




National Aeronautics and
Space Administration

EXPLORE SCIENCE

THOMAS H. ZURBUCHEN

Associate Administrator

NASA Science Mission Directorate

 @Dr_ThomasZ

January 2021



A composite image featuring a person standing on a rocky peak, an eagle in flight, a crescent moon, and a comet against a starry sky.

Science is Important for All

- Continue to align with the values and objectives set out in the NASA's 2020-2024 Vision for Scientific Excellence: go.nasa.gov/sciencevision
- Our core purpose is to explore and make scientific discoveries on behalf of our nation and the world. We enable that through continuous innovation, and partnerships with many stakeholders
- This is a deeply inspiring human endeavor, but we recognize we are not connecting with all audiences
- Join us to actively explore and learn how we can better share the power of science to unite and provide hope for all!





MARS 2020



DART



Landsat 9



Webb



IXPE

2021 – A Year of Science



O-REx



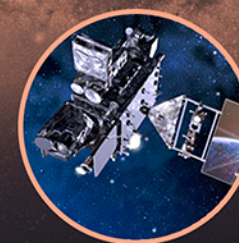
Peregrine



Nova-C



Lucy

























GOES-T

- LAUNCH
- LANDING
- DEPARTURE

2021 MILESTONES

● DECADALS ● MISSIONS ● LAUNCH ● RESEARCH

ASTROPHYSICS	 DECADAL SURVEY		 SMEX DOWNSelect  MIDEX AO	 WEBB LAUNCH  IXPE LAUNCH  GUSTO LAUNCH
BIOLOGICAL & PHYSICAL	 LAUNCH TO ISS (2)	 LAUNCH TO ISS (1)	 LAUNCH TO ISS (2)  FLOW BOILING SELECTIONS	 LAUNCH TO ISS (2)
EARTH		 EVI-6 AO		 LANDSAT-9 LAUNCH  GOES-T LAUNCH
HELIOPHYSICS	 EXPLORERS M0 DOWNSelect  GDC INSTRUMENT CALL			 POTENTIAL STP AO
PLANETARY	 PRISM-1 SELECTIONS  MARS 2020 LANDING	 DISCOVERY STEP 2 DOWNSelect	 DART LAUNCH  PRISM-2 AO	 LUCY LAUNCH  CLPS DELIVERY  CLPS DELIVERY
	QUARTER 1	QUARTER 2	QUARTER 3	QUARTER 4

From Open Data to Open Science

- All NASA mission science data are public. Our international partners are also publishing their data and contributing to the global science commons
- Also, publications funded by NASA, including peer review journal articles, are open access and freely available to the public.
 - We are working on making it easier to search and find the research that is most important to you
- We have initiated an open science data initiative that is making targeted investments in cloud computing, open-source software, AI/ML and open data search and discovery services
- We have included two new ROSES calls targeted at supporting open-source tool development and the opening of legacy software
- SMD-wide policies on open data and open software and models are being developed and should be released soon

Building Excellent NASA Teams Requires Diversity and Inclusion

- In SMD we recognize that excellence is only achieved with inclusive and diverse teams. We are creating a multi-pronged approach across the directorate, at the division level, and in our proposal processes to continue to build lasting progress in this area.
 - Directorate level: Hosting incubator workshops and implementing actions from those workshops focused on short-term, impactful changes to how we are operating, and how we grow our leaders. We are standing up a long-term activity focused on sustained engagement, systemic and lasting changes.
 - Division level: Division task forces are working to align division-level practices with the NASA core value and SMD science strategy
 - We recognize we have influence in our calls for proposals and what we reward in our selections. We have included dual-anonymous review and seek to expand that. We are actively looking into how we can be a model for inclusivity

COVID-19 Impacts

Research:

- SMD is focused on continuing our research programs and providing stability. Further, we do not want the pandemic to derail careers of future leaders; we are focused on mitigating impacts
- Given current funding constraints, SMD will prioritize augmentation and funded extension requests up to 15% of the R&A funding available for new awards that:
 - are in their last year (or the last year of their first NCE); have costed their funds in a timely manner; and for the explicit support of near-finishing graduate students and post-docs (including third-year NPPs), and non-tenured and soft-money early career researchers
- NASA will offer 124 NPP fellowships and does not plan to support new term hires at Centers (these decisions will be revisited if supplementary funding is made available to SMD)

Missions:

- SMD continues to experience disruption to all missions due to COVID-related restrictions; we assume these disruptions will continue for the foreseeable future
- Many missions will likely stay within ABCs (Agency Baseline Commitments) including Psyche, JUICE, Mars 2020, Janus, MEGANE, XRISM, Euclid, Landsat-9, PREFIRE, and TROPICS
 - Some missions have experienced challenges with cost and schedule including Clipper, Webb, Roman, NISAR, SWOT, MAIA, EMIT, and IXPE

THANK YOU, ASTROPHYSICS TEAM!



EXPLORE

With Us



National Aeronautics and
Space Administration




EXPLORE SOLAR SYSTEM & BEYOND

NASA Town Hall

AAS 237th Meeting | January 12, 2021

Paul Hertz

Director, Astrophysics Division
Science Mission Directorate

 @NASAUniverse @NASAExoplanets

<u>Thomas Zurbuchen</u>	<u>Paul Hertz</u>
Dominic Benford	Lin Chambers
Valerie Connaughton	Doris Daou
Kristen Erickson	Daniel Evans
Michael Garcia	Shahid Habib
Thomas Hams	Hashima Hasan
Stefan Immler	Hannah Jang-Condell
Patricia Knezek	Elizabeth Landau
William Latter	Roopesh Ojha
Mario Perez	Natasha Pinol
Aki Roberge	Gregory Robinson
Evan Scannapieco	Kartik Sheth
Eric Smith	Linda Sparke
Eric Tollestrup	

Charts posted at <http://science.nasa.gov/astrophysics/documents>



Outline

- **Highlights of 2020:** 2020 Highlights / Inclusion & Diversity / COVID Update
- **The NASA Team:** NASA Astrophysics Headquarters Staff / AAS Announcements / Public Service Announcement: Keep Informed
- **Research Program Update:** Reviews / Dual Anonymous Peer Review / Funding / ROSES-21 / COVID / Open Data / Sci Act / Citizen Science / Public Service Announcement: Volunteer
- **Mission Program Update:** Operations / Small to Large / CubeSats / Pioneers / Explorers / Artemis / IXPE / Webb / Roman / Development / Athena / LISA / UltraSat
- **Planning for the Future:** Budget / Decadal Survey / 2021 Year of Science



Highlights of 2020





NASA SCIENCE

AN INTEGRATED PROGRAM



**EARTH
SCIENCE**



HELIOPHYSICS



**PLANETARY
SCIENCE**



ASTROPHYSICS



**BIOLOGICAL &
PHYSICAL SCIENCE**



**JOINT AGENCY
SATELLITE**

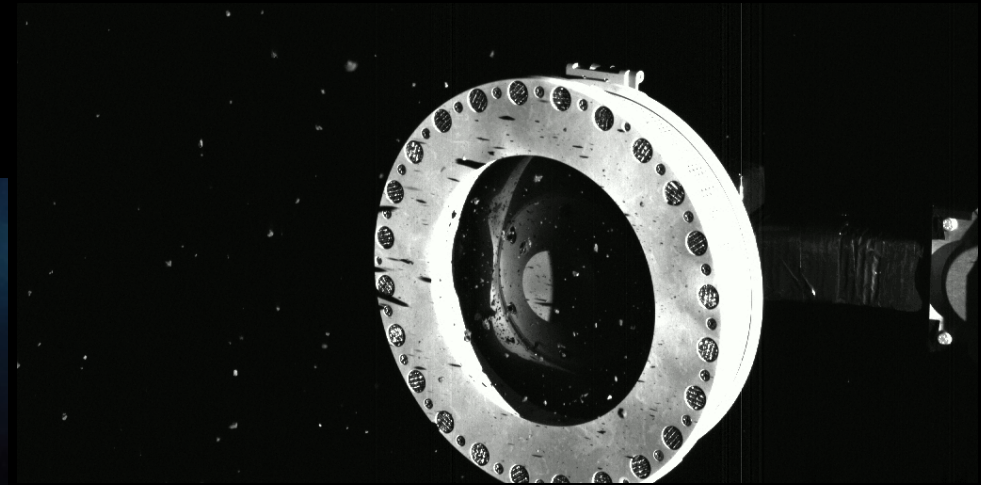


NASA's Mars 2020 Perseverance rover launched on the Atlas V-541 rocket from Launch Complex 41 at Cape Canaveral Air Force Station, Florida on July 30, 2020, at 7:50 a.m. ET. Perseverance (and the Ingenuity Mars helicopter tech demo) will land on Mars on February 18, 2021, around 3:30 pm ET.

OSIRIS-REx



*Touch-and-Go Sample
Acquisition Mechanism
(TAGSAM) Oct 22*



*Touch-and-Go
(“TAG”) at
Nightingale
Crater Oct 20*



*Sample stowed in
Sample Return
Capsule Oct 28*



The fully assembled and folded James Webb Space Telescope on the vibration table at Northrop Grumman Space Park (September 2020). This is the configuration that Webb will be in when it is mated to the Ariane 5 launch vehicle in 2021.

Nancy Grace Roman Space Telescope



SCIENCE
HIGHLIGHT



February 28, 2020 – NASA confirmed the Wide Field Infrared Survey telescope (WFIRST) for development

May 20, 2020 – NASA named its Wide Field Infrared Survey Telescope (WFIRST), in honor of Nancy Grace Roman, NASA's first chief astronomer, who paved the way for space telescopes focused on the broader universe



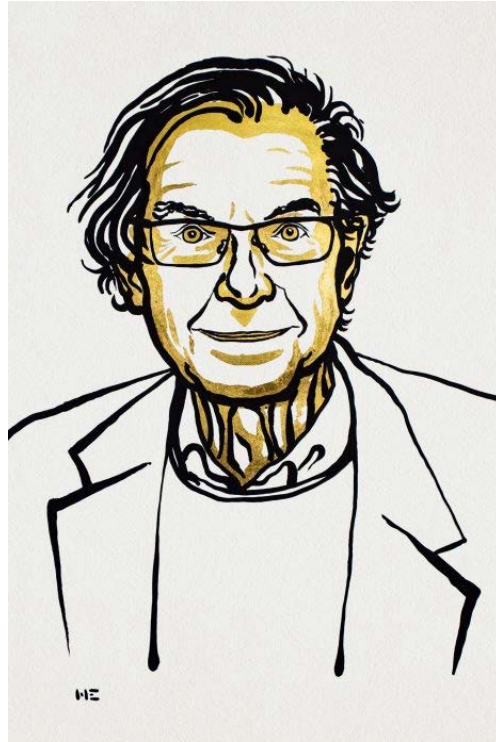
2020 Nobel Prize in Physics

2020 Black Holes
(Penrose, Reinhard,
& Ghez)

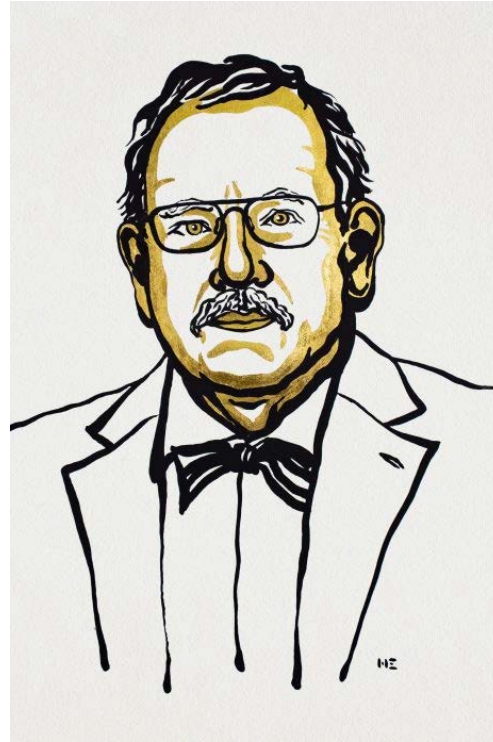
2019 Our Place in
the Universe
(Peebles, Mayor, &
Queloz)

2017 Gravitational
Waves (Weiss,
Barish, & Thorne)

2011 Dark Energy
(Perlmutter, Schmidt,
& Riess)



Roger Penrose
"for the discovery that
black hole formation is
a robust prediction of
the general theory of
relativity"



Reinhard Genzel
"for the discovery of a
supermassive compact
object at the centre of
our galaxy"



Andrea Ghez
"for the discovery of a
supermassive compact
object at the centre of
our galaxy"

Building Excellent NASA Teams Requires Inclusion and Diversity



- At NASA, we recognize that excellence is only achieved with inclusive and diverse teams. We are creating a multi-pronged approach.
 - Directorate level: Hosting [incubator workshops](#) and implementing actions from those workshops focused on short-term changes to how we are operating and how we grow our leaders. [Studying barriers to inclusion in mission leadership](#). Standing up a long-term activity focused on sustained engagement, systemic, and lasting changes.
 - Division level: Division task forces working to align division-level practices with the NASA core value and SMD science strategy. Examining the R&A process for better inclusion and diversity. Adopting a Code of Conduct to improve the inclusion and process of our panels and teams.
- Proposal Processes: Recognizing we have influence through our calls for proposals and what we reward in our selections. Piloting dual-anonymous peer review and seeking to expand that. Actively looking into how we can be a model for inclusivity.

