NASA Astrophysics Update

Astrophysics Advisory Committee | October 17-18, 2022

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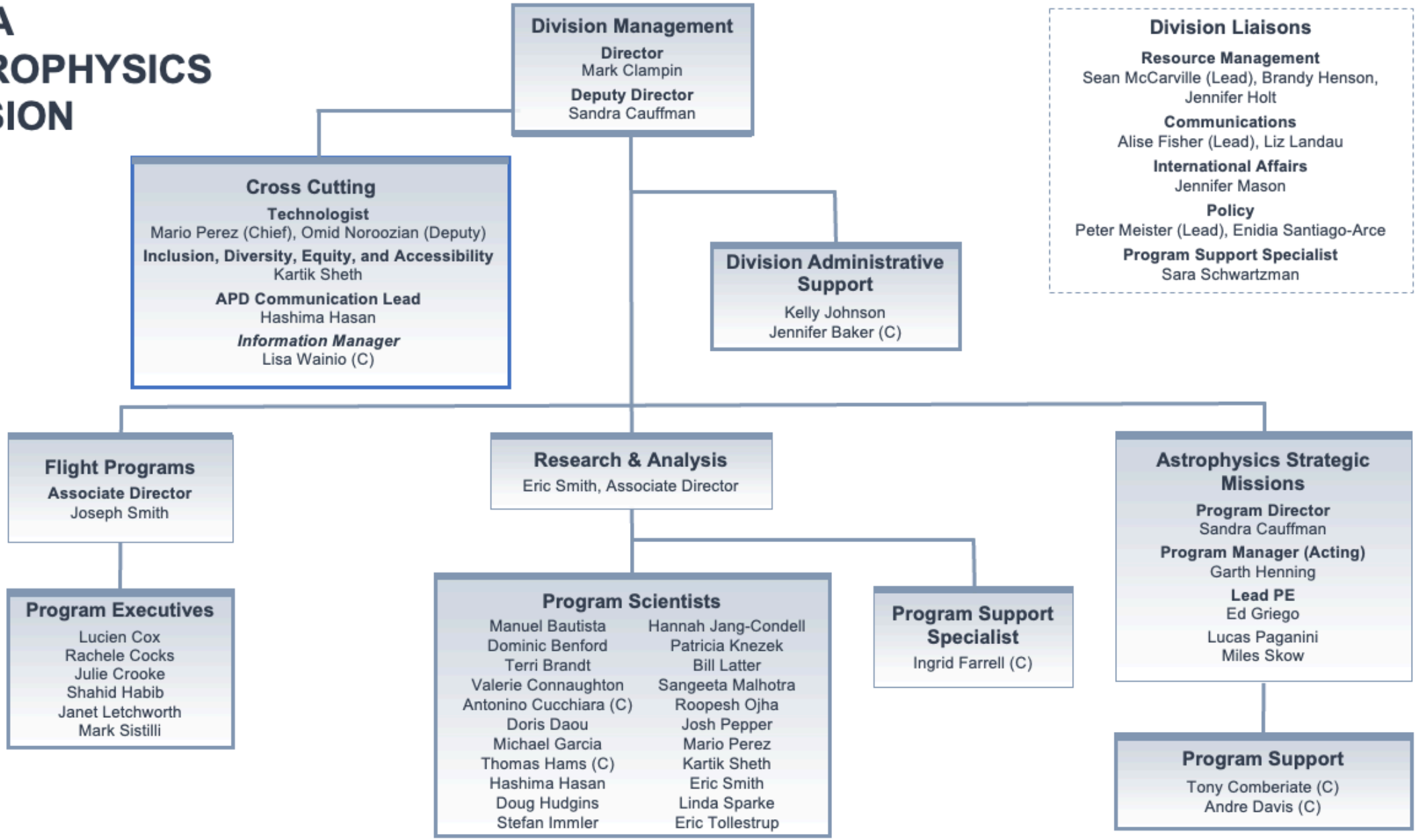
Science Mission Directorate

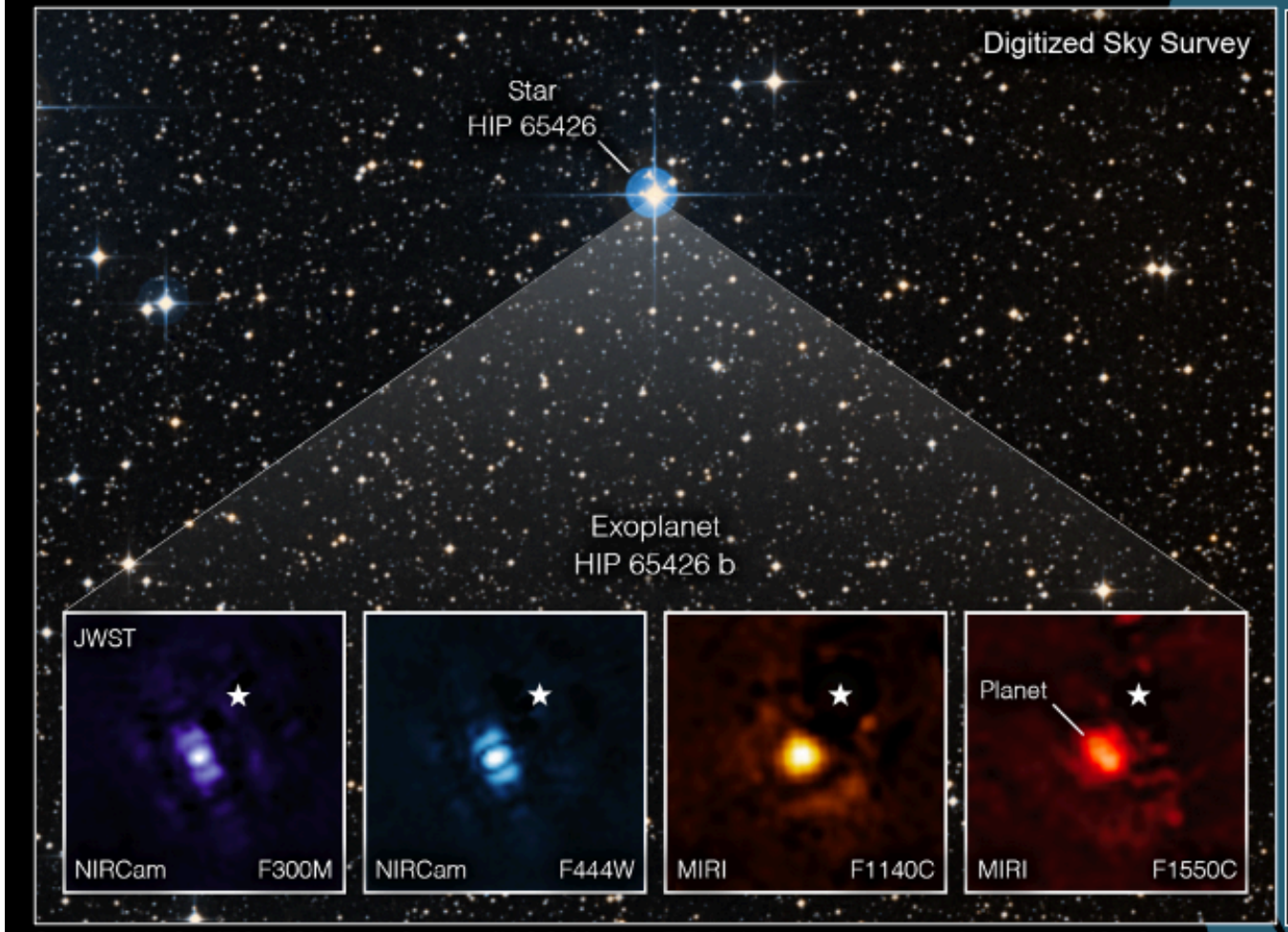
@NASAUniverse @NASAExoplanets @NASAWebb

NASA ASTROPHYSICS DIVISION



NASA's Webb Takes Its First-Ever Direct Image of Distant World

SCIENCE HIGHLIGHT

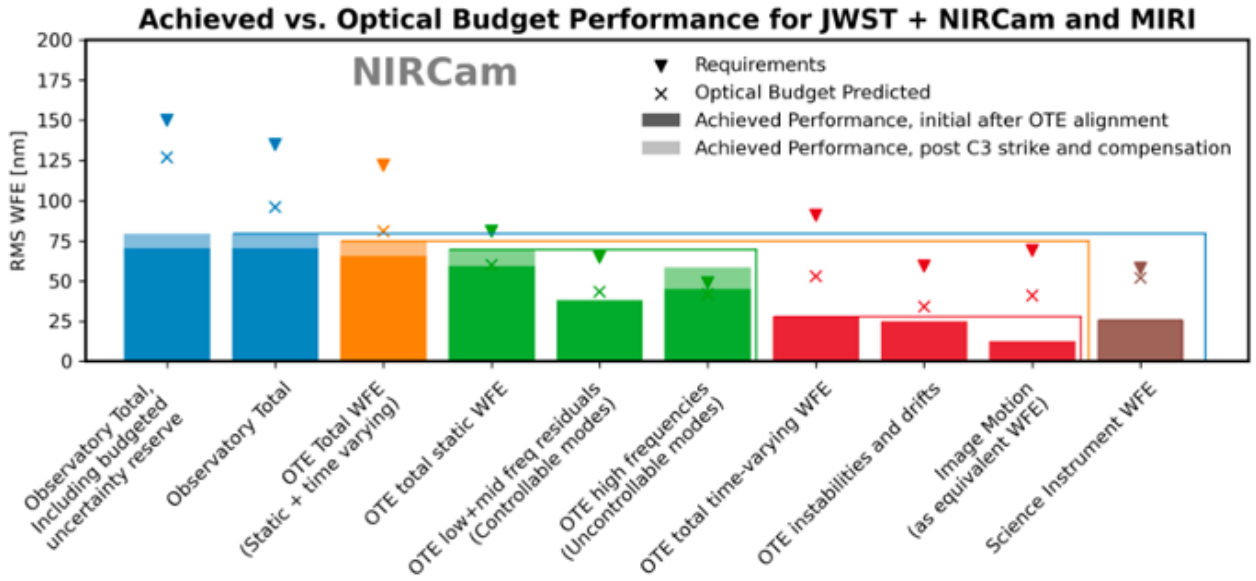


Credit: NASA/ESA/CSA, A Carter (UCSC), the ERS 1386 team, and A. Pagan (STScI).

