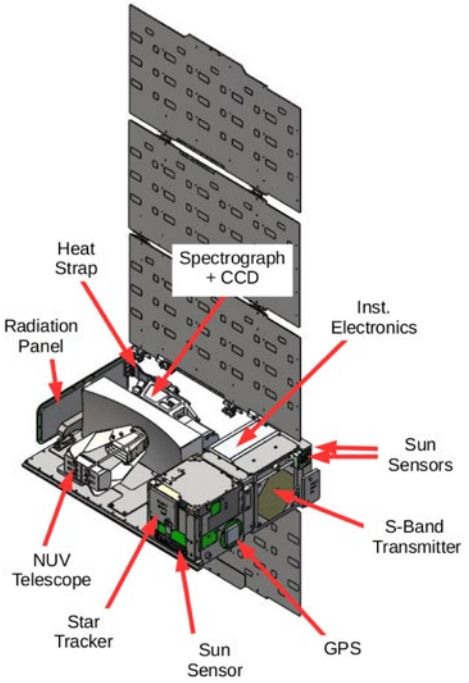
* Only programs with selections made and PIs notified

Astrophysics CubeSats

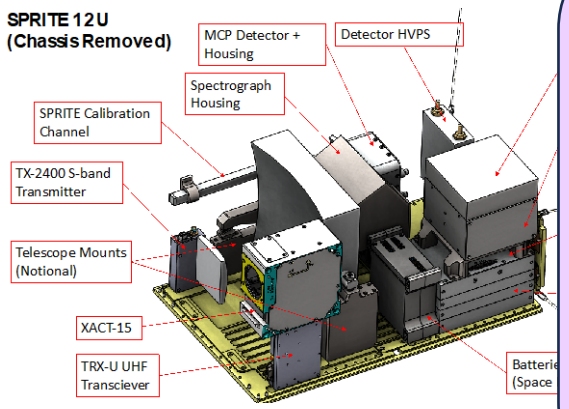
HaloSat
PI Phil Kaaret, U of Iowa, launch 5/2018, reentry 2/2021, OIV line in galactic halo, found unexpected structure of halo



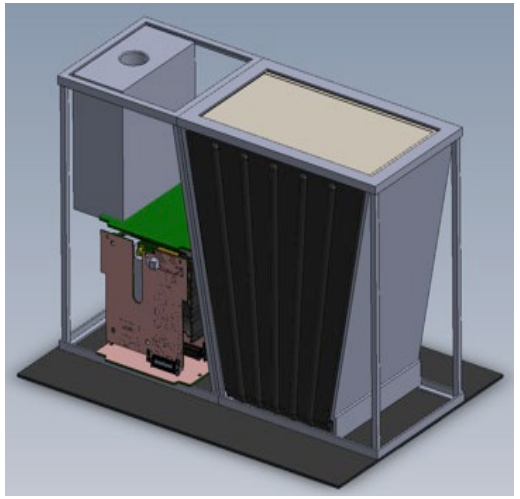
CUTE
PI Kevin France, U CO, launched 7/2021,
in operation,
UV imaging of hot Jupiter ablation



SPRITE
PI Brian Fleming, U CO, First Astrophysics 12U, UV spectra of ionizing radiation from star forming galaxies, bus in house, launch 2024, Space-X Transporter

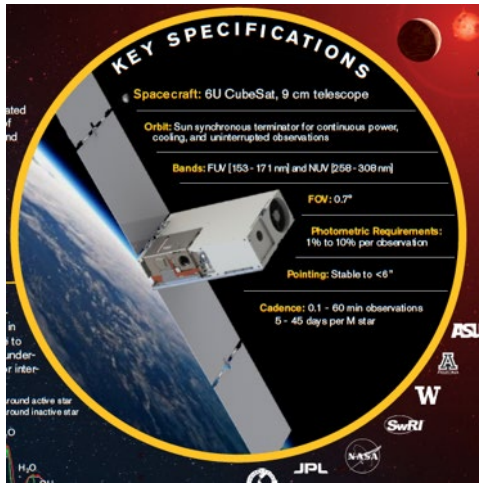


BlackCat
PI Abe Falcone, PSU, launch NET 8/2024, 2-20 KeV wide FOV localization of X-ray transients, real-time ‘cell phone’ downlink, NanoAvionics bus