Enhancing Participation of Minority Serving Institutions in Space Science
Monday, Jan 11 @ 6:50 pm ET



COVID-19 Impacts

Research:

NASA is focused on continuing our research programs and providing stability

- Virtual review panels for ROSES solicitations and AO mission evaluations are going well; all-virtual review panels for ROSES programs will continue until at least June 1, 2021
- NASA is thinking about continuing virtual review panels, at least in part, even after in-person meetings cease to pose a health hazard

NASA does not want the pandemic to derail careers of future leaders; we are focused on mitigating impacts

- Given current funding constraints, NASA will prioritize up to 15% of the R&A funding available for new awards toward augmentations and funded extension requests for existing awards that:
 - Are in their last year (or the last year of their first no-cost-extension);
 - Have costed their funds in a timely manner; and
 - Are for the explicit support of near-finishing graduate students / post-docs (including third-year NPPs) and non-tenured / soft-money early career researchers



The NASA Team



NASA Astrophysics Division

Division Director



Paul Hertz
Astrophysics Division
Director



Jeff Volosin
Astrophysics Division
Deputy Director



Program Executives



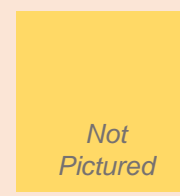
E. Lucien Cox
SOFIA, GUSTO,
XRISM, ExEP



Ed Griego
Astrophysics
Operating Missions



Shahid Habib
COR, PCOS, ARIEL,
Athena, Euclid, LISA,
UltraSat



Future

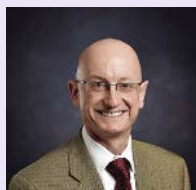


Janet Letchworth
Roman



Mark Sistilli
Explorers Program
IXPE, SPHEREx
Balloons

Cross Cutting



Eric Smith
Chief Scientist
Webb



Jeanne Davis
Assoc Dir for Flight
ASM Program Manager



Mario Perez
Chief Technologist
SAT, RTF

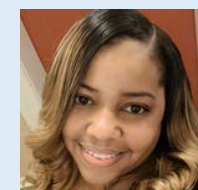


Lisa Wainio
Information Manager,
Public Affairs Liaison

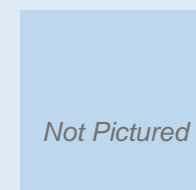
Administrative Support



Kelly Johnson
Administrative Assistant



Maria Washington
Administrative Assistant



Jackie Mackall
Program Support
Specialist



Ingrid Farrell
Program Support
Specialist

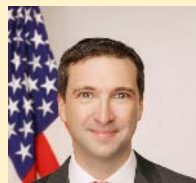
Program Scientists



Dominic Benford
APRA Lead
Roman



Valerie Connaughton
APRA (High Energy)
XRISM, UltraSat



Dan Evans
PCOS Program
NICER
Dual Anon.PR



Michael Garcia
APRA (UV/Optical),
SmallSats/Pioneers
Hubble, Athena



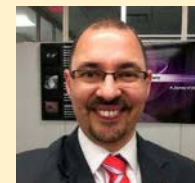
Thomas Hams
APRA (CR, Fund. Phys.)
Rockets/Balloons
GUSTO, LISA



Hashima Hasan
Education/Comms, Citizen
Science, Archives,
Advisory Committees,
NuSTAR, Keck



Douglas Hudgins
ExEP Program
ADAP Lead
TESS, ARIEL



Stefan Immler
Astrophysics Research
Program Mgr, Chandra,
XMM



Hannah Jang-Condell
FINESST, ExEP,
TESS



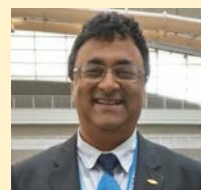
Patricia Knezek
Astrophysics Explorers
Program, SOFIA,
Hubble Fellows



William Latter
APRA (Lab Astro)
Spitzer, SPHEREx,
Fermi



Pamela Marcum
Exoplanet Research
Program (XRP)



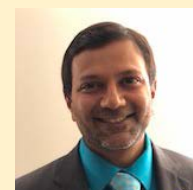
Roopesh Ojha
Data Management,
FINESST, XMM



Aki Roberge
ASMP, Roman



Evan Scannapieco
ATP / TCAN Lead,
Swift



Kartik Sheth
COR Program



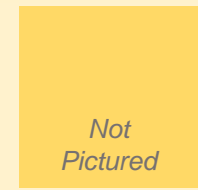
Linda Sparke
On detail to the Office
of the Administrator



Eric Tollestrup
APRA (IR/Submm)
Euclid, IXPE



Heather Watson
Dep. Technologist,
Explorers,
SmallSats/Pioneers



Future

NASA Town Halls



	Session	
NASA Town Hall	220	Tuesday, Jan 12 @ 1:40 pm ET
R&A Program Town Hall	Splinter	Wednesday, Jan 13 @ 12:00 pm ET
STScI Town Hall	319	Wednesday, Jan 13 @ 1:40 pm ET
Webb Space Telescope Town Hall	419	Thursday, Jan 14 @ 1:40 pm ET
Science Activation Next Phase	Splinter	Thursday, Jan 14 @ 4:10 pm ET
SOFIA Town Hall	519	Friday, Jan 15 @ 1:40 pm ET
Roman Space Telescope Town Hall	520	Friday, Jan 15 @ 1:40 pm ET

Program Analysis Groups (PAGs)

COPAG	Mon @ 12:00 pm	PhysPAG	Mon @ 12:00 pm
SIGs	Far-IR/Origins (Tue @ 12:00 pm)	SIGs	Multi-Messenger (Tue @ 12:00 pm)
	Low Freq Radio (Wed @ 12:00 pm)		Inflation Probe (Wed @ 12:00 pm)
	UV/Vis/Tech (Thu @ 12:00 pm)		X-ray (Wed @ 6:50 pm)
	Cosmic Origins (Fri @ 12:00 pm)		Gravitational Wave (Thu @ 12:00 pm)
			Cosmic Structure (Thu @ 4:10 pm)

Enhancing Participation of Minority Serving Institutions in Space Science (Mon @ 6:50 pm)

Virtual NASA at the AAS



237



237TH MEETING OF THE AMERICAN ASTRONOMICAL SOCIETY

VIRTUALLY ANYWHERE 10 – 15 JANUARY 2021

**Astrophysics
Strategic
Missions**

**Exoplanet
Exploration**

Science Stories

Schedule:
Webinars, Chats, Sessions

**Physics of
the Cosmos
&
Cosmic
Origins**

**Astrophysics
Explorers**


NASA SCIENCE

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Postdocs &
Internships

Social Media

Zoom Room

Chat

NASA Science Webinars			
Date	Time (ET)	Presenter(s)	Presentation Title
Monday, January 11	12:00 - 12:30 pm	Aki Roberge, NASA	Exoplanet Science with the Nancy Grace Roman Space Telescope
Monday, January 11	12:00 - 12:30 pm	Jonathan Gardner, NASA	The James Webb Space Telescope Science
Tuesday, January 12	2:30 - 3:00 pm	James De Buizer, USRA	SOFIA: Science from the Stratosphere
Tuesday, January 12	4:00 - 4:30 pm	Dan Evans, NASA	Dual-Anonymous Peer Review at NASA
Wednesday, January 13	12:30 - 1:00 pm	Ryan Hickox, Dartmouth	First Black Holes
Wednesday, January 13	1:30 - 2:00 pm	Travis Fischer, STScI	The ULLYSES Program: Charting Young Stars' Ultraviolet Light with Hubble
Wednesday, January 13	5:00 - 5:30 pm	Dominic Benford, NASA	Wide Field Survey Science with the Nancy Grace Roman Space Telescope
Thursday, January 14	12:00 - 12:30 pm	John Mather, NASA	Overview of the James Webb Space Telescope
Thursday, January 14	2:00 - 2:30 pm	Grant Tremblay, Harvard	The Once & Future Great Observatories
Thursday, January 14	4:00 - 4:30 pm	Marc Kuchner, NASA	Citizen Science

Ask the Director: Paul Hertz will be available for Q&A, Thursday, January 14 @ 2:40 pm ET

Informal Chat with NASA Staff, Every Day, Monday - Friday @ 2:40 pm ET

Zoom Room Chats @ 2:40 – 3:10 pm ET		
Date	Presenter(s)	Chat Topic
Mon, Jan 11	Eliad Peretz, NASA	Orbiting Configurable Artificial Star - ORCAS
Mon, Jan 11	Lynn Cominsky, Sonoma State U	NASA's Neurodiversity Network
Mon, Jan 11	Naseem Rangwala, NASA	How to do Astronomy from 40,000 Feet
Mon, Jan 11	NASA Staff	Informal Chat with NASA Staff
Tue, Jan 12	Steven Crawford, NASA	Open Science at NASA
Tue, Jan 12	Steve Finkelstein, U Texas	JWST Early Release Science: CEERS
Tue, Jan 12	Kristen Erickson, NASA	NASA Science Activation: NASA's Approach to Connect Science to Learners and Communities
Tue, Jan 12	Taifa Simpson, USRA	NASA Postdoctoral Program Information Session
Tue, Jan 12	NASA Staff	Informal Chat with NASA Staff
Wed, Jan 13	Erin Smith, NASA	The James Webb Space Telescope Current Status
Wed, Jan 13	Jack Burns, UC Boulder	Transformative Radio Astrophysics from the Moon
Wed, Jan 13	Evan Scannapieco, NASA	Astrophysics R&A Diversity – Equity - Inclusion Task Force
Wed, Jan 13	NASA Staff	Informal Chat with NASA Staff
Thu, Jan 14	Paul Hertz, NASA	Q&A/Chat with NASA's Director of Astrophysics, Paul Hertz
Thu, Jan 14	Kristen Erickson, NASA	NASA Science Activation: NASA's Approach to Connect Science to Learners and Communities
Thu, Jan 14	Taifa Simpson, USRA	NASA Postdoctoral Program Information Session
Thu, Jan 14	NASA Staff	Informal Chat with NASA Staff
Fri, Jan 15	Stefan Immler, NASA	NASA Astrophysics Research and Analysis, Q&A with Stefan Immler
Fri, Jan 15	NASA Staff	Informal Chat with NASA Staff



Keep Connected with NASA

NSPIRES mailing list – information about NASA solicitations

<https://nspires.nasaprs.com/>

Cosmic Origins mailing list, Exoplanet Exploration mailing list, Physics of the Cosmos mailing list – information about NASA missions and science

<https://cor.gsfc.nasa.gov/cornews-mailing-list.php>

<https://exoplanets.nasa.gov/exep/exopag/announcementList/>

<https://pcos.gsfc.nasa.gov/pcosnews-mailing-list.php>

NASA Astrophysics Federal Advisory Committees

Astrophysics Advisory Committee (APAC)

<https://science.nasa.gov/researchers/nac/science-advisory-committees/apac>

NASEM Committee on Astronomy and Astrophysics (CAA)

http://sites.nationalacademies.org/bpa/bpa_048755

Astronomy and Astrophysics Advisory Committee (AAAC)

<https://www.nsf.gov/mps/ast/aaac.jsp>

Sign up to be a panel reviewer:

<https://science.nasa.gov/researchers/volunteer-review-panels>



Why Volunteer to Serve on a NASA Peer Review Panel?

Personal professional development:

- See how the whole review process works

- Learn what constitutes excellent proposals

- Network with your professional colleagues and NASA scientific staff

Institutional achievement:

- Improve at competing for NASA money

- Increase knowledge of NASA's research and technology programs

Investment in the future:

- Help select the most transformative science

- Ensure that all proposals receive a fair and competent review

Sign up to be a panel reviewer:

- <https://science.nasa.gov/researchers/volunteer-review-panels>

- or contact a NASA program officer (for contact info, see

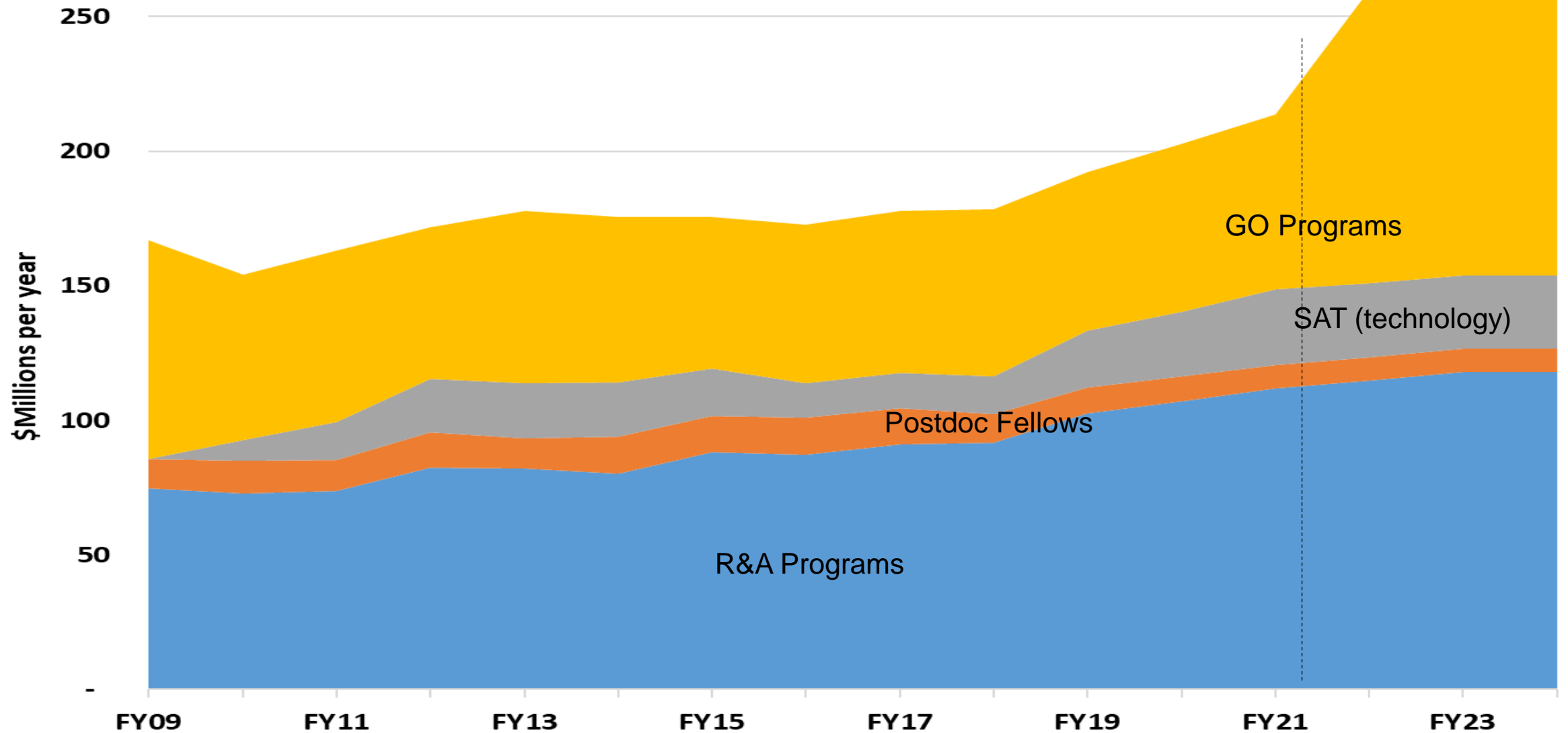
- <https://science.nasa.gov/researchers/sara/program-officers-list>)