- These JWST coronagrphic images shows the exoplanet HIP 65426 b in different infrared bands of infrared light.
  - NIRCam instrument's view at 3.00 μm (purple),
  - NIRCam instrument's view at 4.44 μm (blue),
  - MIRI instrument's view at 11.4 μm (yellow)
  - MIRI instrument's view at 15.5 μm (red)
- The small white star in each image marks the location of the host star HIP 65426, which has been subtracted using the coronagraphs and image processing. The bar shapes in the NIRCam images are artifacts of the telescope's optics, not objects in the scene.

Webb Telescope: On-Orbit Performance

- Webb telescope exceeds on-orbit performance requirements
  - Optical performance

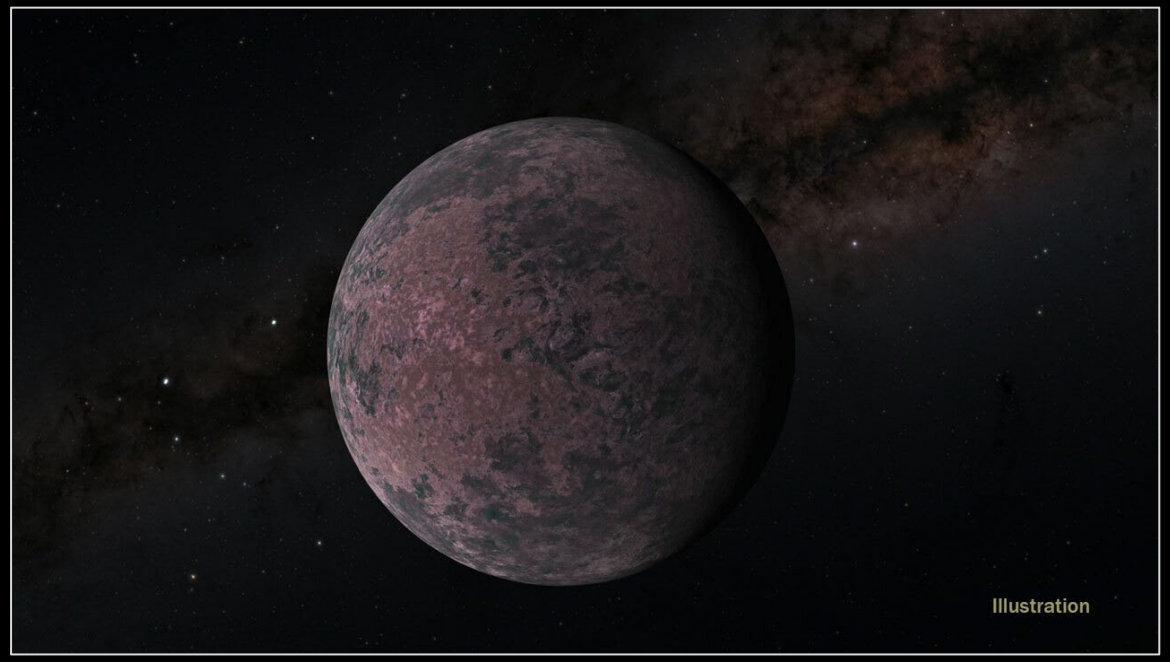


  - Sensitivity

Wavelength (μm)	2	3.5
Requirement (nJy)	11.4	13.8
ETC prediction (nJy)	10	14.1
Actual (nJy)	7.3	8.8

Table 3: NIRCam limiting point source sensitivity. *What is quoted is the faintest flux density that can be detected at SNR=10 in 10,000s. Values are for wide-band filters. Smaller numbers are better.*

Ultra-hot 'Super-Earth' Could Have No Atmosphere

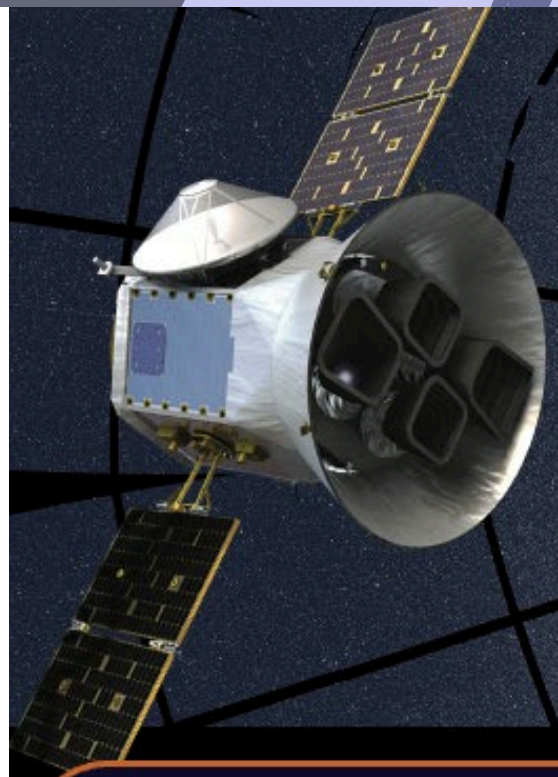


Credit: NASA/JPL-Caltech

Caption: Illustration of the terrestrial super-Earth GJ 1252 b, which lies approximately 65 light-years from Earth.

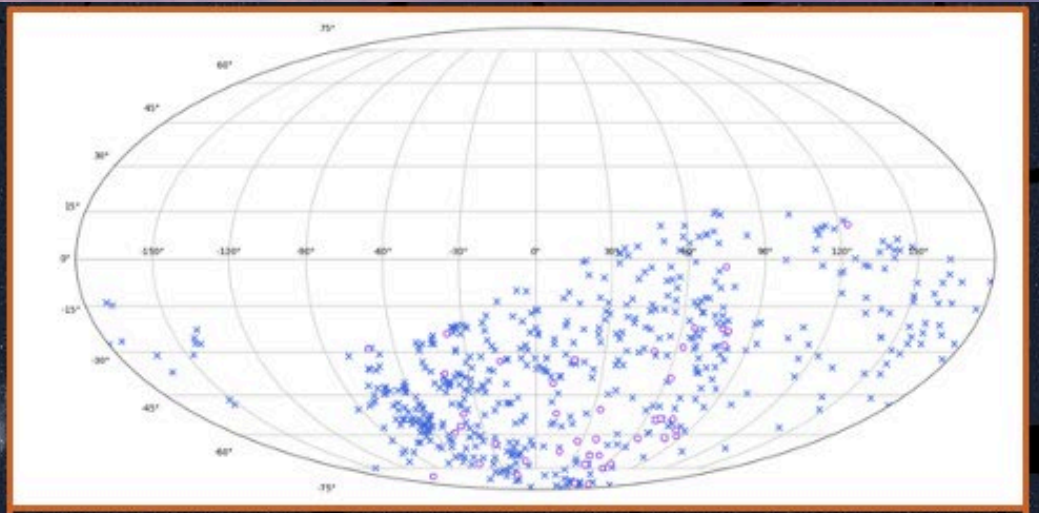
SCIENCE HIGHLIGHT

- GJ 1252 b was discovered using the transit method by NASA's Transiting Exoplanet Survey Satellite (TESS) in 2020.
- It is a rocky, terrestrial "super-Earth" about 65 light-years away with a radius 1.18 times larger than Earth.
- Astronomers in a new study observed the exoplanet with the Spitzer Space Telescope before it retired and were able to get a closer look at the planet and its atmosphere.
- With Spitzer, the team detected a secondary eclipse, which occurs when a planet passes behind a star and the planet's light, which comes from its own infrared radiation (or heat), as well as light reflected from the star, is blocked.
- These observations revealed the planet’s scorching day-side temperature, which is estimated to reach as high as 2,242 degrees Fahrenheit (1228 degrees Celsius).



TESS: Transiting Exoplanet Survey Satellite

TESS has officially surpassed 1,000 peer-reviewed publications!



Celestial distribution of the Cycle 1 targets searched (blue and purple markers). Purple circles mark the stars with detected transit signals; follow-up observations will determine whether planets are the source of the signals. The same team will search for transits in Cycle 2-4 targets, filling in much of the remaining sky.