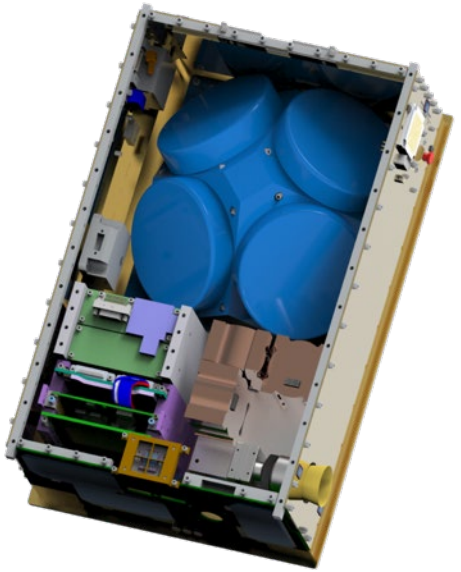


Astrophysics CubeSats

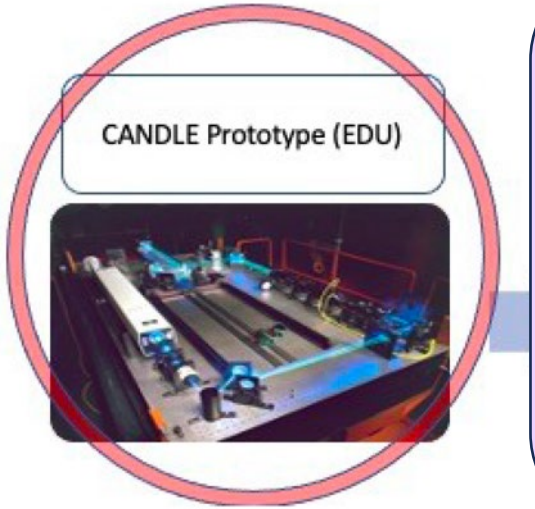
SPARCS
PI Evgenya Shkolnik, ASU, launch NET 7/2024, two UV band monitoring of M-star flares to investigate planetary habitability effects, BCT bus



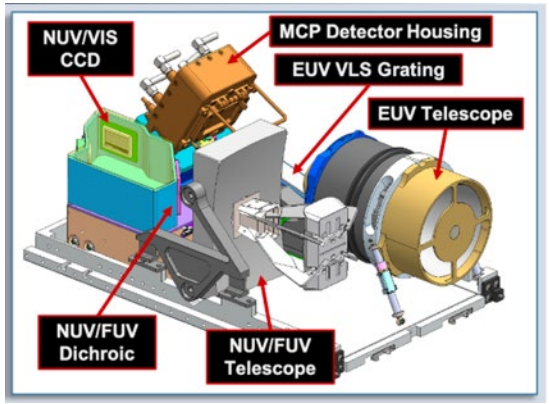
BurstCube
PI Jeremy Perkin, GSFC, launch 2/2024 Space-X resupply, GRB monitor with TDRSS link, GSFC bus



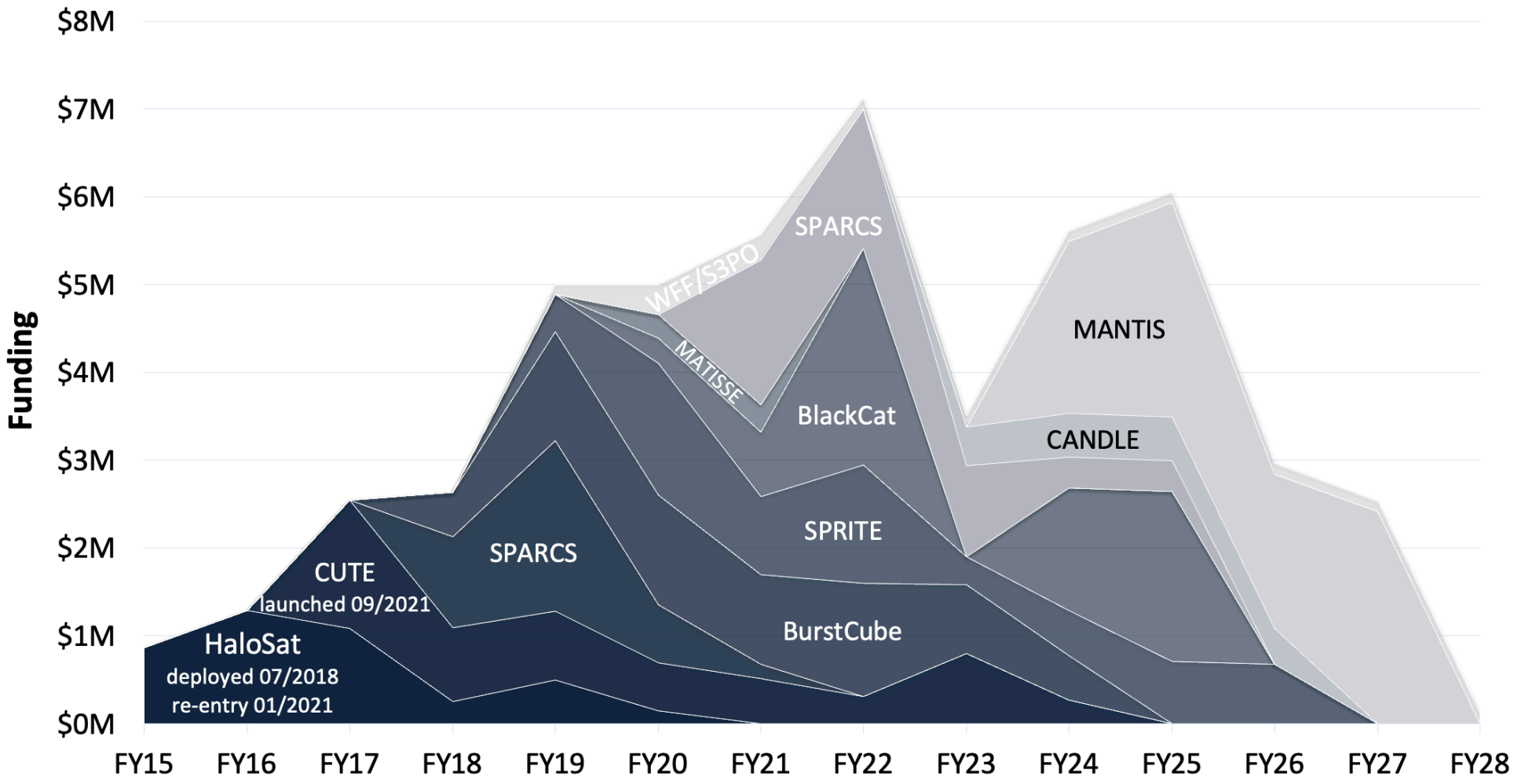
CANDLE
PI Susana Deustra, NIST, three-year build of engineering demonstration unit, goal is 0.1% absolute calibration of 0.4u-2.5u flux scale for astronomy