Research Program Update



Astrophysics Community Funding



R&A Reviews since the Start of COVID-19

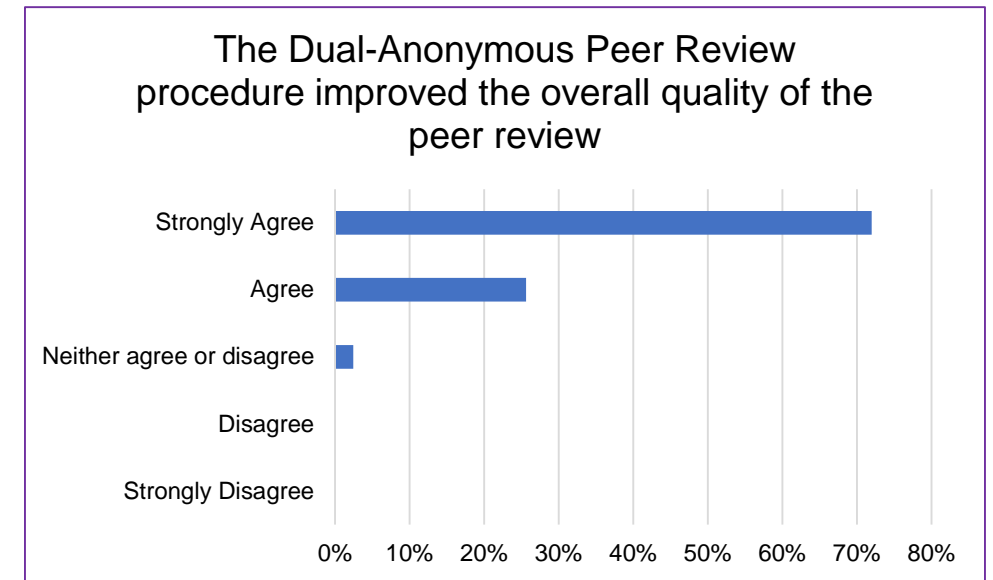
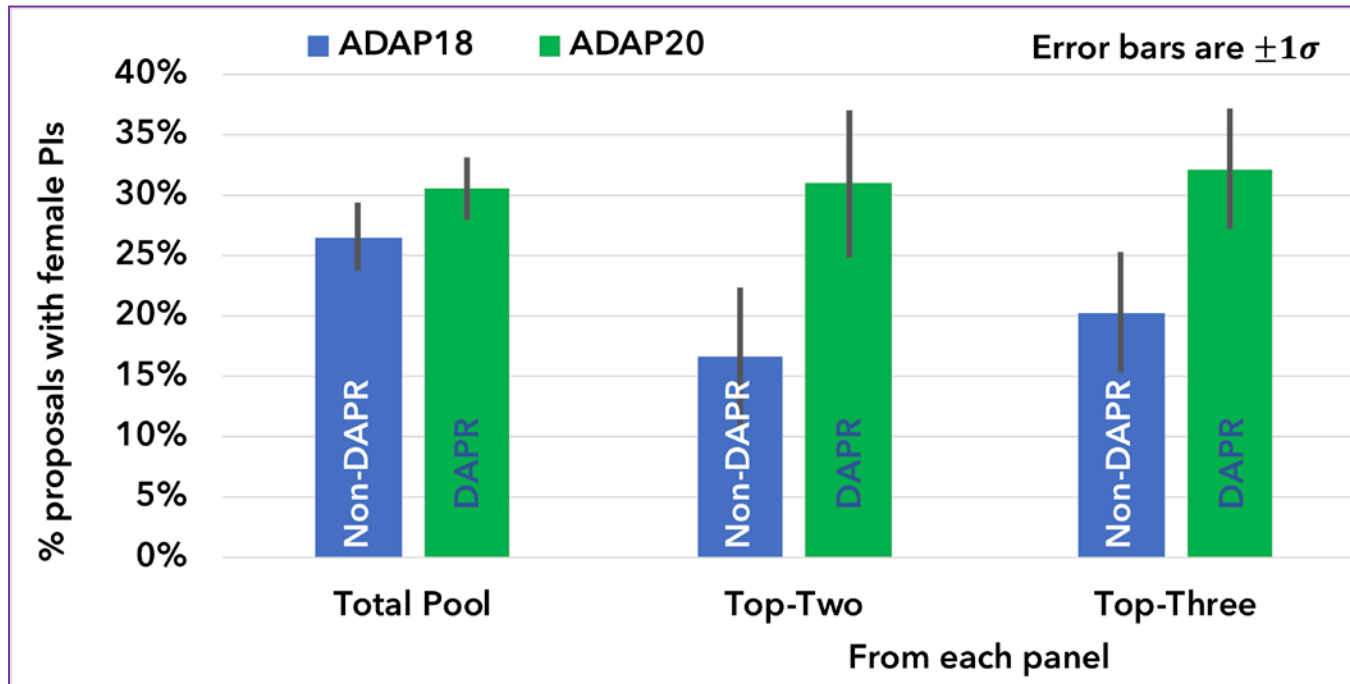
No solicitation was canceled due to COVID-19 and some due dates were postponed to give PIs more time.

R&A Review	Number of Proposals	Selection Rate	New PIs *	PI Notification	Review Format	Comment
FINESST (Graduate Student Awards)	158	13%	N/A	108 days	Virtual	
TESS GI Cycle 3	155	32%	76%	137 days	Virtual	
NuSTAR GO Cycle 6	172	34%	39%	88 days	Virtual + dual anonymous	GO/GI dual anonymous pilot program
Fermi GI Cycle 13	109	38%	24%	126 days	Virtual	
Hubble GO Cycle 28	1,080	18%	33%	86 days	Virtual + dual anonymous	
Chandra GO Cycle 22	520	31%	31%	132 days	Virtual	
Astrophysics SmallSat Studies	32	25%	100%	148 days	Virtual	
TCAN (Theory)	22	18%	100%	97 days	Virtual	
XRP (Exoplanets Research)	153	17%	77%	185 days	Virtual	Cross-Division
ADAP (Data Analysis)	313	13%	82%	141 days	Virtual + dual anonymous	R&A dual anonymous pilot program
Pioneers SmallSat Missions	24	17%	100%	89 days	Virtual	Confirmation gate in 2021

* New PI defined as one who has not been a PI in this program in the past five years

Dual-Anonymous Peer Review

- Dual-Anonymous Peer Review (DAPR) has successfully been used in multiple Astrophysics programs
- All Astrophysics GO/GI programs have permanently converted
- Astrophysics Data Analysis and Habitable Worlds among ROSES programs converted in 2020
- Will be joined by Exoplanet Research and Astrophysics Theory programs in ROSES-2021



NASA Science Webinar : Dual Anonymous Peer Review at NASA
Daniel Evans, Tuesday, Jan 12 @ 4:00 pm ET

2021 Astrophysics Research Program Elements

ROSES-21:

Supporting Research and Technology

- Astrophysics Theory Program (ATP), every other year
- Astrophysics Research & Analysis (APRA)
- Strategic Astrophys Tech (SAT) (dependent on Astro2020)
- Roman Technology Fellowships (RTF)

Data Analysis

- Astrophysics Data Analysis (ADAP)
- GO/GI programs for Fermi, Swift, NuSTAR, TESS, NICER

Mission Science and Instrumentation

- Astrophysics Pioneers (suborbital science investigations)
- Suborbital payloads solicited through APRA
- XRISM Guest Scientist **New**
- Roman Research and Support Opportunities **New**

Cross Divisional

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

Not in ROSES-21:

Separately Solicited

- GO/GI/Archive/Theory programs for Hubble, Chandra, SOFIA, Webb
- NASA Hubble Fellowship Program (NHFP)
- NASA Postdoctoral Program (NPP)
- Support for XMM-Newton U.S. PIs selected by ESA

Not Solicited this Year

- Theoretical and Computational Astrophysics Networks (TCAN), every three years
- Astrophysics Explorers U.S. PIs (APEX USPI), every two to three years

Red – evaluated using dual-anonymous peer reviews

NASA Research Program Town Hall
Splinter Session
Wednesday, Jan 13 @ 12:00 pm ET

NASA R&A Zoom Chat
NASA Virtual Booth
Friday, Jan 15 @ 2:40 pm ET

R&A Grant Extensions & Flexibilities

(COVID-19 mitigation)

NASA does not want the pandemic to derail careers of future leaders; we are focused on mitigating impacts

Within current funding constraints, NASA will prioritize augmentations and funded extension requests for existing awards that:

- Are in their last year (or the last year of their first no-cost-extension);

- Have costed their funds in a timely manner; and

- Are for the explicit support of near-finishing graduate students / post-docs (including third-year NPPs) and non-tenured / soft-money early career researchers

NASA has issued a ROSES call for funded extensions (ROSES-20, Appendix E.10)

Existing awardees may submit Post COVID-19 Recovery proposals at any time until the final due date of March 5, 2021. Requests received by January 4, 2021, will be processed as a group. Requests submitted after January 4, 2021 but before March 5, 2021, will form a second group and will be processed together.

This initiative must be funded from the current R&A Program, size of commitment is approximately 15% of funding available for new awards in FY21

There will be 15% fewer new awards in FY21

Government-wide flexibility for paying salaries of researchers, even if they could not work because of COVID, expired on September 30. NASA has established a process to consider extending this flexibility to pay salaries on a case-by-case basis

<https://science.nasa.gov/researchers/covid-and-awards>



From Open Data to Open Science

All NASA mission science data are public

Publications funded by NASA, including peer review journal articles, are open access and freely available to the public

NASA has initiated an open science data initiative that is making targeted investments in cloud computing, open-source software, Artificial Intelligence/Machine Learning, and open data search and discovery services

- Includes two new ROSES calls targeted at supporting open-source tool development and the opening of legacy software

NASA is developing a policy to ensure that the results of its Federally funded scientific research and technology development are shared openly; this policy will cover:

- Information produced by NASA Science Missions
- Information produced by NASA research awards: includes, but not limited to, experiments, research on sub-orbital platforms, field campaigns, or citizen science projects
- NASA-funded publications, data, and software created in the pursuit of scientific knowledge

Draft will be released for public comment

Zoom chat at NASA booth with Steven Crawford, SMD Open Science Officer
Tuesday, Jan 12 @ 2:40 - 3:10 pm ET



Science Engagement

As a part of NASA's Science Activation (SciAct) program, Astrophysics brings the excitement of the science from its portfolio to provide content to help learners of all ages “do” science.

NASA Science Activation's Next Phase

- Hear from NASA, including Kristen Erickson, Paul Hertz, and Hashima Hasan, and from PI's of Astrophysics SciAct projects.
- Find out how you can participate in as a subject matter expert; come to splinter session or contact the SciAct PI's.

NASA Science Activation Next Phase
Splinter Session
Thursday, Jan 14 @ 4:10 pm ET

Science Activation Zoom Chats
NASA Virtual Booth
Tuesday, Jan 12 @ 2:40 pm ET
Thursday, Jan 14 @ 2:40 pm ET

<https://science.nasa.gov/learners>



Citizen Science

Citizen Science is a form of open collaboration in which individuals participate voluntarily in the scientific process – Citizen Science is a science investigation that relies on volunteers

Current projects at <https://science.nasa.gov/citizenscience>

Backyard Worlds: Planet 9 project at <https://backyardworlds.org> announced the first extreme T subdwarfs and most of the known brown dwarfs colder than 500 K

Planet Patrol launched at <https://exoplanetpatrol.org>; volunteers help vet exoplanet candidates from the TESS mission

Proposers to any ROSES program element may incorporate citizen science and crowdsourcing methodologies into proposals, where such methodologies advance the proposed investigation

Citizen Science Seed Funding Program in ROSES funds prototyping of citizen science projects offered. ROSES-20 deadline was in December 2020; 18 proposals for Astrophysics

NASA Citizen Science Community Workshop series online will continue in 2021

NASA Science Webinar: Citizen Science
Thursday, Jan 14 @ 4:00 pm ET



Mission Program Update



Astrophysics Missions in Operations

Hubble 4/90 NASA Strategic Mission  Operations Nominal	Chandra 7/99 NASA Strategic Mission  Operations Nominal	XMM-Newton 12/99 ESA-led Mission  Operations Nominal (ESA)	Gehrels Swift 11/04 NASA MIDEX Mission  Operations Nominal	Fermi 6/08 NASA Strategic Mission  Operations Nominal	NuSTAR 6/12 NASA SMEX Mission  Operations Nominal
SOFIA 5/14 NASA Strategic Mission  Ops Restarted Aug 17 - Sep 29 Planned Maint. Oct '20 - Jan '21 Ret-to-Sci Feb '21	ISS-NICER 6/17 NASA Explorers Miss. of Oppty  Operations Nominal	TESS 4/18 NASA MIDEX Mission  Operations Nominal	Balloon Program Four Campaigns per Year  2020 Operations Suspended 2021 TBD	Sounding Rockets Worldwide Campaigns  Operations Resumed Sep 8	Data Archives HEASARC, IPAC, MAST, etc.  Operations Nominal