Where is TESS pointing now?: Observation Sector 57
Orbit 1: Sep 30, 2022 – Oct 14, 2022
Orbit 2: Oct 15, 2022 – Oct 28, 2022

Planet Count: 256 confirmed planets
* 95 with radii < 2.5 R_{Earth}
* 157 with radii > 2.5 R_{Earth}
* 4 with unknown radii

5,887 candidate planets

Publication Count: 1207 submitted, 1010 peer-reviewed (40% exoplanets, 60% astrophysics)

A Search for Transiting Planets around Hot Subdwarfs II. Supplementary Methods and Results from TESS Cycle 1 (Thuiller et al., 2022, submitted on arXiv)

- Hot subdwarfs, also known as extreme horizontal branch stars, are compact, hot He-burning post-red-giant branch stars.
- Planets discovered around these stars would be prime targets for understanding planetary evolution beyond the main sequence.
- The authors searched for transit signals in the TESS Cycle 1 short cadence light curves of 792 hot subdwarfs, but no planetary candidates were confidently identified.
- Taking into account the sensitivity of the TESS data, the authors exclude the presence of small 2.5 R_{Earth} planets at 1-day orbital periods in >90% of hot subdwarfs. At 6-day orbital periods, the presence of small 2.5 R_{Earth} planets is excluded in >70% of hot subdwarfs.
- Planets are clearly rare around hot subdwarfs, and additional analysis using TESS Cycles 2-4 data will place firmer constraints on the planet occurrence rates around these evolved stars.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APAC Recommendations

APAC Recommendations from July 2022

Recommendation (general)	Response
The APAC requests frequent updates on the evolution of the NASA Science Mission Directorate (SMD) Bridge program	Presentation at Spring meeting. There is also a workshop for the bridge program 17-21 October 20211.
In preparation for the FY2024 budget, the APAC requests a presentation at the October 2022 APAC meeting concerning the slate of APD IDEA initiatives to aid APAC in making recommendations for those to prioritize	See Mark Clampin's "Astrophysics Division Update" presentation on Day 1 of this meeting.
APAC would like a synopsis of actions taken in response to the recommendations of the first independent review of the Hubble fellowship program, with particular focus on those involving IDEA.	See Mark Clampin's "Astrophysics Division Update" presentation on Day 1 of this meeting.

APAC Recommendations from July 2022

Recommendation (general)	Response
The APAC advises APD to continue close evaluation of the ROSES Inclusion Plans Initiative as it extends to different programs and begins to have a role in proposal funding.	Accepted.
The APAC recommends the APD commit to augmenting the ATP program, and to analyze an approach that extends the co-funding concept of the third option to also collaborate with the NSF so that an early career theory program is offered every year (i.e. by coordinating offset biannual calls or by sharing annual calls).	APD is consulting with NSF and will address the recommendation at the Spring meeting.

APAC Recommendations from July 2022

Recommendation (mission naming)	Response
The APAC requests the APD strongly encourage the NASA historian and their team to document fully and completely in a written report the current status of the ongoing investigation of archival materials, conversations, and other sources. The APAC requests the NASA historian be invited to provide a thorough debrief to the committee for the record as soon as possible, and that a public Town Hall be held to disseminate the findings.	The NASA historian plans to release additional information on the historical research conducted. NASA has not yet completed the process we committed to.
The APAC suggests that the findings of the NASA historian, the issue of James Webb memorialization, and the naming of future observatories be discussed by the NASA Advisory Council (NAC).	This recommendation is not addressed to APD
The APAC advises APD to consider development of written policies and guidelines-of-practice of naming flagship missions that could build community trust and endorsement.	SMD is developing a policy on naming missions.

APAC Recommendations from July 2022

Recommendation (Roman, JWST)	Response
The APAC requests regular updates on the cost and schedule of the Roman Observatory. At the next meeting, the APAC requests a focus on the lessons learned from JWST to apply to Roman if available.	See the “Roman Update” presentation on Day 2 of this meeting.
The APAC requests an update on the status of the Committee on Astrophysics and Astronomy (CAA) non-advocate review of Roman’s capacity for large ambitious community driven surveys at a future meeting.	The CAA review of Roman’s capacity for large community driven surveys was published on 7th October. A full report will be presented at the next APAC meeting, together with APD’s response.
The APAC strongly advises the APD to prioritize funding for the scientific, technical, and theoretical investigations conducted by the JWST user community and to use the success of JWST as a jumping off point for the New Great Observatories Program and to leverage the success for increased funding for NASA Astrophysics and the Science Mission Directorate as a whole.	APD plans a full discussion of GOMAP and the Decadal Survey recommendation for a Near-Infrared/Optical/Ultraviolet 6-m telescope for high-contrast imaging and astrophysics at the next APAC meeting.
The APAC appreciates continued updates on JWST in the October 2022 meeting.	See Eric Smith’s “Webb Update” presentation on Day 1 of this meeting

APAC Recommendations from July 2022

Recommendation (Athena, GUSTO, Probe, MIDEX)	Response
The APAC requests a presentation of the status of the Athena trade study and the Athena mission.	See Mark Clampin's "Astrophysics Division Update" presentation on Day 1 of this meeting.
The APAC would like to get a review of NASA contributions to these L-class missions and evaluation of on-going support during the October meeting. In particular, the APAC requests a briefing on the LISA Science Ground Segment report delivered to HQ.	See Mark Clampin's "Astrophysics Division Update" presentation on Day 1 of this meeting See Ira Thorpe's "LISA Independent Data Study" presentation on Day 1 of this meeting.
Since both L-class missions are over the current ESA cost cap and are also tightly coupled in ESA's budget, the APAC recommends APD undergo a feasibility study of possible US contributions to LISA.	APD does not intend to increase its contribution to LISA beyond the current contributions.

APAC Recommendations from July 2022

Recommendation (General)	Response
The APAC advises APD to reconsider its position on tracking the impact of the Balloon and Sounding Rockets programs, and develop policies to track metrics of science, technology and IDEA impacts as well as workforce development.	Metrics of science, technology, workforce development: Annual standard 'quad-chart' track these Typically, we collect quad-charts at our Annual PI Program Review, which we are restarting this year after a 2-year COVID pause. In addition, NSPIRES cover pages have recently been modified to track TRL-in and TRL-out.
APAC recommends a taskforce to examine ways to maintain the X-ray and Far-IR communities in preparation for the Probe-class and the second and third Flagship missions to maximize technical readiness within APD. In the shorter term, the APAC recommends that APD consider how to incorporate tech development into existing programs, such as SAT, APRA, and ISFM, to better maintain and enhance current capabilities. One example that was discussed during APAC was to modify the APD AOs to weigh technical development suborbital mission proposals that may have less science return more equally with higher-science-based missions that may require less technology development. Another example that could be rapidly implemented is to conduct yearly human capital technological expertise gap assessments similar to the Technology Gap Assessments conducted through the PAGs to better prioritize areas of investment.	In the most recent APRA selections, we identified additional funds in order to select a set of highly ranked proposals that had direct relevance to VIRGO (UV-OIR) technologies. In addition, we extended the APRA sub-orbital program to include commercial sub-orbital launch which allow additional technology development. We are considering expanding the SAT program to allow sub-orbital programs for technology development.

APAC Recommendations from July 2022

Recommendation (General)	Response
The APAC requests a presentation from Julie Crooke on the Great Observatories Mission and Technology Maturation Program (GOMAP) process focusing on mechanisms to develop, maintain, and support a pool of technological talent and infrastructure	APD will present the final GOMAP plan at the spring meeting.
Recognizing that the workshop is the week just prior to the October APAC meeting, the APAC requests a very cursory update (~2 slides) on first impressions on the second Precursor Science workshop and plans for future ones.	Will be included in GOMAP briefing.
The APAC requests a presentation from the data science and technology community about the current best practices in open science to mitigate negative impacts on national security or human rights.	Deferred to Spring 2023 meeting
The APAC requests more information on the TOPS plan regarding success metrics, providing core services to enable open science, particularly for historically marginalized groups, partnering with ground-based observatories, and engaging with the commercial sector.	Deferred to Spring 2023 meeting

APAC Recommendations from July 2022

Recommendation (PAG reports)	Response
The APAC requests a presentation of the GOMAP cross-PAG SIG proposal at the next meeting	This is an action to the PAG's and has been deferred to the Spring meeting
The APAC requests that the COPAG provide further details of the COPAG technical workforce study at the October 2022 APAC meeting.	See Rachel Beaton's "COPAG Update" presentation on Day 1 of this meeting.
The APAC recommends reaching out to members of the CMB community, and hosting CMB sessions at the PhysPAG to renew engagement and increase participation.	See Grant Tremblay's "PhysPAG Update" presentation on Day 1 of this meeting
The APAC recommends PhysPAG reach out to the community for input on maintaining technical readiness within the PhysPAG purview	See Grant Tremblay's "PhysPAG Update" presentation on Day 1 of this meeting
PhysPAG should coordinate with the NASA Bridge Program to avoid duplicating effort in the Astrophysics with Equity SAG.	See Grant Tremblay's "PhysPAG Update" presentation on Day 1 of this meeting

APAC Recommendations from July 2022

Recommendation (PAG reports)	Response
The APAC recommends that APD form the three proposed New Great Observatories, Gamma-ray Transient Network, and AWESOM Science Analysis Groups	Approved
The APAC recommends that APD change the Physics of the Cosmos program acronym from PCOS to PhysCos moving forward	Accepted
The CMB community should be asked whether they would like to retain a SAG and in which capacity, before the IPSIG is retired	See Grant Tremblay's "PhysPAG Update" presentation on Day 1 of this meeting

APAC Recommendations from July 2022

Recommendation (TDAMM)	Response
The APAC would like to hear a summary of the findings (white paper) resulting from the first TDAMM workshop and status of the Advisory Committee formulation and Terms of Reference (TOR).	See Mark Clampin's "Astrophysics Division Update" presentation on Day 1 of this meeting
The Senior Reviews in 2018 and 2022 recommended coordination of the NASA mission portfolio to optimize the fleet for TDAMM. The APAC would like to hear which plans NASA has to address this recommendation	See Mark Clampin's "Astrophysics Division Update" presentation on Day 1 of this meeting
The APAC requests APD to provide frequent updates on action related to time-domain and multi-messenger initiatives, with emphasis on planned infrastructures and related funding timelines, and coordination with NSF.	See Mark Clampin's "Astrophysics Division Update" presentation on Day 1 of this meeting

APAC Recommendations from July 2022

Recommendation	Response
The APAC also requests information from other divisions about the effect of zero proprietary time on early career scientists.	Deferred to Spring 2023.