MANTIS
PI Briana Indahl, U CO, launch 01/2028, EUV-NUV stellar flux on ExoPlanet habitability, bus in house



Astrophysics CubeSats



Astrophysics CubeSats

Tentative Upcoming Launch Dates:

Name	Date	Launch Vehicle
BurstCube	Feb 2024	Space-X ISS resupply
SPRITE	Jul 2024	Space-X Transporter
SPARCS	Dec 2024	not yet identified
BlackCat	Jan 2025	not yet identified

Astrophysics Balloon Investigations

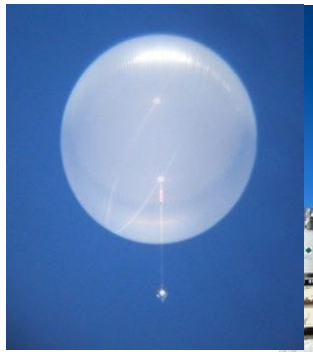
Strategic Objective:

Enable discovery through conduct of frequent scientific balloon flight opportunities for NASA scientific, technology development, and educational investigations.

Balloons provide low-cost, quick response, near space access for:

- Conducting cutting-edge research.
- Developing technologies to enable future spacecraft science missions.
- Advancing lighter-than-air platform technologies.
- Providing calibration and validation of on-orbit instrumentation.
- Enabling hands-on training of the next generation of scientists and engineers.

Annual Program Snapshot
8-12 launched
3+ campaigns
300+ undergrad/grad students participate
40+ research Institutions