STScI Town Hall (Session 319)
 Wednesday, Jan 13 @ 1:40 pm ET

SOFIA Town Hall (Session 519)
 Friday, Jan 15 @ 1:40 pm ET

Astrophysics Mission Classes

Mission Class	How initiated	Total Cost (PI cost cap when different)
Large: Great Observatory or Flagship	Decadal Survey	> \$1B
Medium: Probe	Decadal Survey	~\$1B
Small: Medium Explorer (MIDEX)	Explorer AO	~\$450M (\$290M)
Small Explorer (SMEX)	Explorer AO	~\$225M (\$145M)
Standard Mission of Opportunity *	SALMON AO	\$80M
SmallSat Mission of Opportunity *	SALMON AO	\$40M
Pioneers SmallSat *	ROSES	\$20M
APRA CubeSat	ROSES	<\$5M **
Suborbital: Pioneers Balloon	ROSES	\$20M
APRA Balloon	ROSES	<\$10M **
APRA Sounding Rocket	ROSES	<\$5M **

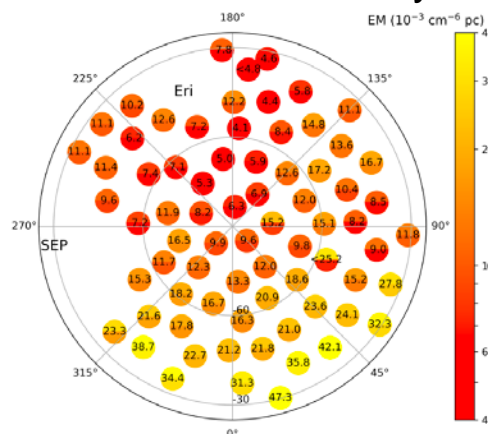
* includes ISS-attached experiments

** not explicitly cost capped; value is historical upper bound for support within APRA

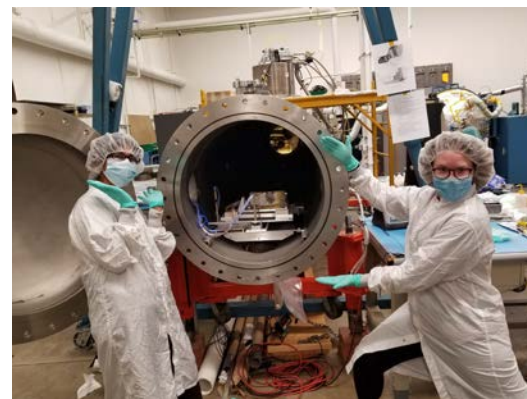
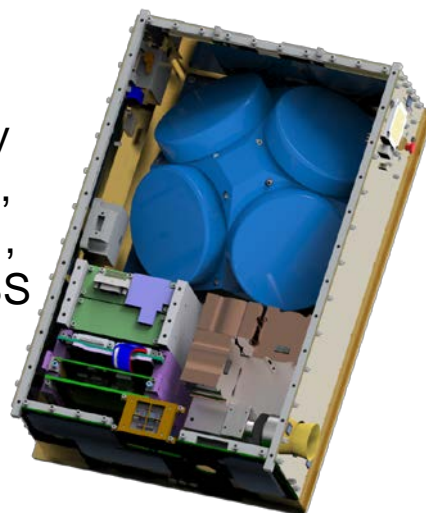
Astrophysics CubeSats

Solicited annually in ROSES/APRA, ~1 new start per year, ~<\$5M each total cost

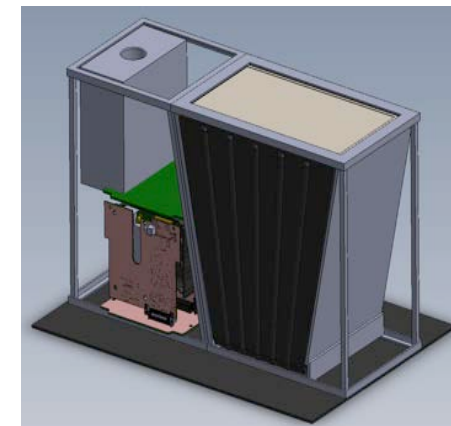
HaloSat: PI Phil Kaaret (U of Iowa),
Launch May 2018, Reentered Jan 2021,
OVII/OVIII lines in Galaxy halo, determine
mass and structure of Galaxy halo



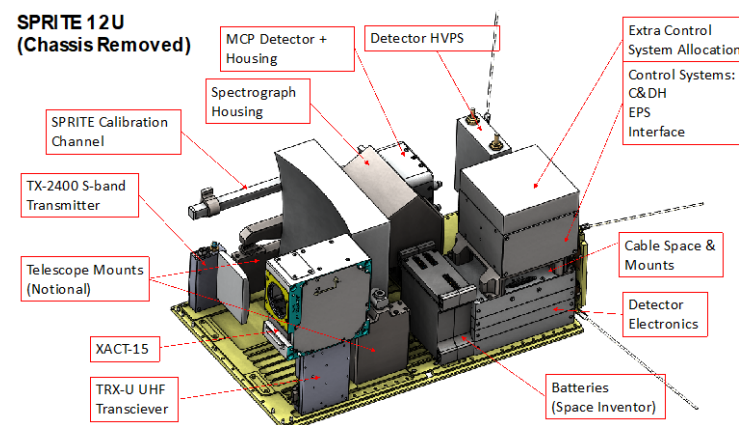
BurstCube: PI Jeremy
Perkins (NASA GSFC),
Launch NET Dec 2021,
GRB monitor w/ TDRSS
real-time event
notification



CUTE: PI Kevin
France (CU),
Launch Sep 2021,
UV Imaging of hot
Jupiter ablation,
(Arika Egan & Ambily
Suresh in lab)



BlackCat: PI Abe
Falcone (Penn St U),
Launch NET Mar 2024,
2-20 KeV wide FOV
localization of X-ray
transients, real-time
'cell phone' downlink



SPRITE, PI Brian Fleming (CU),
Launch NET Jan 2023,
UV spectra of ionizing radiation
from star forming galaxies

Astrophysics Pioneers

New in 2020

Major extended duration balloon payloads, CubeSats larger than 6U, and modest ISS attached payloads are more expensive than ROSES/APRA can accommodate (<\$10M maximum)

Pioneers: A new class of small missions offered for first time in ROSES-2020, \$20M maximum PI cost cap

- Include SmallSats, CubeSats >6U, major balloon payloads, and modest ISS attached payloads with a \$20M cost cap, not including launch
- Fill in the gap between existing ROSES investigations (<\$10M for APRA) and existing Explorers MO investigations (~\$35M for SmallSats)
- Solicit through ROSES; relieves burden of writing full Explorers MO proposal
- Manage as Research and Analysis projects with enhanced research project processes with defined gates and light touch management from WFF and HQ, rather than flight project processes appropriate for a Small Explorer (SMEX) mission

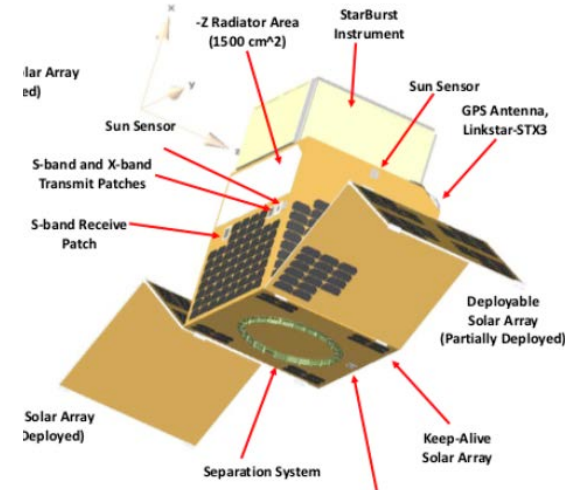
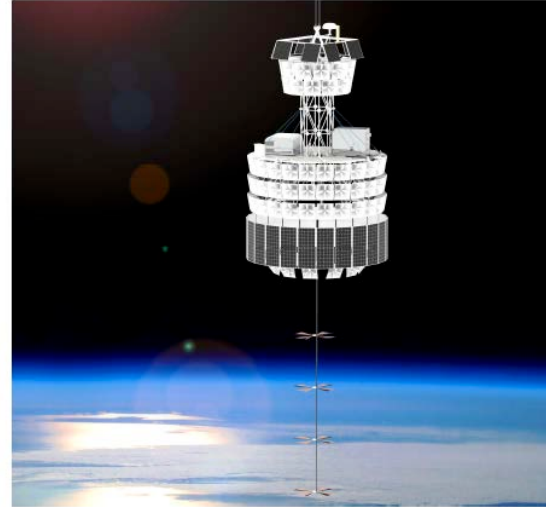
Received 24 proposals on October 8, 2020 (17 SmallSats, 7 Balloons); most were selectable

Selection of 4 proposals announced January 2021 (3 SmallSats, 1 Balloon)

Next round of Pioneers proposals due in Fall 2021

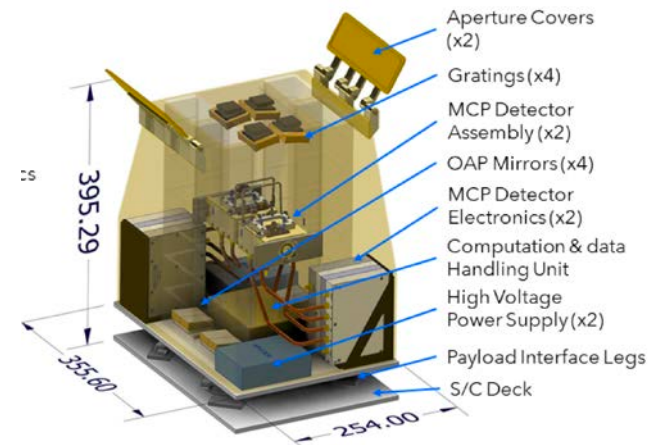
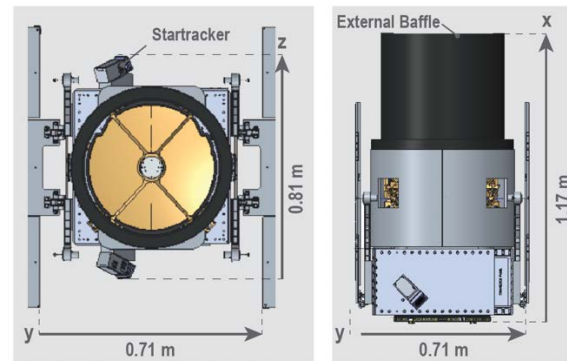
Astrophysics Pioneers-2020 Selections

PUEO: A Long-duration Balloon-borne Instrument for Particle Astrophysics at the Highest Energies (PI Abigail Vieregg, U. Chicago)



StarBurst:
Gamma-ray ASM,
Simultaneous
detection of NS/NS
mergers with LIGO
(PI Daniel Kocevski,
NASA MSFC)

Pandora:
Multiwavelength
Characterization of
Exoplanets and their
Host Stars
(PI Elisa Quintana,
NASA GSFC)



Aspera: IGM
Inflow/outflow from
galaxies via OVI
 10^5K emission line
imaging
(PI Carlos Vargas,
U. Arizona)

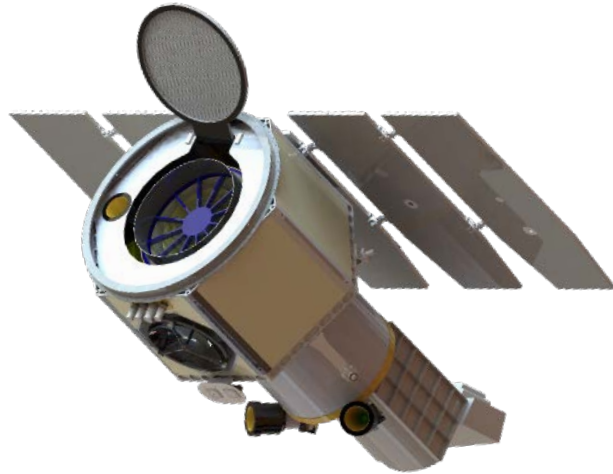
<https://www.nasa.gov/feature/nasa-selects-4-concepts-for-small-missions-to-study-universe-s-secrets>

Astrophysics Explorers in Competitive Phase A

Small Explorers

ESCAPE

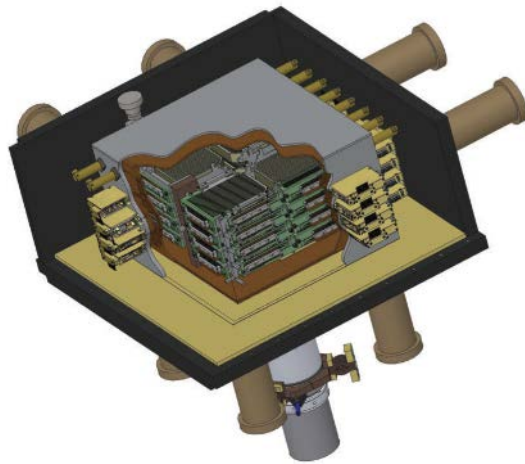
PI: K. France, U Colorado



Do extreme ultraviolet stellar flares zap atmospheres of exoplanets in the habitable zone?