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TDAMM

TDAMM: I

- Transient Alerts: NASA's Alert system GCN has been upgraded (July 2022) to incorporate modern, open-source, reliable, and secure alert distribution technologies that have been established by the broader astronomy community and promoted by the Vera C. Rubin Observatory. Additional upgrades / coordination among TDAMM space / ground missions with directed funding in FY '23.
- Coordination with NSF:
  - APD members met with their NSF counterparts to initiate discussions soon after Decadal Report and identified areas for collaboration: coordination of alert systems, interoperability of data archives, funding of TDAMM-relevant science investigations relevant to both agencies.
  - APD and NSF representatives (Roopesh Ojha and Luca Rizzi, respectively) have been meeting to identify challenges, develop optimal means of coordination and create a roadmap to work towards a goal of seamless access to all astrophysics data regardless of origin (space or ground based instrument) and depository.
  - NASA representatives will be attending "The Future of Astrophysical Data Infrastructure" organized by NSF. Diverse group of invited experts will address effective collaboration between NASA and NSF as a key question/theme at dedicated half-day session.
  - Discussions with DOE are being initiated

TDAMM: II

- The highest priority among Sustaining Activities from the 2022 Decadal Recommendations for NASA is for a program in Time Domain and Multi-Messenger Astrophysics (TDAMM)

- TDAMM science touches many existing R&A programs in APD, but TDAMM capabilities can be difficult to establish, given that they often support a number of disparate science goals, rather than a single science driver.

- Such capabilities include wide field monitoring, real-time alert generation & processing, rapid follow-up slewing, data analysis, software development, and coordinated observing, among others

- In ROSES-2023 NASA is exploring ways to enable, encourage, and fund TDAMM-relevant investigations within existing APD R&A programs, and will review this approach in time to incorporate any changes in ROSES-2024

TDAMM: III

The APAC would like to hear a summary of the findings (white paper) resulting from the first TDAMM workshop and the Advisory Committee's formulation and Terms of Reference (TOR)

- TDAMM Workshop Held Aug 22-24 at the Gov Calvert House in Annapolis, MD

- 130 In Person Attendees. 90 Virtual at the Plenary, sessions, average ~40 per session. White Paper now in progress!

- Advisory Committee to be formed following White Paper delivery to HQ in early 2023

- International agency splinter meeting at TDAMM workshop suggests coordination on TDAMM infrastructure desirable

Deliverable	Responsible party	Due date
Individual report sections	The co-chairs	October 14
First draft report	Suvi and Rita	November 5
Community input Due	Community	November 30
Report finalized	Suvi, Rita, Co-chairs	December 16
Report submitted to HQ	Suvi and Rita	December 20

TDAMM: IV

The Senior Reviews in 2018 and 2022 recommended coordination of the NASA mission portfolio to optimize the fleet for TDAMM. The APAC would like to hear which plans NASA has to address this recommendation

- In FY ‘23 the PhysCos Program Office is undertaking a funded study of a proposal-driven, multi-mission TDAMM Guest Observer Facility that would remove or alleviate the burden on individual missions to evaluate rare ToO-driven observing campaigns and allow better coordination and deployment of NASA assets.

- This responds to both the Senior Review recommendations and attempts to address the findings of the Gravitational-Wave Electromagnetic counterpart Task Force GW-EM report which called for more and better-coordinated TDAMM follow-up campaigns from NASA.


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AO/Mission Status

Astrophysics Probe

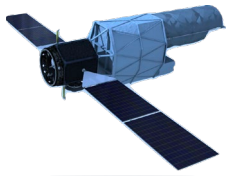
- NASA has issued a draft AO for a PI-led Astrophysics Probe
- The target date for the final Probe AO was revised to July 2023
- Due to European Space Agency (ESA) consideration of whether the Athena mission will be substantially replanned, it was no longer practical to require proposed X-ray probes to "complement ESA's Athena Observatory." This requirement was therefore removed. Astrophysics will now accept proposals for:
  - A far-infrared imaging and/or spectroscopy mission
  - An X-ray probe

Community announcements and FAQ at https://explorers.larc.nasa.gov/2023APPROBE/

Release of draft AO:	August 2022
Release of final AO:	July 2023 (target)
Proposals due:	NET 90 days after AO release

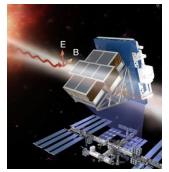
2022 Explorer Step1 Selections

- **Midex/MO selections**
- **UltraViolet EXplorer (UVEX):** Deep survey of the sky in two bands of ultraviolet light, to provide new insights into galaxy evolution and the lifecycle of stars.
  MIDEX Principal investigator: Fiona Harrison (Caltech)

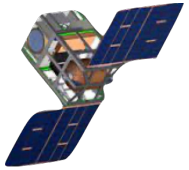


- **Survey and Time-domain Astrophysical Research Explorer (STAR-X):** STAR-X turns rapidly to point wide-field X-raya and UV telescopes at transient cosmic sources.
  MIDEX Principal investigator: William Zhang (GSFC)

- **Moon Burst Energetics All-sky Monitor (MoonBEAM):** MoonBEAM sees almost the whole sky at any time, watching for bursts of gamma rays from distant cosmic explosions and providing rapid alerts.
  MO Principal investigator: Chiumun Michelle Hui (MSFC).



- **LargE Area burst Polarimeter (LEAP):** Mounted on the ISS, LEAP studies gamma-ray bursts from the energetic jets launched during the formation of a black hole after the explosive death of a massive star, or in the merger of compact objects.
  MO Principal investigator: Mark McConnell (University of New Hampshire)



Pioneers Mission Status

Aspera: SmallSat mission that will study galaxy evolution.
Phase Implementation (7120.8)
Cost Cap $20M, LRD ~2025

Pandora: SmallSat that will study 20 stars and their 39 exoplanet in Optical/IR
Phase Implementation (7120.8)
Cost Cap $20M, LRD ~2025

PUEO: Balloon mission designed to detect signals from ultra-high energy neutrinos
Phase Implementation (7120.8)
Cost Cap $20M, LRD ~2024 / 2025 (Balloon)

StarBurst: SmallSat that will detect high-energy gamma rays from extreme events
Phase Implementation (7120.8)
Cost Cap $20M. LRD ~2025

TIGERISS: Space Station Experiment To Probe Origins of Elements
Phase Implementation (7120.8)
Cost Cap $20M. LRD ~2026

SOFIA

- The Decadal Survey recommended NASA end the SOFIA mission after its current mission extension.
- On April 28, NASA and DLR (the German Space Agency) jointly announced that they will conclude the SOFIA mission, after a successful eight years of science.
- SOFIA completed its scheduled operations at the end of the 2022 fiscal year.
- The SOFIA project has been directed to develop a project closeout plan for FY 2023. The closeout plan will include processing and archiving all SOFIA data at IRSA.
- Discussions are underway for the disposition of Government property associated with SOFIA.

GUSTO Mission Overview

Science Description	Project Description	Key Information	
GUSTO will provide the first complete study of all phases of the stellar life cycle, from the formation of molecular clouds, through star birth and evolution, to the formation of gas clouds and the re-initiation of the cycle. GUSTO provides 500 times the angular and 1,000 times the velocity resolution of previous surveys of the Galaxy in [CII], [OI], and [NII].	Sub-orbital Balloon-borne 0.9 m Cassegrain telescope launched from Antarctica to study the Milky Way and the Large Magellanic Cloud.	**Mission Phase:** C **Launch Date:** 12/2023 **Mission Life:** 75 days **Category:** 3 **Class:** D Streamlined **Launch Vehicle:** Zero Pressure Balloon	

- The NASA SMD Astrophysics Division conducted a Continuation/Termination Review decisions

  Decision: The GUSTO Project was approved for an extension provided critical launch readiness milestones are met:

  1. Complete the GUSTO payload and meet the success criteria for an instrument TVAC Pre-Ship Review in early August 2022; **[completed]**
  2. Conduct the instrument TVAC test and pass the instrument TVAC Review based on criteria set by the GUSTO SRB/IRT in August 2022; failure to meet and pass these milestones will result in mission termination. **[completed]**
  3. The GUSTO Team will plan to integrate the completed payload and telescope before the planned storage period and will use air shipment to deliver the integrated observatory to Antarctica in 2023.