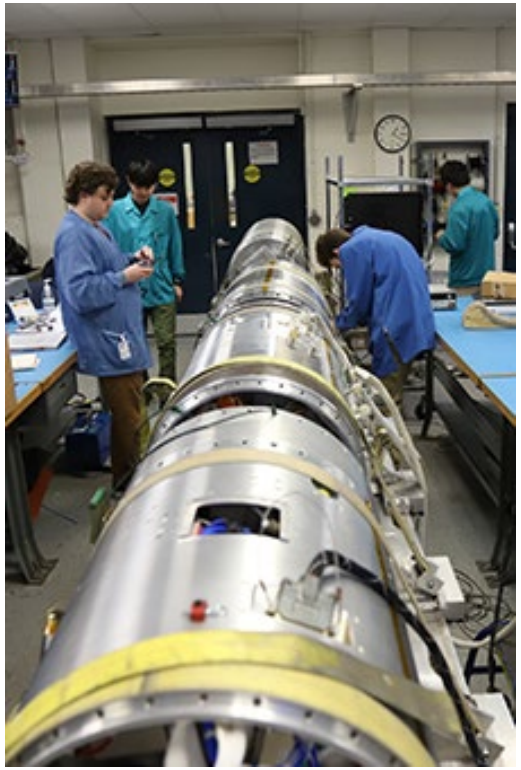


Astrophysics Balloon Investigations

Campaign	Date	Name	PI
McMurdo	Dec 21, 2022	**SPIDER**	J. Filippini, U Illinois
New Zealand	Apr 15, 2023 May 13, 2023	**SuperBIT** **EUSO-SPB2**	W. Jones, Princeton U A. Olinto, U Chicago
Palestine, TX	Jul 18, 2023	**WhatsUP-2** (HL)	A. Tang, JPL
Ft Sumner, NM	Aug 19, 2023 Aug 27, 2023 Sep 7, 2023 Sep 25, 2023 Sep 27, 2023 Rescheduled Rescheduled	**Salter Test Flight** **GRAPE** **HASP** **FIREBALL-2** **Remote** **EXCITE** **TinMan**	N/A M. McConnell, UNH D. Grainger, LSU C. Martin, Caltech A. Tang, JPL P. Nagler, GSFC S. Wender, LANL
McMurdo	Dec 2023	**GUSTO** **AESOP-Lite**	C. Walker, UoA J. Clem, U Del
Sweden	May-Jul 2024	**XL-Calibur** **HELIX** **SUNRISE-III** **BOOMS**	H. Krawczynski, Wash U S. Wakely, U Chicago S. Solanki (Max-Planck) J. Sample, Montana State

Astrophysics Sounding Rockets

Range	Date	Name	PI
White Sands Missile Range	Sep 25, 2022	**tREXS:** the Rockets for Extended-Source X-ray Spectroscopy	R. McEntaffer, PSU
	Apr 16, 2023 (terminated)	**CIBER**: Cosmic Infrared Background ExpeRiment	M. Zemcov, RIT
	Oct 29, 2023	**INFUSE**: INtegral-Field Ultraviolet Spectroscopic Experiment	B. Fleming, U Colorado, Boulder
	Feb 15, 2024 (relaunch)	**CIBER**: Cosmic Infrared Background ExpeRiment	M. Zemcov, RIT



CIBER integration at WFF

Decrease the Burden on PIs

We acknowledge that there are significant barriers for participation in NASA programs, particularly for early career scientists and those who do not work at large institutions.

1) ROSES Solicitation:

- The ROSES Summary of Solicitation almost doubled in page numbers over the last 10 years (70 pages) and is not easy to understand. Bring your own lawyer!
- New requirements (Open Science and Data Management Plan, anonymizing proposals, Inclusion Plans, etc.) require more efforts to be responsive/compliant with ROSES submissions.

2) Budget Submissions:

- We charge review panels for R&A proposals to only evaluate the “level of effort,” not budgets. Yet, every proposal submission must include a detailed and final budget. At a ~20% selection rate, the majority of all submitted budgets will never be looked at.
- Early career scientists might not be familiar with indirect cost rates, facility fees, tuition rates.
- Crafting a full budget adds ~1 week to the time it takes to prepare a proposal.
- AORs of institutions are submitting budgets, not the PIs, adding to institutional burden.

Decrease the Burden on PIs

R&A Offsite Decision:

1) ROSES Solicitation:

- SMD: form a cross-divisional Working Group to simplify the ROSES Summary Solicitation.
- Astrophysics Division: no longer allow individual solicitations to have their own style guides.
- Astrophysics Division: will make better use of the “D.1 Overview” element and provide more useful and easy-to-understand information.
- Astrophysics Division: will create a short “ABC Guide” (with cartoons/flow chart) for proposal submission that guides proposers through the process.

2) Budget Submissions:

- We will run a pilot program in ROSES-25 where institutions no longer need to submit full budgets at Phase-1. PIs will only be asked to indicate in which of three budget brackets their proposed investigation will fall (small, medium, large). Full budgets will be due at Phase-2.
- **The ROSES-25 Astrophysics Data Analysis Program (ADAP) solicitation will no longer require full budgets during Phase-1 proposal submission, only after selection at Phase-2.**

The Future of Peer Reviews

SMD expects all Divisions that no more than 15% of all R&A peer reviews be held in-person.

Polling our panels over the past ~3 years shows no preference:
50% prefer in-person panels, 50% prefer virtual panels, there is no desire for hybrid panels.

Virtual reviews offer the benefits of smaller carbon footprints, reduced costs, more diverse panels, more flexibility in terms of time & schedules, higher acceptance rate for invitations, etc.

In-person reviews offer the benefits of networking, especially for early career scientists, socializing, exchange of ideas, formation of collaborations, and produce higher quality evaluations.

R&A Offsite Decision:

There is a desire among NASA HQ Program Officers and half of the community to hold more peer reviews in-person.

Starting next year, each R&A program will hold an in-person review at least once every three years.





THANK YOU