COSI

PI: J. Tomsick/UC Berkeley

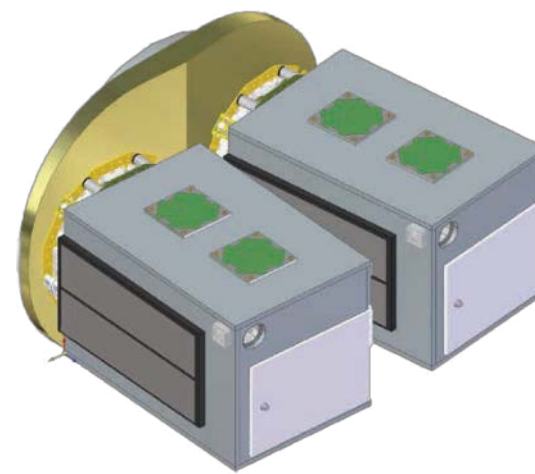


MeV gamma-rays trace Milky Way's supernova activity, positron production; polarization in gamma-ray bursts

Missions of Opportunity

Dorado

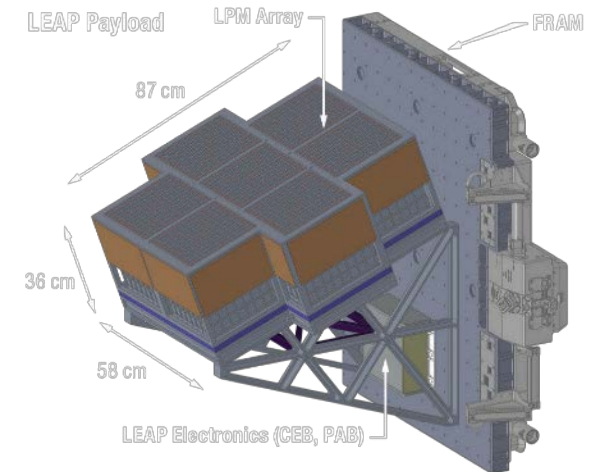
PI: B Cenko/GSFC



Two 12U CubeSats watch for UV light when neutron stars merge

LEAP (on ISS)

PI: M. McConnell/ U New Hampshire

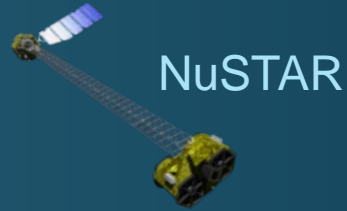


Polarization of gamma-ray bursts sheds light on jet structure

Concept Study Reports due March 4, 2021

SMEX/MO downselect fall 2021

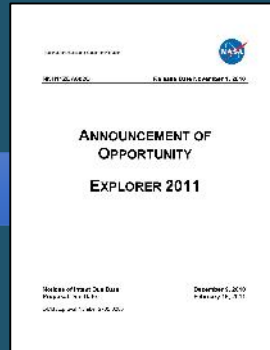
Astrophysics Explorers Program



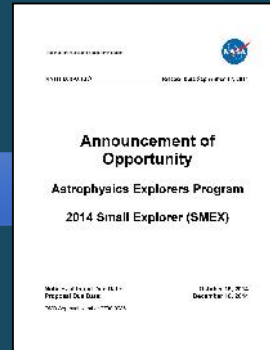
SMEX 2019 Downselect
Phase A Studies due Mar 4, 2021
Downselect decision Fall 2021

MIDEX 2021
Comm Ann release Sep 29, 2020
Draft AO release Jan 6, 2021
Comments due Feb 25, 2021
Final AO release August 2021
NOIs due October 2021
Proposals due December 2021
ALL FUTURE DATES TARGETS

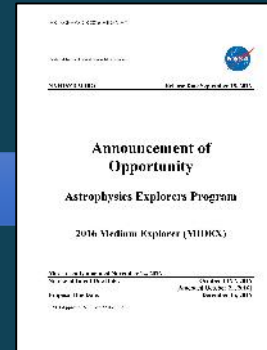
4 AOs per decade



MIDEX
2011



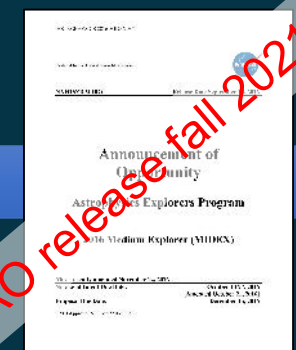
SMEX
2014



MIDEX
2016

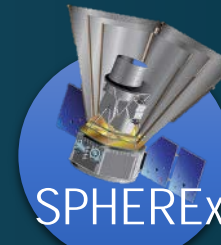


SMEX
2019



MIDEX
2021

Small and
Mid-Size
Missions



Missions of
Opportunity



Astrophysics and Artemis



Every opportunity for lunar science is open to astrophysics – if you have a great idea, propose it

Artemis enables astrophysics

- All science opportunities enabled by Project Artemis include astrophysics
- Most important criterion for proposals remains the astrophysics science merit

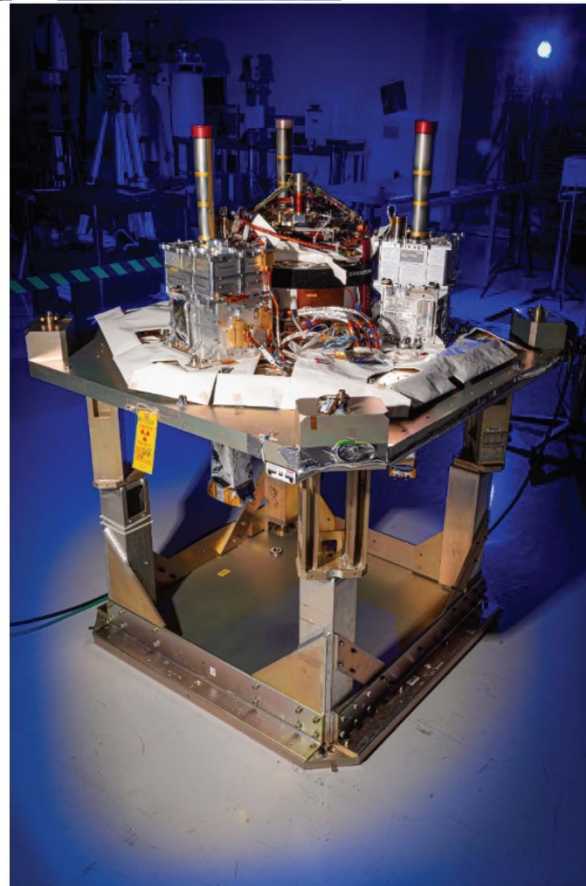
There are many opportunities to propose astrophysics that uses Artemis capabilities

- Lunar surface astrophysics experiments can be proposed to the PRISM program of small landed payloads (in ROSES)
 - PRISM Step 2 proposals are due February 3, 2021
 - Two lunar surface astrophysics experiments have been selected and manifested for 2021:
 - Low-frequency Radio Observations from the Near Side Lunar Surface Instrument (PI: R. MacDowall, GSFC)
 - Next Generation Lunar Retroreflectors (PI: D. Currie, University of Maryland)
- Astrophysics Explorers Mission of Opportunity calls (including 2021 call for Explorers MO) allow proposals for cislunar smallsat missions
- APRA and Pioneers calls (in ROSES) allow proposals for cislunar cubesats and smallsats

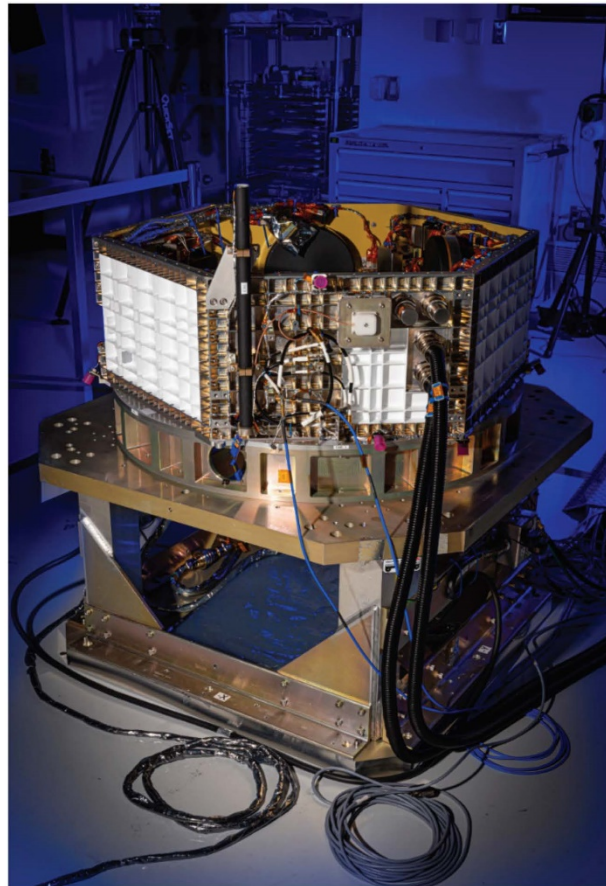
Astro2020 Decadal Survey will identify any compelling astrophysics that is both a high priority and enabled by the capabilities being developed within the Artemis program



Imaging X-ray Polarimeter Explorer



Instrument & Deployable Boom
Integrated to Top Deck



IXPE Spacecraft



IXPE Solar Array



Mirror Module Assembly (MMAs)
Integrated on MMSS Deck

KDP-D successfully
passed on November 2,
2020

All observatory elements
have been delivered to
Ball Aerospace, Boulder
CO

Observatory integration
began December 7, 2020

Revised launch date is
November 2021

<https://ixpe.msfc.nasa.gov/>

Flight Hardware Assembly is Near Complete

Image credits: Ball Aerospace

James Webb Space Telescope



The final deployment of Webb's sunshield on Earth (December 2020). Webb will undergo folding and stowing before shipment and mating to the Ariane 5 in 2021.

2020 Accomplishments

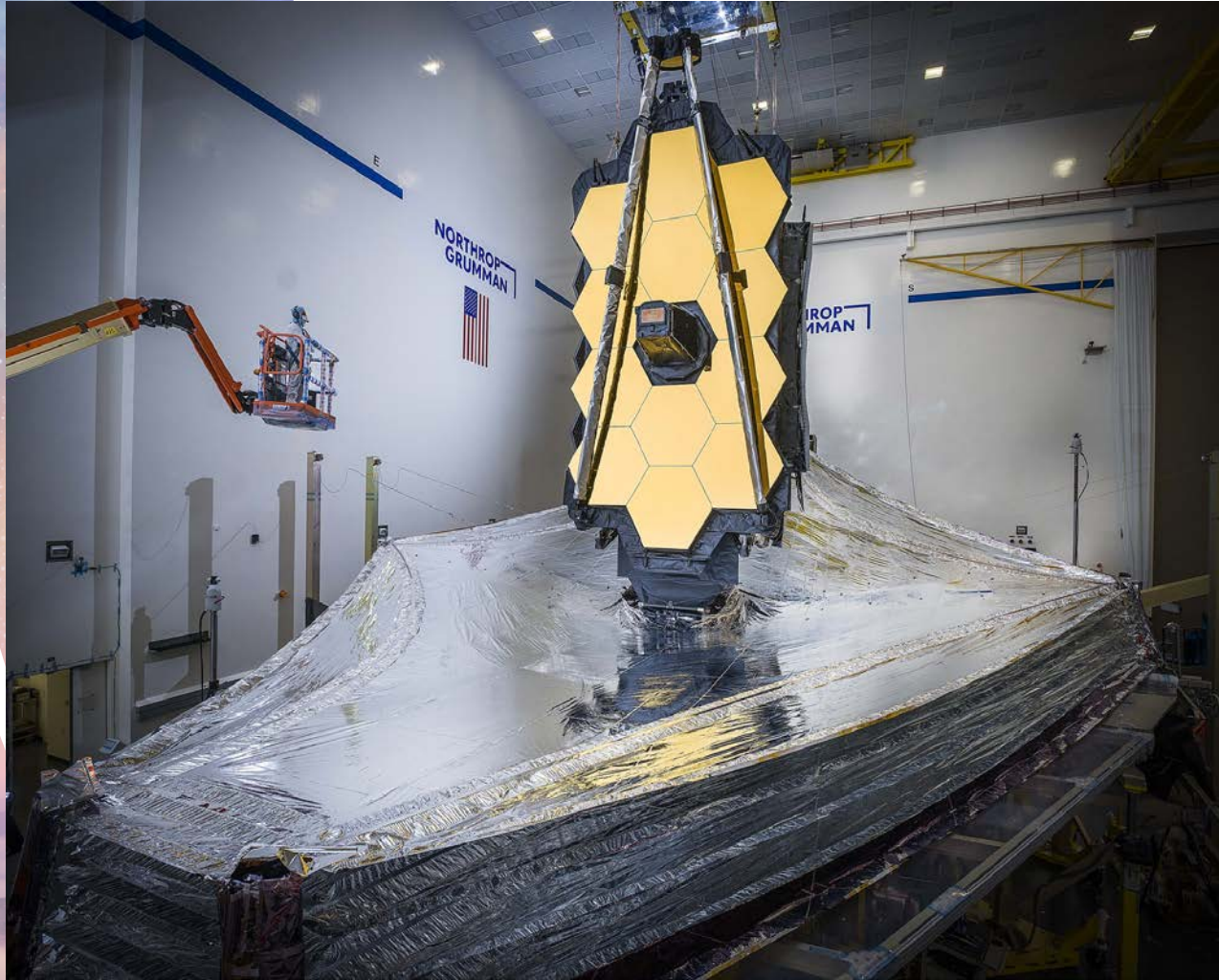
- Work continues at Northrop Grumman, but at lower efficiency due to social distancing practices required by COVID19 response
- Changed launch date from March 2021 to October 2021
- Conducted several mission rehearsals at the STScI mission operation center
- Completed Observatory-level environmental tests
- Completed Observatory-level post environmental test deployments
- Received ~1200 proposals in the Cycle 1 GO call

2021 Plans

- Final stow after post environmental deployments
- Ready Observatory for shipping to launch site
- Additional mission rehearsals at STScI
- Launch Webb in October 2021

Webb Town Hall (Session 419)
Thursday, Jan 14 @ 1:40 pm ET

James Webb Space Telescope



The final deployment of Webb's sunshield on Earth (December 2020). Webb will undergo folding and stowing before shipment and mating to the Ariane 5 in 2021.