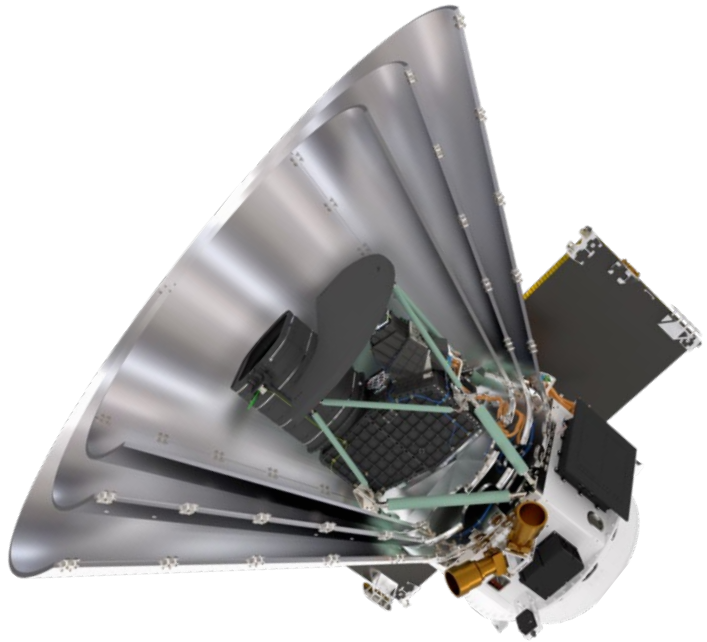
SPHEREx

Spectro-Photometer for the History of the Universe, Epoch of Re-ionization, and Ices Explorer

NASA's first all-sky near-infrared (0.75microns – 5 microns) spectral survey

Status:

- Development of flight detectors completed
- KASI (Korea Astronomy and Space Science Institute) payload thermal test chamber delivered to Caltech May 31, 2022
- Payload thermal subsystem delivery planned for August 2022
- Flight telescope delivery planned for March 2023
- Photon shield payload thermal subsystem is in vendor procurement process, with flight hardware delivery planned for July 2023



Critical Design Review (CDR) successfully completed January 18-21, 2022

Systems Integration Review (SIR) planned for December 2023

Current Agency launch readiness date is April 2025

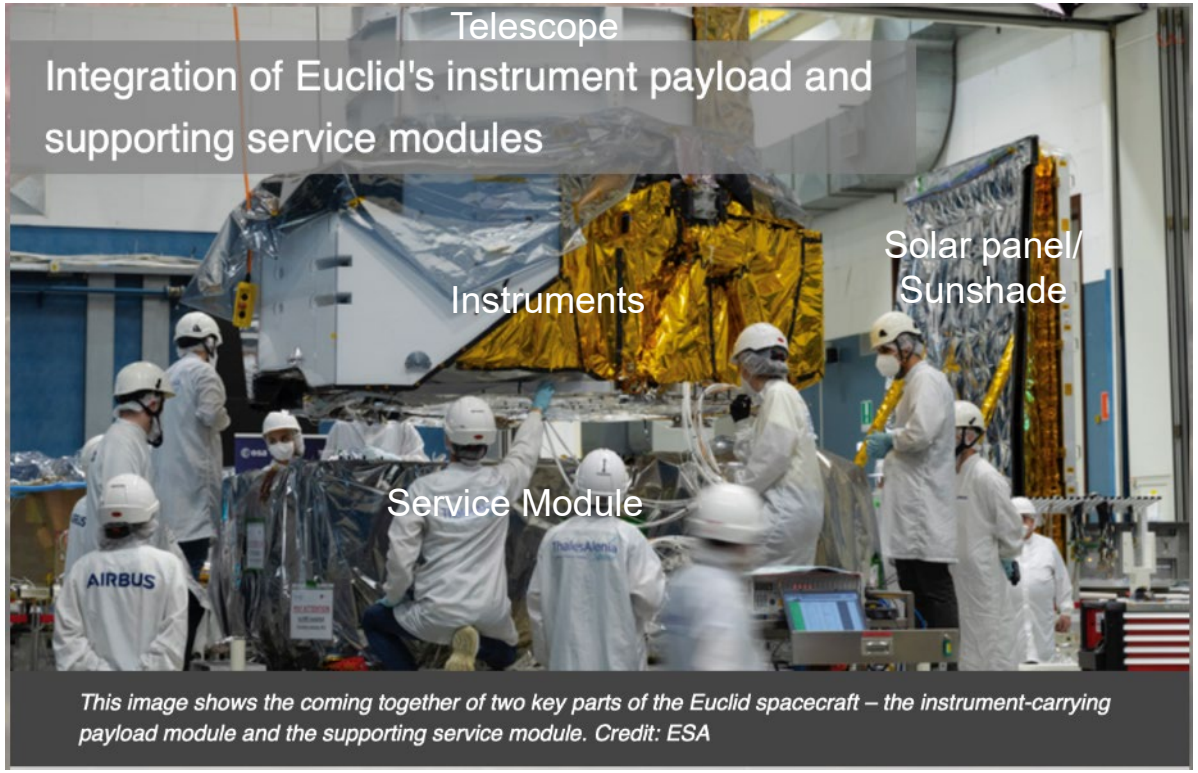
Euclid

ESA and NASA partnership

- Euclid will study the nature of Dark Energy, Dark Matter, and General Theory of Relativity

NASA's contribution:

- Sensor Chip System for the Near Infrared Spectrometer Photometer instrument
- Euclid NASA Science Center at IPAC
- Over 70 US Science Team members



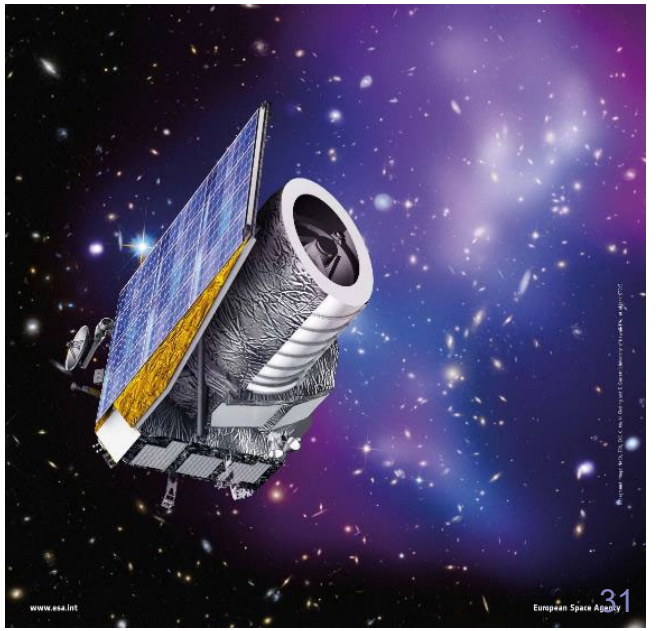
This image shows the coming together of two key parts of the Euclid spacecraft – the instrument-carrying payload module and the supporting service module. Credit: ESA

NASA Status:

- NASA hardware successfully delivered and integrated into NISP
- IPAC science ground segment software deliveries on track
- Three NASA science teams continue science preparation

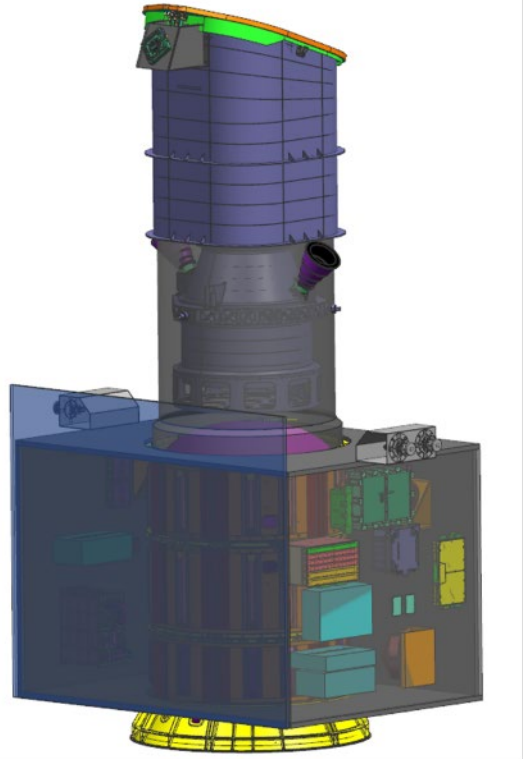
ESA Status

- Observatory is fully integrated and is at Thales-Alenia Cannes facilities for the Environmental Test Campaign
- Launch delays expected
  - Was early-2023 on a Soyuz ST2-1b; Russian cooperation suspended
  - ESA is investigating Space X/Falcon-9 options in late 2023

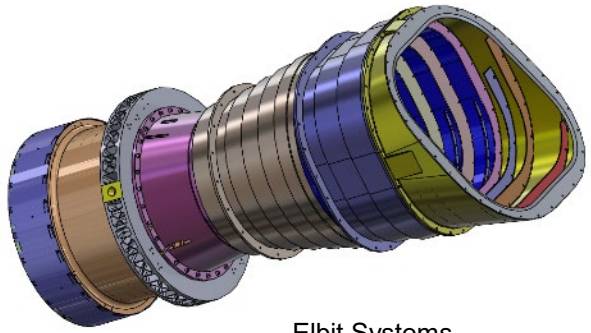


ULTRASAT

- ULTRASAT: a wide-field (>200 sq deg) UV survey & transient detection mission will be located at the geostationary orbit. Mission funded by the Israel Space Agency and managed by the Weizmann Institute of Science
  - NASA providing commercial launch ~ June 2025 for a 3-yr prime mission to geo-transfer orbit
  - Data public at IPAC following 12-mo exclusive data use period
  - Public alerts within 20-min of trigger.
- Science: main focus on gravitational wave sources, supernovae, variable and flare stars, and time domain astronomy. Status
  - ULTRASAT mission CDR completed in April 2022
  - NASA completed the MoU and submitted to ISA on August 18, 2022 for their review
  - NASA Flight Planning Board gave approval on September 8, 2022 to proceed with commercial launch
  - US Participating Scientist program planned as a ROSES-22 amendment



ULTRASAT Concept
Source: Israel Aerospace Industries (IAI)