NASA Science Webinar: Webb
Monday, Jan 11 @ 12:00 pm ET

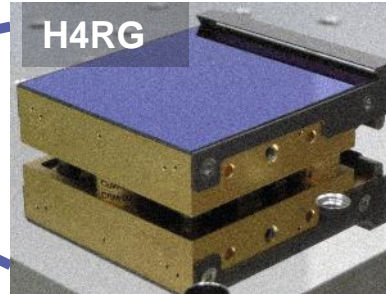
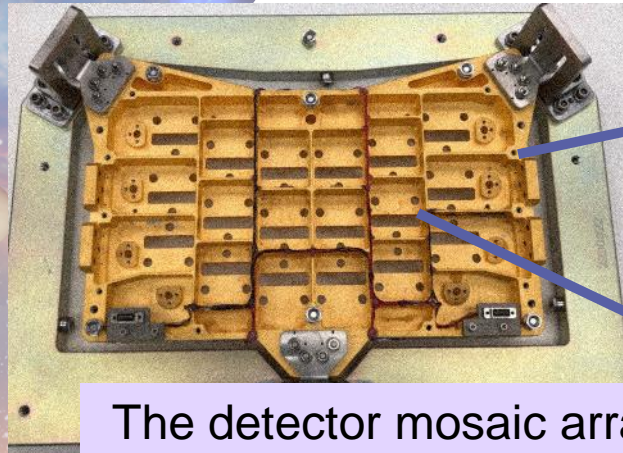
Webb Zoom Chat @ NASA Booth
Wednesday, Jan 13 @ 2:40 pm ET

NASA Science Webinar: Webb
Thursday, Jan 14 @ 12:00 pm ET

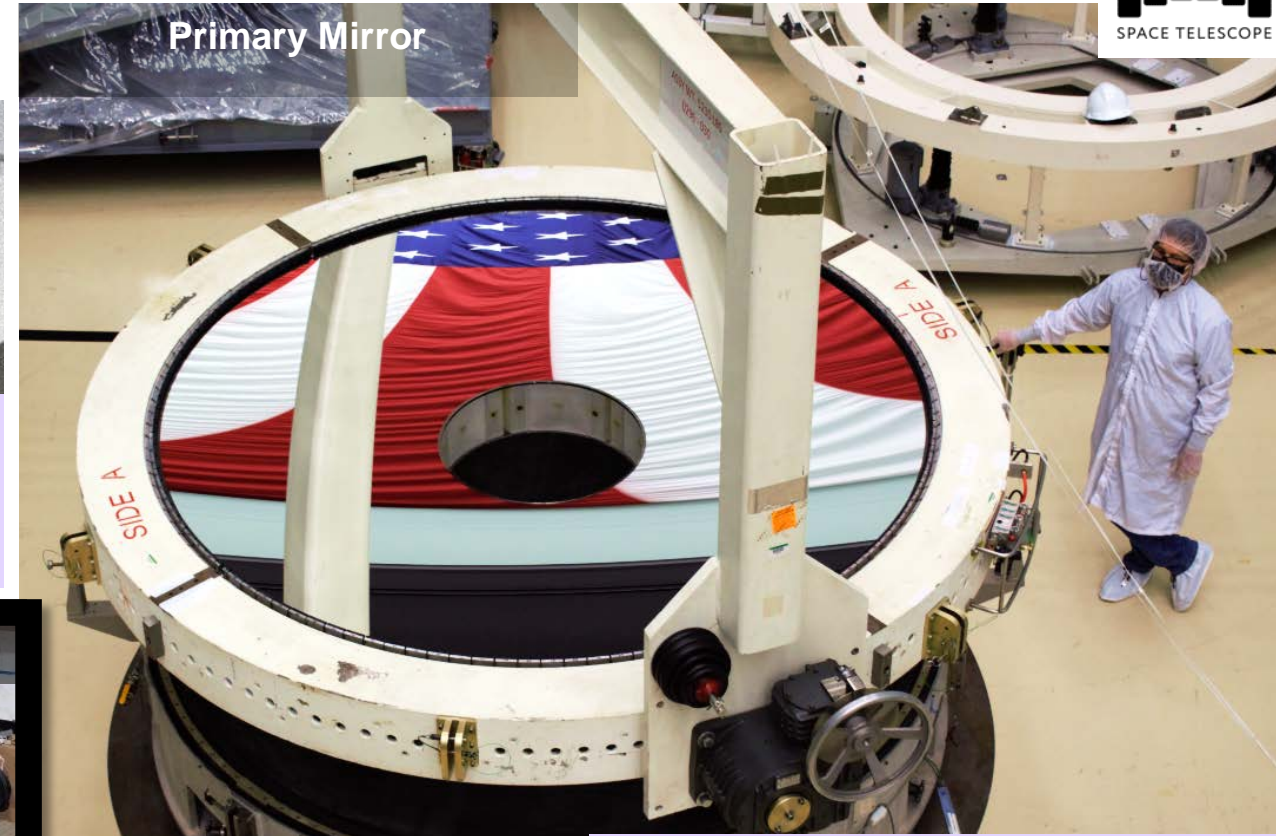
Webb Town Hall (Session 419)
Thursday, Jan 14 @ 1:40 pm ET

<https://webb.nasa.gov/>

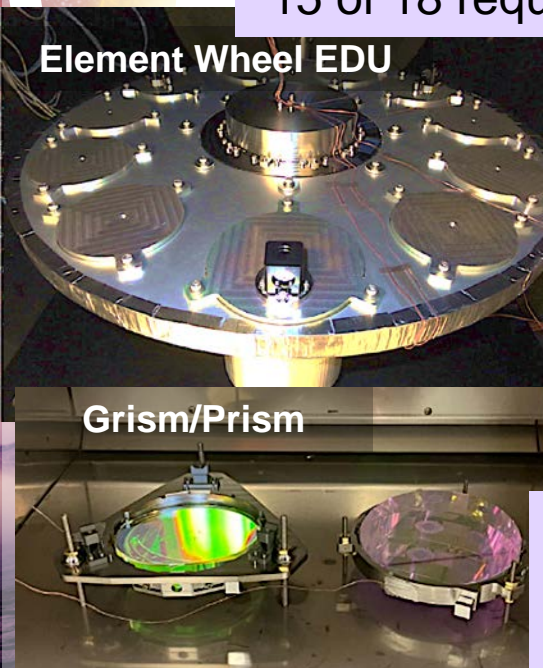
Roman Hardware Progress



The detector mosaic array will hold 18 H4RG Sensor Chip Assemblies (SCAs).
15 of 18 required SCA detectors are in hand.



Primary Mirror



Element Wheel EDU

Grism/Prism

Spacecraft Bus Frame Mockup



Engineering Test/Development Units and Mock-ups aid in maturing designs and assembly processes.

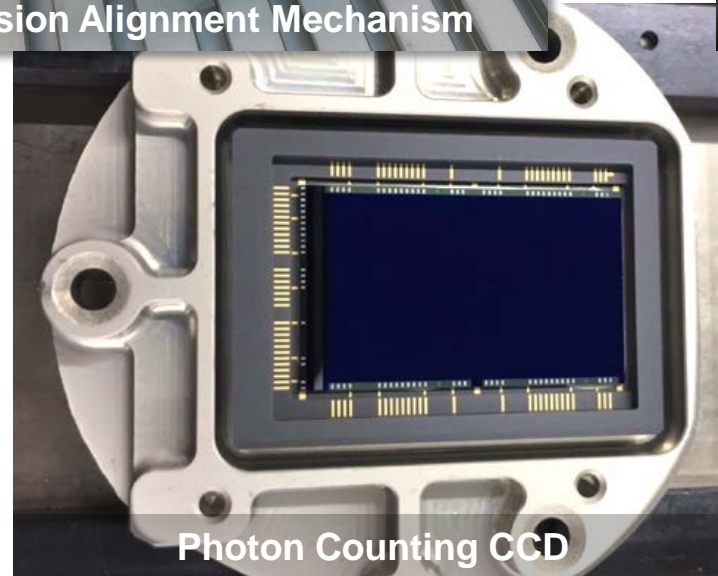
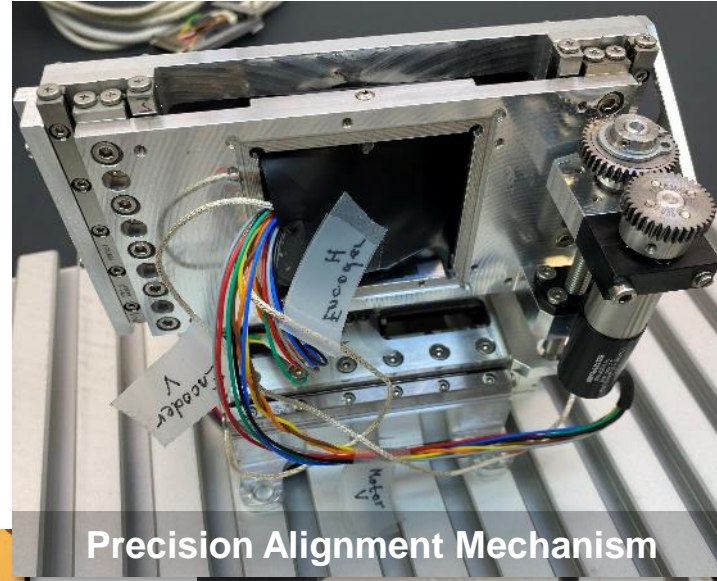
Sunshade Engineering Development Unit



Primary and secondary mirror fabrication complete. Telescope finished by end of 2021.

<https://roman.gsfc.nasa.gov/>

Coronagraph Instrument Technology Demonstration Hardware Progress



<https://roman.gsfc.nasa.gov/>

Roman Space Telescope

Roman Science Interest Group (RSIG) formed to provide broad-based community input to the Roman project and NASA Headquarters

- RSIG documents available at <https://roman.gsfc.nasa.gov/science/rsig.html>

Critical design reviews for telescope, wide field instrument, coronagraph, instrument carrier, spacecraft, and ground system to be completed by July 2021

Mission critical design review (CDR) is September 2021

Complete telescope by the end of 2021

Cost and schedule commitments are unchanged since beginning of Phase B in 2018, but COVID impacts have liened cost and schedule reserves

- Review of COVID impacts to cost and schedule underway in early 2021

Opportunities for participation in Roman Space Telescope research and support will be offered in ROSES-2021 (next chart)

<https://roman.gsfc.nasa.gov/>

Roman Town Hall (Session 520)
Friday, Jan 15 @ 1:40 pm ET

NASA Science Webinars: Roman Space Telescope
Exoplanet Science: Monday, Jan 11 @ 12:00 pm ET
Wide Field Survey Science: Wed, Jan 13 @ 5:00 pm ET

Roman Space Telescope



<https://roman.gsfc.nasa.gov/>

Roman Science Interest Group (RSIG) formed to provide broad-based community input to the Roman project and NASA Headquarters

- RSIG documents available at <https://roman.gsfc.nasa.gov/science/rsig.html>

Opportunities for participation in Roman research and support offered in ROSES-2021

- Key Project Teams: Science teams to conduct scientific investigations using the data from the major surveys identified by the Astro2010 Decadal Survey
- Coronagraph Community Participation Program: Investigators to work with the coronagraph instrument team to plan and execute tech demo observations
- Wide Field Instrument Preparatory Science: Investigators to work on science preparation activities related to mission performance verification and science operations preparation

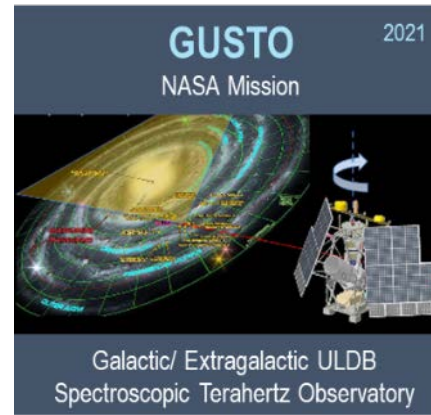
All Roman observing time is available through open processes

- Major Legacy Surveys will be defined using a community-driven open process
- Key Projects – funded science investigations using these surveys – will be openly competed
- Roman observing time will be available for General Observer (GO) projects
- All data will be available to the community with no period of limited access

Roman Town Hall (Session 520)
Friday, Jan 15 @ 1:40 pm ET

NASA Science Webinars: Roman Space Telescope
Exoplanet Science: Monday, Jan 11 @ 12:00 pm ET
Wide Field Survey Science: Wed, Jan 13 @ 5:00 pm ET

Astrophysics Missions in Development



Launch dates are current project working dates; Agency Baseline Commitment launch date could be later; impacts of COVID-19 not yet known



COVID-19 Impacts – Missions

Many missions are expected to stay within their cost commitments (known as the ABC or Agency Baseline Commitment, which includes HQ held reserves above project budget)

- ABC is set at Confirmation Review
- In astrophysics, this includes NASA contributions to Euclid and XRISM

Some missions have experienced challenges that affect cost and schedule commitments

- In astrophysics, this includes Webb, Roman, and IXPE
- Missions that have been Confirmed since COVID began (e.g., SPHEREx), or will be Confirmed in the future (e.g., future Explorers) have assumed impacts from COVID included within their cost and schedule commitments

To date, challenges to Flagships (Webb, Roman) have been accommodated with no impact to Explorers or R&A

- Challenges to Explorers have been accommodated within the Explorers Program

NASA participation in Athena



ESA's Athena X-ray Observatory

- NASA formal project in 2021/2022
- ESA mission adoption in 2022
- Launch in early 2030s

Opportunities for US scientists

- Join Athena working groups
- Future opportunities
 - US members of Athena science team
 - Guest Observer program

NASA's hardware contributions are in the \$100M-\$150M range

NASA contributions consist of various enabling technologies:

- X-IFU Focal Plane Detectors and Readout Electronics (GSFC, NIST)
- Use of NASA Testing Facilities and involvement in mirror calibration (MSFC)
- WFI VERITAS ASIC Design (Stanford)
- WFI Background Analysis Model (BAM) Development (PSU, SAO, MIT, Stanford)
- Vibration Isolation System (Moog SoftRide)