Elbit Systems

ARIEL

Atmospheric Remote-sensing Infrared Exoplanet Large survey

ESA and NASA partnership

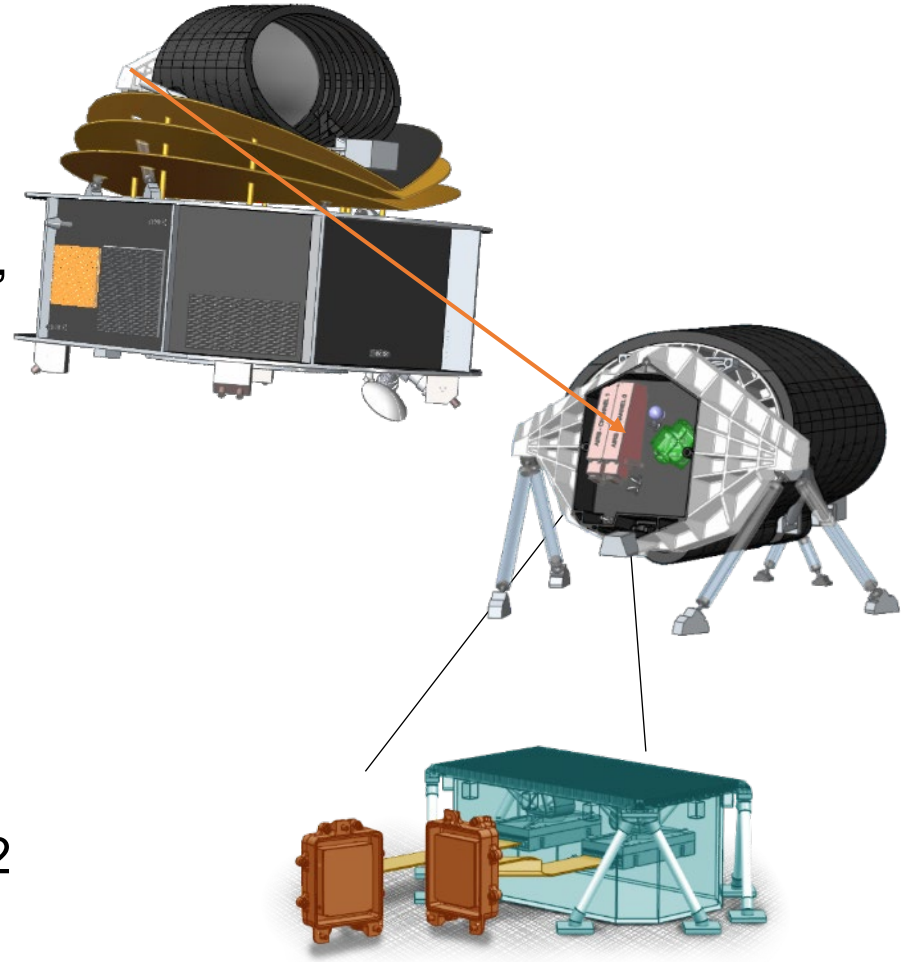
- Observe ~1000 exoplanets
- Survey and characterize exoplanet atmospheres

NASA contribution (CASE) includes detectors and cold front-end electronics, packaging, thermal management, and cryoflex cables for ARIEL Fine Guidance System

Provides US participation in science team, mission survey design, and scientific discoveries

STATUS:

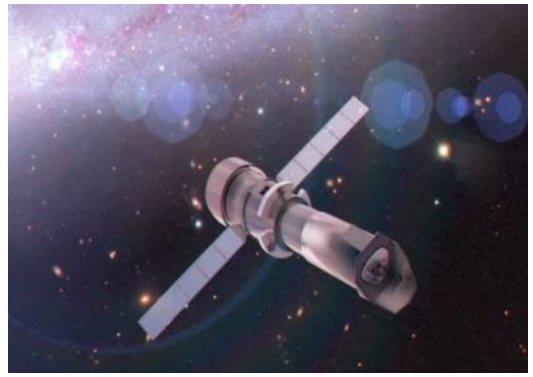
- MOU draft is under NASA final review before submission to Department of State
- NASA Preliminary Design Review completed in September 12-13, 2022
- NASA confirmation review (KDP-C) on Dec 1, 2022
- Fall 2023 – NASA Critical Design Review
- Hardware deliveries late 2024 to 2025
- Launch ~late 2029



CASE
Contribution to ARIEL Spectroscopy of Exoplanets

ATHENA

Advanced Telescope for High Energy Astrophysics



ESA and NASA partnership

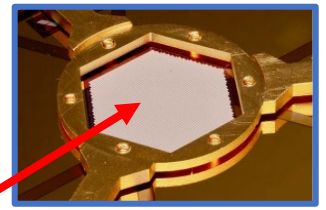
- ATHENA will map hot gas structures and determining their physical properties, search for supermassive black holes in the Hot and Energetic Universe

NASA contributions:

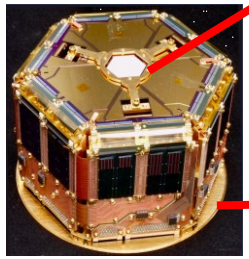
- X-IFU Focal Plane Array (GSFC, NIST-Boulder, LLNL, Stanford, UMBC, UC-Boulder)
- Use of NASA Testing Facilities (MSFC XRCF facility for calibration)
- Vibration Isolation System
- WFI VERITAS ASIC Design and WFI Background Analysis Model
- US Athena Science Center
- Science Grant Program for US Co-Is and Guest Observers

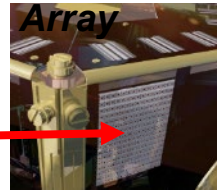
x 120

Vibration Isolation System



Focal Plane Array



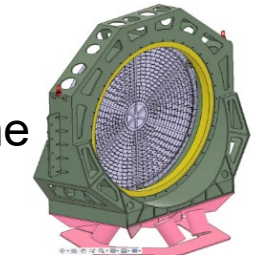


Sensor Assembly ***Readout***

X-IFU Focal Plane Array

STATUS:

- ESA initiated Mission Reformulation Study to reconfigure the mission in order to constraint the cost. Study to be completed late 2023
- Athena mission adoption will be delayed to 2027 and launch ~ 2035
- NASA project team is currently engaged with ESA's Athena Science and Mission Reformulation Teams to redefine the mission
- NASA may have to reprioritize its commitment based on the outcome of the mission reconfiguration



XRCF Mirror Assembly

LISA

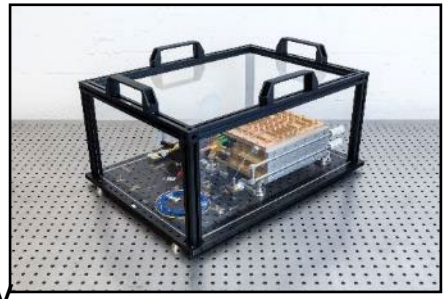
Laser Interferometer Space Antenna

ESA and NASA partnership

- LISA will observe the universe in the millihertz gravitational wave band, detecting tens of thousands of sources ranging from white dwarf binaries in the Milky Way to massive black hole mergers at high redshift.

NASA contributions

- Interferometric Telescopes (GSFC, L3 Harris)
- Laser Systems (GSFC)
- Charge Management Device (U. Florida, Fibertek)
- TBD contributions to data analysis & science (concept study initiated)
- NASA in pre-Phase A Study and technology development managed by Physics of the Cosmos Program Office at GSFC. Systems engineering & science support from JPL & MSFC.

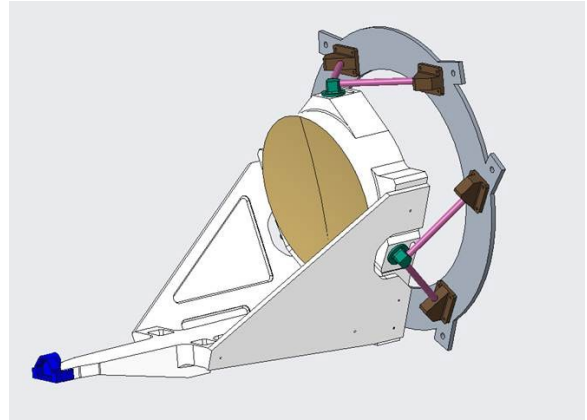


TRL4 laser brassboard

TRL5 Charge Management Unit

STATUS

- ESA development in phase B1
- NASA TRL 4/5 laser under test at GSFC and CSEM lab, Switzerland
- Telescope Structural Thermal Model assembled and ready for environmental testing at L3Harris
- Charge Management Device TRL 6 unit under development
- September 2023 – NASA KDP A/B
- November 2023– ESA Mission Adoption
- 2026 – NASA KDP C
- ESA Launch >2035



Telescope structure with gold coated primary mirror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R&A

ROSES-22 Astrophysics Research Program Elements

Supporting Research and Technologies			
Astrophysics Research & Analysis	APRA	IP	
Strategic Astrophysics Technology	SAT	IP	
Theoretical and Computational Astro Networks	TCAN	IP	
Nancy Grace Roman Technology Fellowships	RTF		
Astrophysics Decadal Survey Precursor Science	ADSPS	IP	DAPR
Data Analysis			
Astrophysics Data Analysis	ADAP		DAPR
Fermi, Swift, NuSTAR, NICER, TESS	GO/GI		DAPR
Mission Science and Instrumentation			
Astrophysics Pioneers (suborbital science)	Pioneers		
Suborbital payloads solicited through APRA	APRA	IP	DAPR
LISA Preparatory Science	LPS	IP	
Roman Research and Opportunities	Roman	IP	DAPR
XRISM Guest Scientist	XGS		DAPR
Supporting Research and Technologies			
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, SOFIA GO/GI/Archive/Theory programs	GO/GI		DAPR
NASA Hubble Fellowship Program	NHFP		
NASA Postdoctoral Program	NPP		DAPR
Support for XMM-Newton U.S. PIs (selected by ESA)	XMM GO		
Not Solicited in ROSES-22 but solicited again in ROSES-23			
Astrophysics Theory Program, every other year	TCAN	IP	DAPR

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

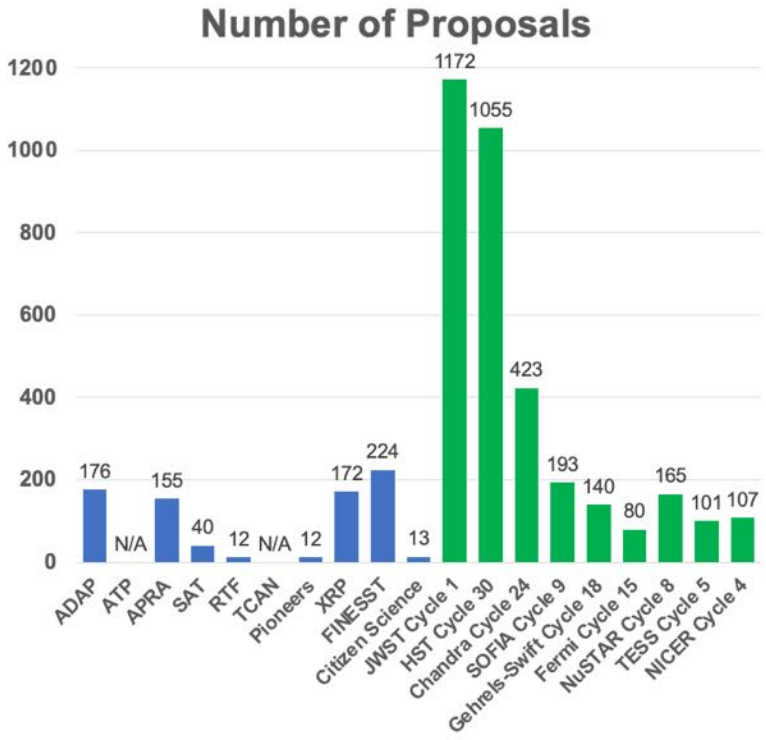
Assessment of IP not part of adjectival rating / does not inform selection of proposals. However funding only released after a satisfactory Inclusion Plan is accepted.

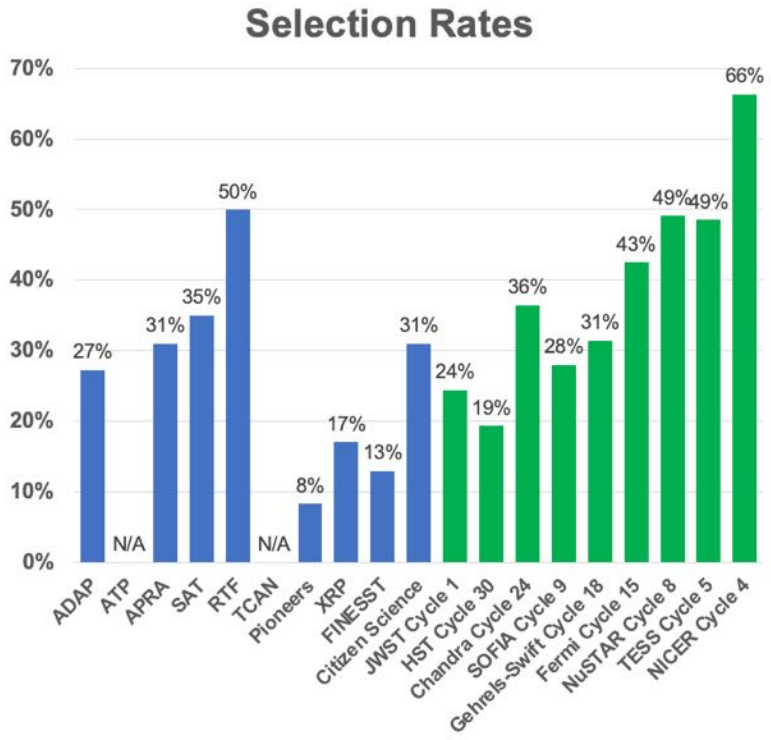
Inclusion Plan pilot program will continue in ROSES-23 (to be released Feb 2023) but likely not expand till later.

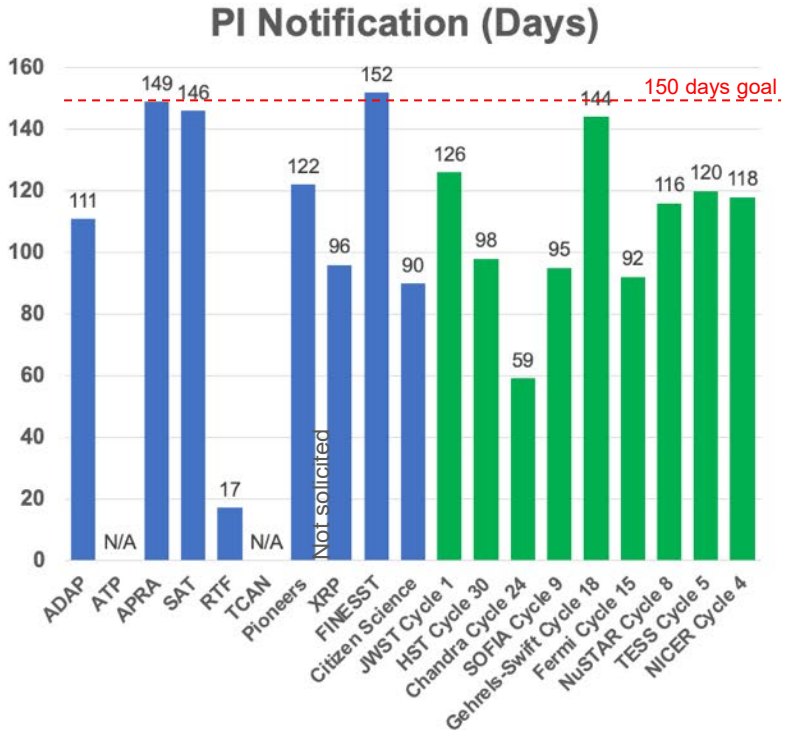
DAPR: Proposals evaluated using dual-anonymous peer reviews.

Astrophysics R&A Selection Rates

September 2021-2022







R&A: 804 proposals
GO/GI: 3,436 proposals
Total: 4,240 proposals

R&A: 22% (19% last year)
GO/GI: 28%
Average: 27%

80% of PI notification:
R&A: 125 days
GO/GI: 109 days

* Only programs with selections made and PIs notified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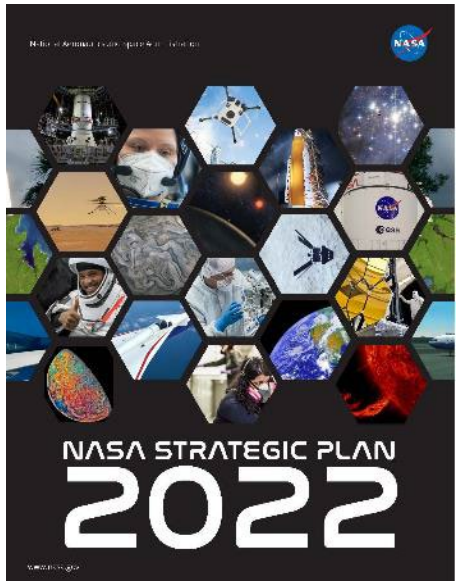
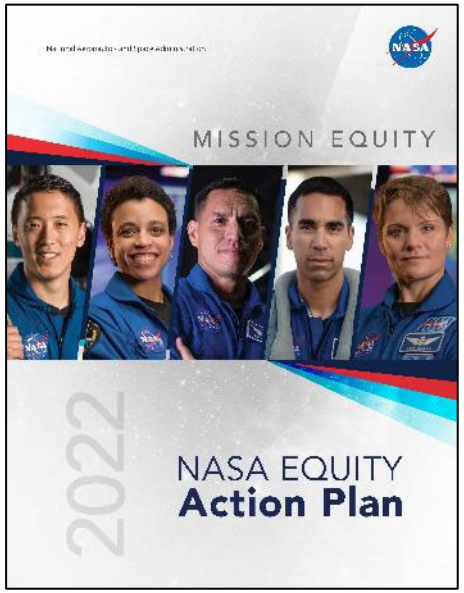
IDEA Initiatives

Inclusion & Diversity of Thought





Strategic Objective 4.1: Attract and develop a talented and diverse workforce. Cultivate a diverse, motivated, and highly qualified workforce through modernizing our Human Capital processes and systems, increasing our workforce agility and flexibilities, and implementing a robust Inclusion, Diversity, Equity, and Accessibility (IDEA) approach to ensure systematic and sustainable fairness, impartiality, and equity in our business practices.

NASA is continuing its journey towards equity. To this end, NASA has established four foundational focus areas:

- Increase Integration and Utilization of Contractors and Businesses from Underserved Communities to Expand Equity in NASA's Procurement Process
- Enhance Grants and Cooperative Agreements to Advance Opportunities, Access, and Representation for Underserved Communities
- Leverage Earth Science and Socioeconomic Data to Help Mitigate Environmental Challenges in Underserved Communities
- Advance External Civil Rights Compliance and Expand Access to Limited English Proficient (LEP) Populations within Underserved Communities

Building Excellent NASA Teams Requires Inclusion & Diversity

- IDEA is infused throughout everything we do. It is not a standalone or separate activity.
- Astrophysics has pioneered and piloted IDEA activities that are n… …lopted across SMD:
  1. Inclusion Plans adopted in ROSES elements across all SM…
  2. Code of Conduct now adopted for panel reviews a…
  3. Dual Anonymous Peer Reviews adopte…
  4. Inclusion Criteria in Senior Re… …across all SMD divisions *
  5. Increasing diversity… …expected across all SMD divisions
- Other SM…
  - …and publication of demographics of ROSES proposers and awardees *
  - …port data on proposal submissions and success rates *
  - …D Bridge Program funded for better engagement with MSIs *
  10. National Academies study of barriers to inclusion in mission leadership
  11. National Academies study of demographic data required to assess the health of the community *
  12. Regular participation at meetings such as SACNAS and NSBP
  13. PI Launchpad to incubate next generation of diverse leaders for missions *
  14. IDEA criteria being added to Announcements of Opportunity *

Additional initiatives are being considered for inclusion in the FY24 NASA budget request *

* Responsive to an Astro2020 Decadal Survey recommendation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NHFP

Actions taken to date in response to the recommendations of the review of the NASA Hubble Fellowship Program (NHFP)

- There are several parallel efforts underway:
  - NHFP Working Group is developing an overall implementation plan based on the report recommendations and has already targeted some “low hanging fruit.”
  - The NHFP Leads have implemented recommendations that are high priority, minimal workload impact, and funding neutral
  - Current and past NHFP Fellows have self-organized to tackle areas where they can directly impact the opportunities for current and future NHFPs.