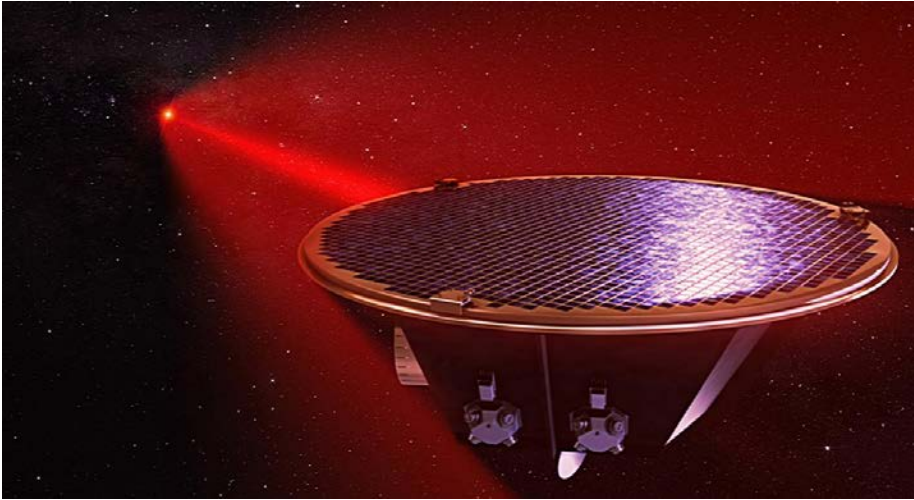
Additional NASA contributions will include:

- Science Ground Segment support
- US Guest Observer Facility
- Guest Observer programs

NASA Athena Science Team

- Co-chairs: L. Brenneman & J. Miller

NASA participation in LISA



ESA's LISA Gravitational Wave Observatory

- NASA formal project in 2022
- ESA mission adoption in 2023
- Launch in mid 2030s

Opportunities for US scientists

- Join the LISA Consortium
- Future opportunities
 - LISA Preparatory Science
 - Guest Investigator program

NASA's hardware contributions are in the \$300M-\$400M range

NASA contributions consist of various enabling technologies:

- Telescopes (GSFC, U. Florida)
- Laser Systems (GSFC)
- Charge Management Device (U. Florida)

Additional NASA contributions will include:

- Systems engineering support
- Phasemeter design consultation
- Science Ground Segment support
- Preparatory Science programs
- Guest Investigator programs

NASA LISA Study Team

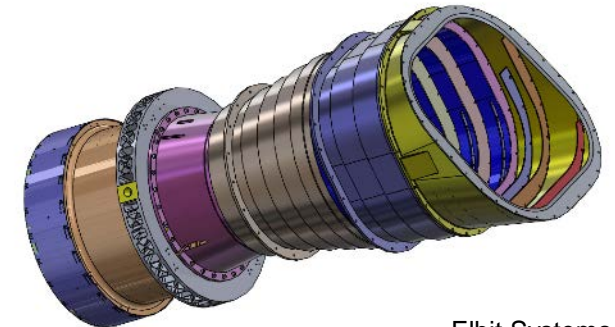
- Chair: K. Holley-Bockelman
- Reports on Technology Assessment (2016), Data Access for U.S. Community (2020)

NASA participation in UltraSat

- NASA is joining Israel's UltraSat mission
- UltraSat: a wide-field (>200 sq deg) UV survey & transient detection mission from the Israel Space Agency & Weizmann Institute of Science
 - 50 cm diameter primary mirror
 - Camera contributed by DESY in Germany
 - Launch NET late 2024 for a 3-year mission
- Science: gravitational wave sources, supernovae, variable and flare stars, time domain astronomy, etc.
- Point-and-stare observing plan from super-geostationary orbit
- Transient alerts within <20 min
 - 12-month proprietary non-alert data
- NASA participation:
 - Rideshare launch to GTO
 - Science team membership – competed slots (via ROSES) on Working Groups with full data access during proprietary period
 - Enabling community-wide data analysis through availability in NASA archive & ADAP/XRP
 - Participation in alert definition & protocols



ULTRASAT Concept
Source: Israel Aerospace Industries (IAI)



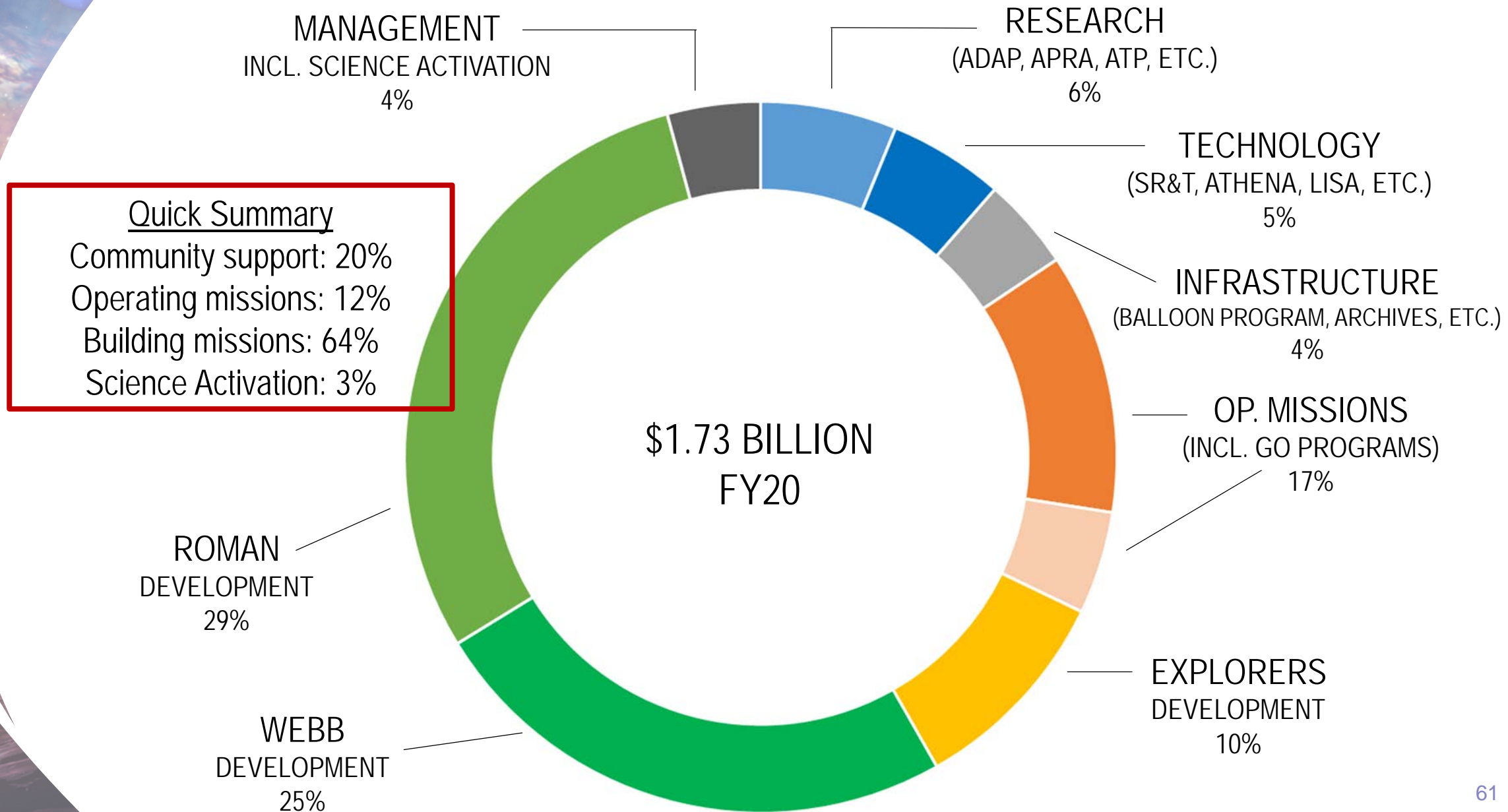
Elbit Systems



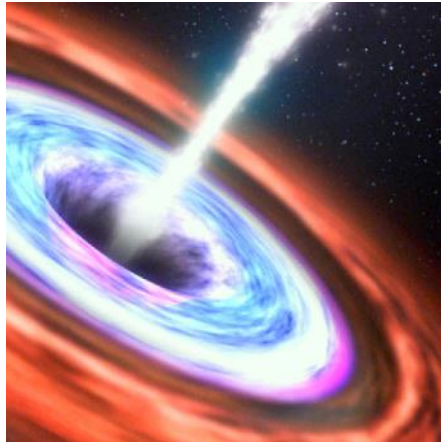
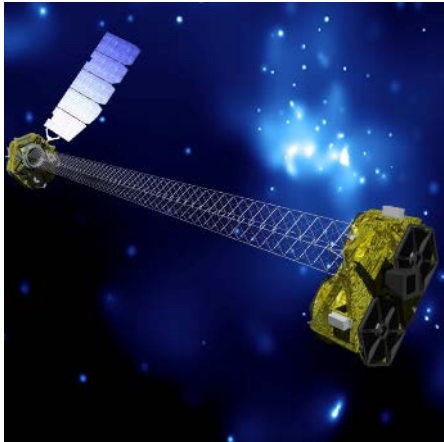
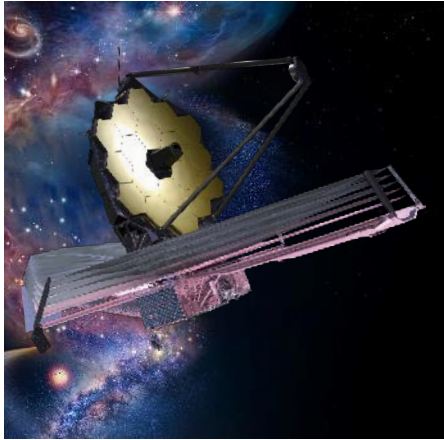
Planning for the Future



Astrophysics Budget – FY20 Actual



Astrophysics FY21 Appropriation



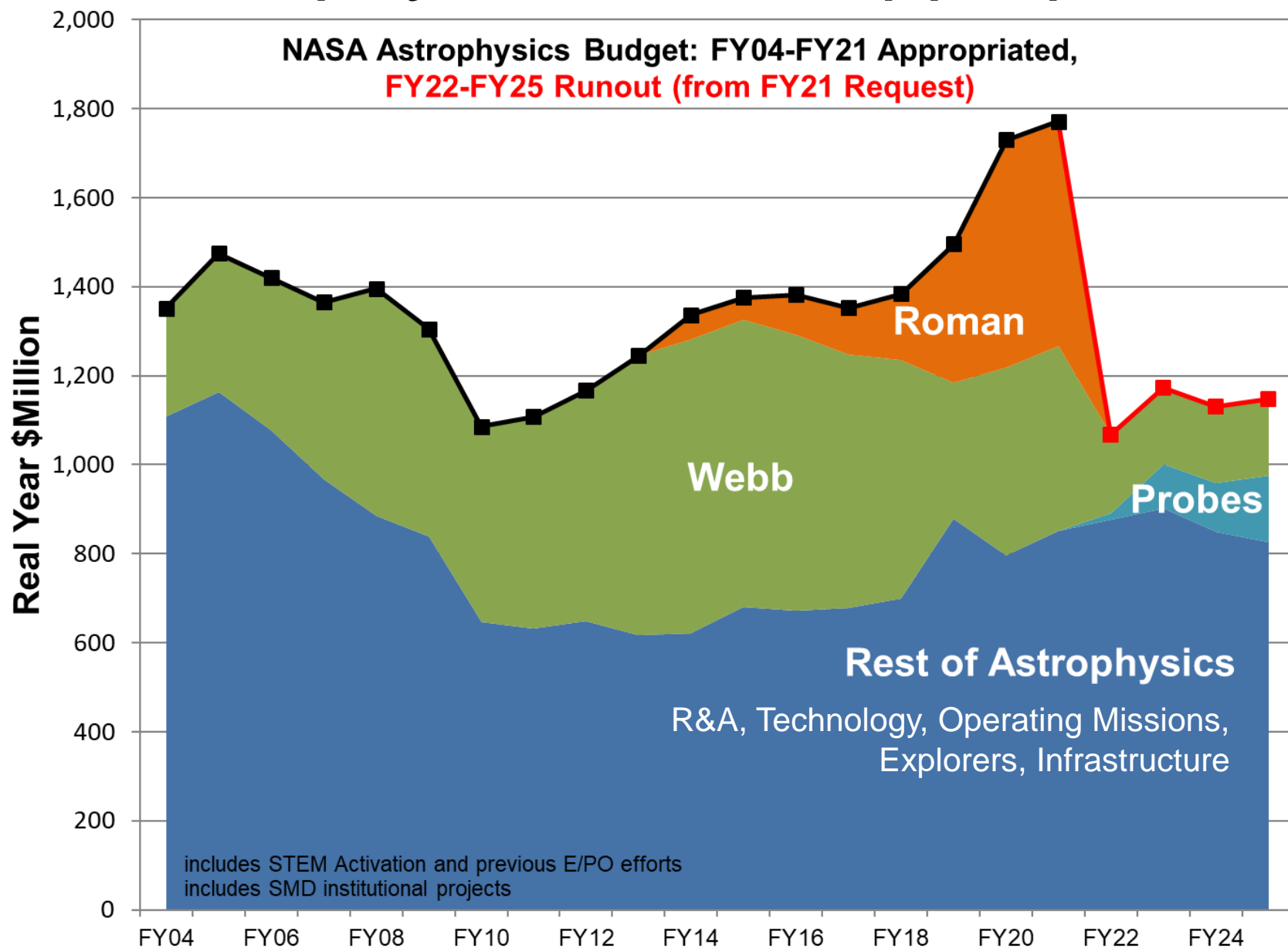
The FY 2021 NASA Budget Request included no funding (\$0) for the Roman Space Telescope and only close out funding (\$12M) for SOFIA

The FY 2021 Omnibus Appropriation Bill

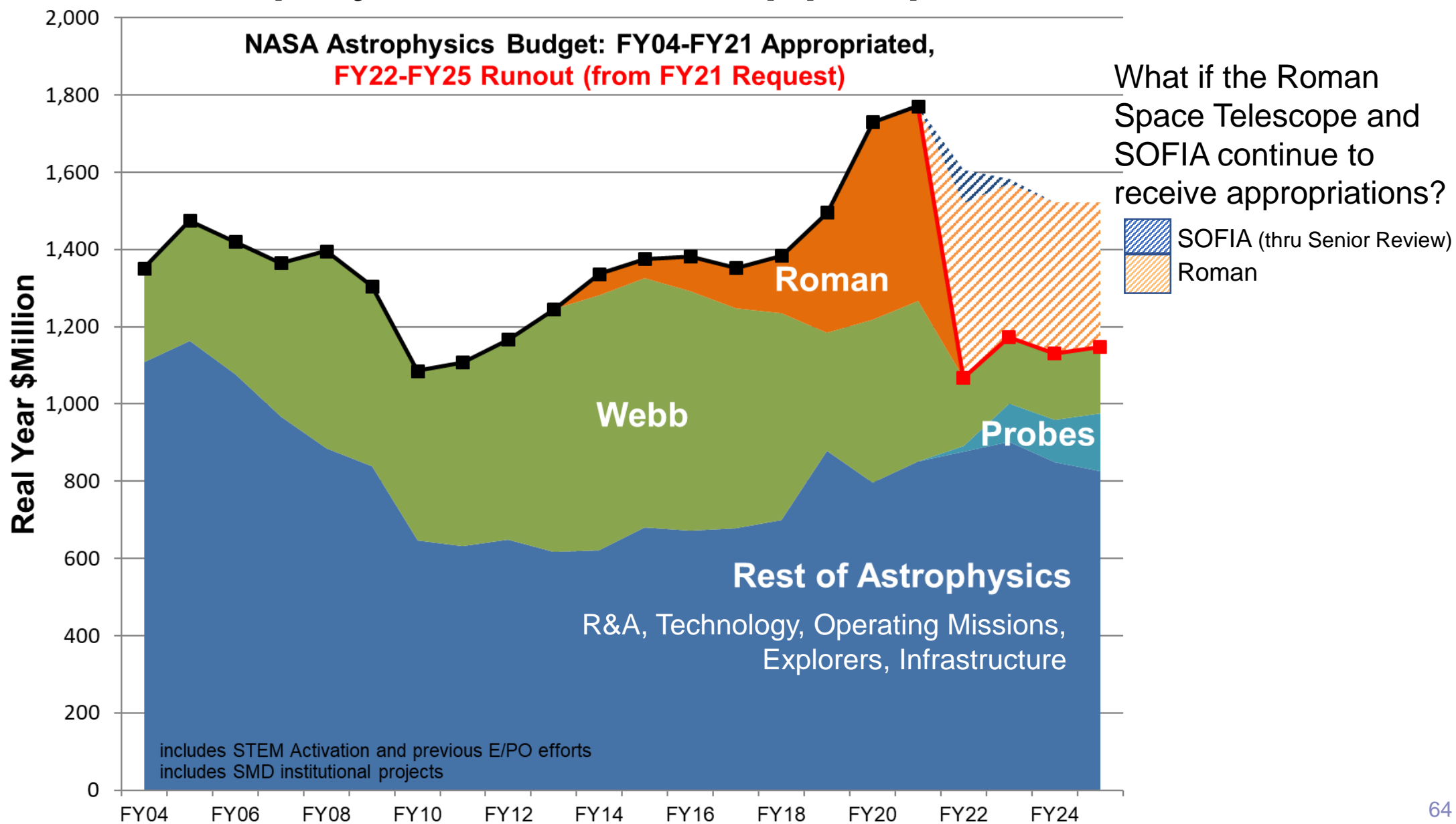
- Provides \$1.77B for Astrophysics (including the James Webb Space Telescope), \$525.2M more than the request
- Directs \$414.7M for Webb, same as the request
- Directs \$505.2M for Roman, \$505.2M more than the request
- Directs \$93.3M for Hubble, \$5M more than the request
- Directs \$85.2M for SOFIA, \$73.2M more than the request
- Directs \$10M for “search for life technology development”

The total funding provided is an increase of \$525.2M over the request.

Astrophysics FY21 Appropriation

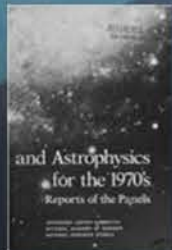


Astrophysics FY21 Appropriation

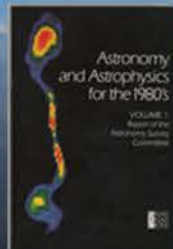


Astrophysics

Decadal Survey Missions



1972
Decadal
Survey
Hubble



1982
Decadal
Survey
Chandra



1991
Decadal
Survey
Spitzer



2001
Decadal
Survey
Webb



2010
Decadal
Survey
Roman



2021
Decadal
Survey

?

Technology Development and Risk Reduction Activities

Completed

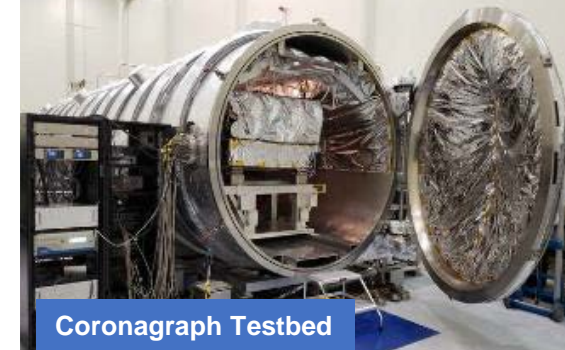
Large Mission Concept Studies / Probe Mission Concept Studies / In-Space Assembly of Telescopes (iSAT) Study / Large Mission Management Study / STMD Technology Collaborations

Ongoing

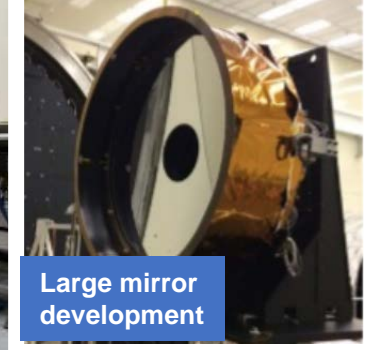
Segmented Mirror Technology Program / Binary Star Coronagraph Technology / Deformable Mirrors / Starshade Technology / Extreme Precision Radial Velocity Research and Technology / Detectors (at all wavelengths) / X-ray Mirrors / Cryocoolers

Testbeds (Coronagraph, Ultrastable, X-ray & Cryogenic)

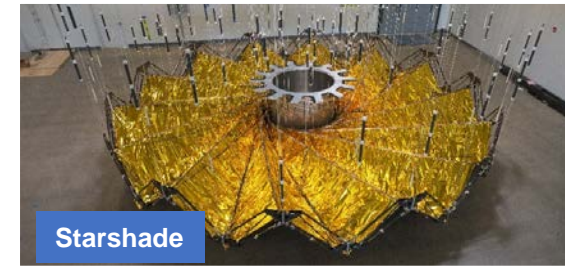
PI-led Strategic Astrophysics Technology (SAT) Advancements



Coronagraph Testbed



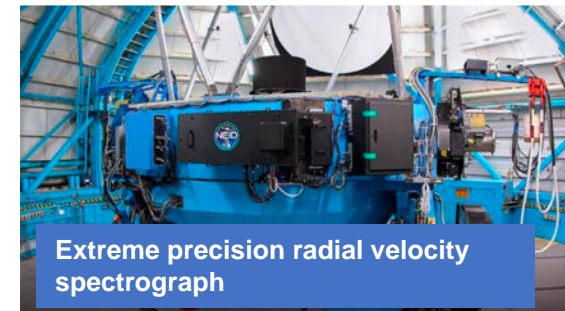
Large mirror development



Starshade



X-ray mirror development



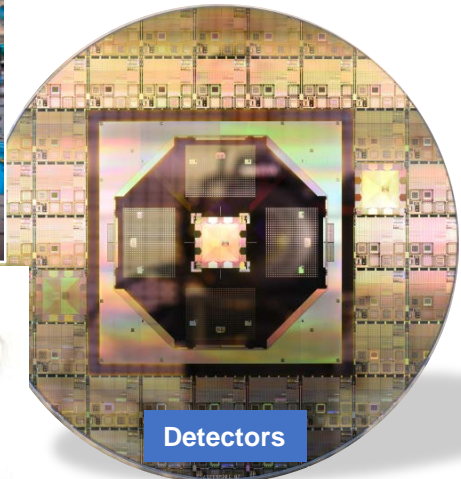
Extreme precision radial velocity spectrograph



Deformable Mirror



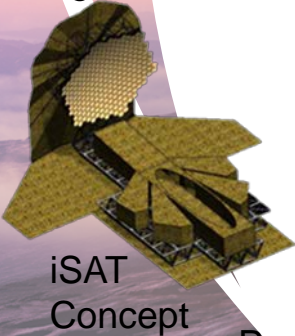
Cryocooler



Detectors

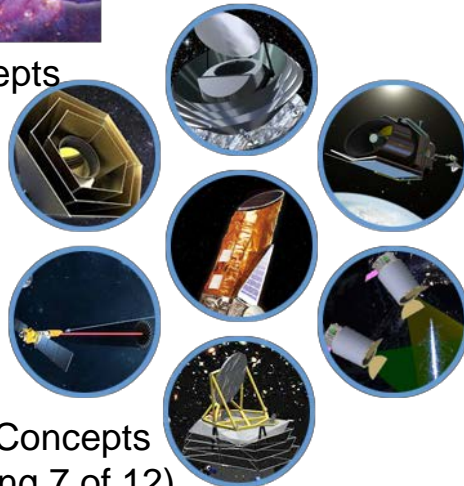


Large Mission Concepts



iSAT Concept

Probe Concepts
(Showing 7 of 12)



For more information on technology development activities, see the Astrophysics Technology Development Database (<http://www.astrostrategictech.us/>)

Astro2020 Decadal Survey Status



- Large Mission Concept Studies presented to Astro2020 in November 2019
- Probe Mission Concept Studies submitted to Astro2020 in November 2019
- Last public meeting of the Steering Committee on August 25, 2020
 - Agencies presented updated programmatic and budget guidance
 - Co-Chairs stated publicly that report will be delivered by Spring 2021
- NASA is planning ahead for implementing the Decadal Survey
 - Reducing risks of large missions via technology development
 - Planning underway for recommendations in R&A, archives, suborbital, etc.
 - Developing options for Probe and flagship pre-formulation management
 - Holding a wedge in out year planning budget for new initiatives



MARS 2020



DART



Landsat 9



Webb



IXPE

2021 – A Year of Science



O-REx



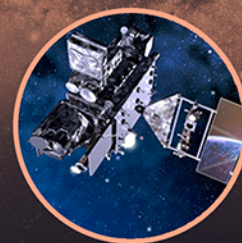
Peregrine



Nova-C



Lucy



GOES-T

- LAUNCH
- LANDING
- DEPARTURE



National Aeronautics and
Space Administration

2021 EXPLORE SCIENCE

Anyone who registered for the AAS 237 meeting before December 1 will receive by mail a copy of the 2021 Explore Science NASA Calendar

Copies can also be ordered from the Government Printing Office at <https://bookstore.gpo.gov/products/2021-explore-science-nasa-calendar>

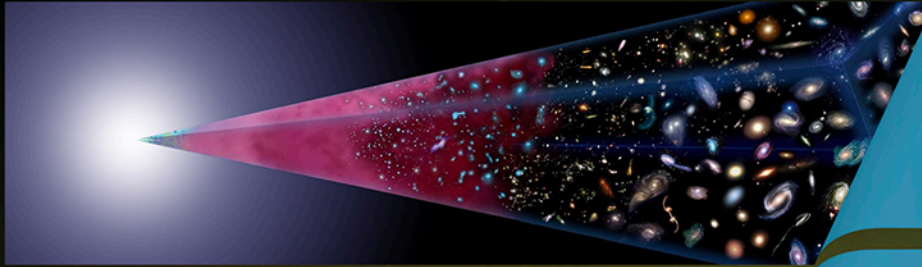
www.nasa.gov



Backup



Why Astrophysics?



How did our universe begin and evolve?

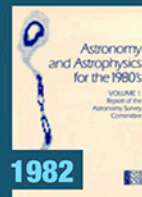


How did galaxies, stars, and planets come to be?



Are we alone?

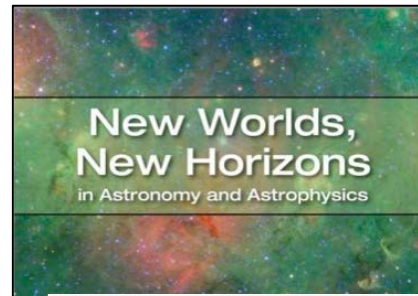
Enduring National Strategic Drivers



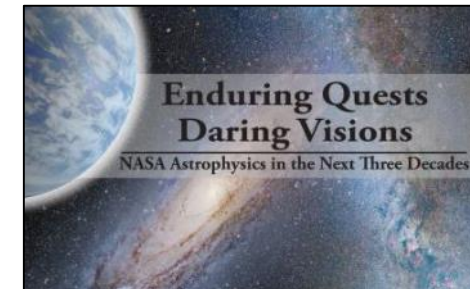
Astrophysics is humankind's scientific endeavor to understand the universe and our place in it.

Astrophysics Strategic Planning

<https://science.nasa.gov/astrophysics/documents>



Next update:
2021 Decadal Survey



Next update:
December 2021
Implementation Plan

December 17, 2018

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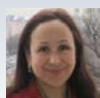


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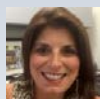


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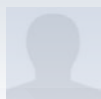
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COVID Impacts to Astrophysics Missions in Development

Missions are in launch date order

Webb	Launch delay, cost impacts within reserves, replan approved July 2020
IXPE	Launch delay approved, KDP-D November 2020
GUSTO	Balloon program impact delays certification of super-pressure launch vehicle
XRISM	JAXA announced launch delay
Euclid	ESA maintaining schedule
SPHEREx	Schedule and cost replan approved, KDP-C December 2020
SMEX/MO	Phase A extended to March 2021, further schedule and cost impacts TBD, KDP-B (downselect) fall 2021
Roman	Schedule and cost impacts likely, mission CDR 2021
ARIEL	Too early to tell, KDP-C Fall 2022
Athena	Too early to tell, KDP-A 2021
LISA	Too early to tell, KDP-A 2022

Many missions' launch delay and cost impacts may be covered within project and HQ-held reserves