- The NHFP Leads serve as the liaisons between all three efforts to ensure coordination, not duplication

- Inclusion, Diversity, Equity and Accessibility (IDEA): To quote former astrophysics director Paul Hertz “IDEA is a part of all we are doing.”

- Tasks marked with a red asterisk (*) are especially relevant to IDEA.

The NHFP Working Group (1/2)

NHFP Working Group meets bi-weekly (was weekly prior to the June AAS) to both work on an implementation plan and draft the initial response to the report recommendations

- We are doing this with input from our community about what they see as priorities and how we might address some of the more challenging recommendations, and seeing how we align with the 2020 Decadal Survey

- A public webinar was held on February 22, 2022 (in lieu of AAS splinter session)

- A hybrid splinter session was held at the American Astronomical Society meeting in June 2022

- A Community Survey was created to collect input from the community via a google form on the relative priorities and potential impact of the 32 recommendations.
  - The form was open June 6 – August 30, 2022. Over 100 responses.
  - An intern at HQ is currently analyzing the results this fall

➢ *All of this community input is being used to inform the initial response to the recommendations.*

The NHFP Working Group (2/2)

- 3 pilots in FY 2023 that the current and past NHFPs raised as high priority
  - *Providing funds to attend non-research, outreach/conference opportunities for NHFP Fellows
    - This is intended to allow NHFPs who are interested in encouraging broader participation in the NHFP to attend things like SACNAS, NSBP
  - *Providing career development training for NHFP Fellows
    - It is up to the Fellow to decide what training they would like, which could include an emphasis on IDEA
  - *Providing funds for NHFP Fellows to fund students mentees
    - Fellows are encouraged, but not required to offer underrepresented minority students an opportunity to work with them

- Drafting the initial response to the review recommendations, including target timeline
  - Plan to post this living document by the end of 2022
  - *Discussion of all responses informed by intent to attract a broader pool of applicants
  - *Will again seek input from the community on the response*

NHFP Program (led by the NHFP Leads)

The NHFP Program has already:

- *Instituted a demographic survey of prospective, accepted and past fellows - 1,200 respondents to date. Includes voluntary data e.g., PhD year and institution, host institution, family care status, gender, ethnic/racial group, disability, career path.
- *Worked with GSFC & STScI to allow fellows to propose research funding for student research-related travel.
- *Implemented a new applicant evaluation rubric developed with an IDEA Subject Matter Expert with specific emphasis on Leadership, Inclusion, Diversity, that is publicly available to applicants and the public for next Announcement of Opportunity (AO) i.e., the call for applications.
- *Enhanced AO outreach to SACNAS, NSBP, AWIS, Twitter, Facebook, MinorityPostDoc
- Implemented a new policy requiring availability of employee status with full benefits by all host institutions
- Implemented a new policy to allow NHFPs to be hosted at NASA Centers for U.S. citizens; working with GSFC to find a way to host non-U.S. citizens

The NHFP Fellows

A self-organized subgroup of NHFP Fellows have also decided to be proactive. They have launched the NHFP Fellows' Anti-Racism Initiative (FARI). FARI has already:

- Held a workshop for potential applicants in August 2021 & 2022 called "Demystifying the Hubble Fellowship Program. *"
- Held an orientation program for new Fellows*.
- Launched https://www.nhfp-equity.org/*.
- Recruited volunteer mentors for applicants from among current and recent fellows in 2021 and 2022.*
- Compiled a public database of past successful applications shared by volunteers, and continue to update it*.
- Offer to review the applications of prospective Fellows*.

➢ Discussions have begun to see how NASA/NHFP Program can work with the Fellows to ensure the long-term viability of these efforts

➢ **Through these parallel efforts, we are accomplishing much more than we could do on a serial path**


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Data Archives

NASA's Astrophysics Archives Structure: I

- NASA Astrophysics supports an integrated system of **science data archives** for legacy, active, and future astrophysics missions:
  - **HEASARC** (High Energy Astrophysics Science Archive Research Center) at GSFC (extreme UV/X-ray/gamma ray data)
  - **MAST** (Mikulski Archive for Space Telescopes), STScI (primarily UV/visible/near IR)
  - **IRSA** (Infrared Science Archive) at IPAC/Caltech (primarily IR and submillimeter)
- **KOA** (Keck Observatory Archive) holds ground-based data from the W.M. Keck observatory
- Thematic archives enable comprehensive views of particular classes of objects
  - **NED** (NASA Extragalactic Database) at IPAC/Caltech: fusion of multiwavelength data and bibliography for objects beyond the Milky Way
  - **LAMBDA** (Legacy Archive for Microwave Background Data) at HEASARC: multimission center of expertise for cosmic microwave background radiation research
  - **NEA** (NASA Exoplanet Archive) at NASA Exoplanet Science Institute (NExScI)/Caltech: collating data on exoplanets and their host stars
- **ADS** (Astrophysics Data System) at Smithsonian Astrophysical Observatory: a digital library with bibliographic databases (the topic of a dedicated talk later in the Workshop)
- Central to each archive is the scientific and technical expertise of their staff, and their support for users.

NASA's Astrophysics Archives Structure: II

- The main domain archives (HEASARC, MAST, and IRSA) have each built a standard multi-mission capability for wavelength-specific astrophysics that supports data archiving, data retrieval and analysis, proposal and software support, and Virtual Observatory support that can be readily adopted in all or in part by new missions.

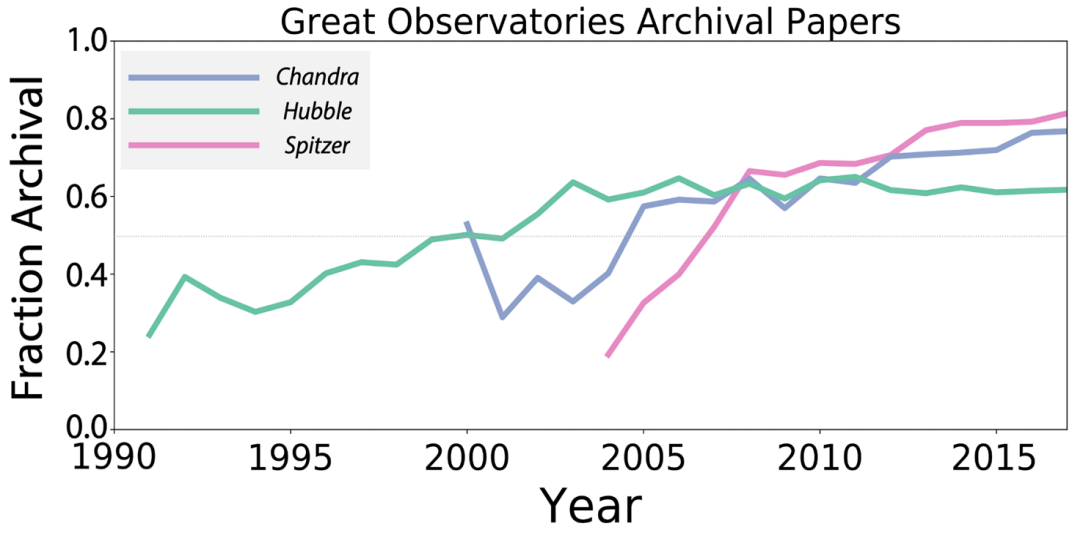
- The archives have a very high degree of collaboration, networking, and commonality. They voluntarily share information, seek out synergies and new opportunities, ensure interoperability, and promote multi-wavelength and multimission data and software standards.

- Major areas of collaboration include:
  - ADEC - Astronomy Data Centers Executive Committee, an informal organization of archive leads and selected designees. Holds monthly telecons, plus a healthy email exchange, F2F discussions at meetings (AAS, ADASS), etc. Rotating chairship.
  - NAVO - NASA Astronomical Virtual Observatories, coordinating the archives in providing comprehensive and consistent access to data through standardized interfaces (est. 2014; see later slide)
  - Joint Science Platform project (HEASARC/MAST/IRSA), supported by HQ/SMD – common cloud-based science platform (see later slide)

NASA's Astrophysics Archives Structure: III

- DEI is a guiding consideration in establishing membership for the archives' community oversight panels
- Most science from our observatories relies on the archives. Scientists from smaller institutions and poorer countries leverage the archives even more (Peek et al. 2019)
- Science Platform supports inclusive science by providing easier access to data, software, and tools.
- Sonification, the process of representing data as sound offers exciting new ways for scientists to study data, and provides blind and low-vision people with a new level of data access and analysis. MAST has developed astronify, an open source Python package for sonifying astronomical data.

- NExScI's NASA Exoplanet Archive is working with vision impaired representatives to help bring exoplanet data to this community
- The NASA/IPAC Teachers Archive Research Program (NITARP) has been offering authentic research experiences to high school teachers and students across the United States for 15 years (Rebull et al. 2018)



BACKUP