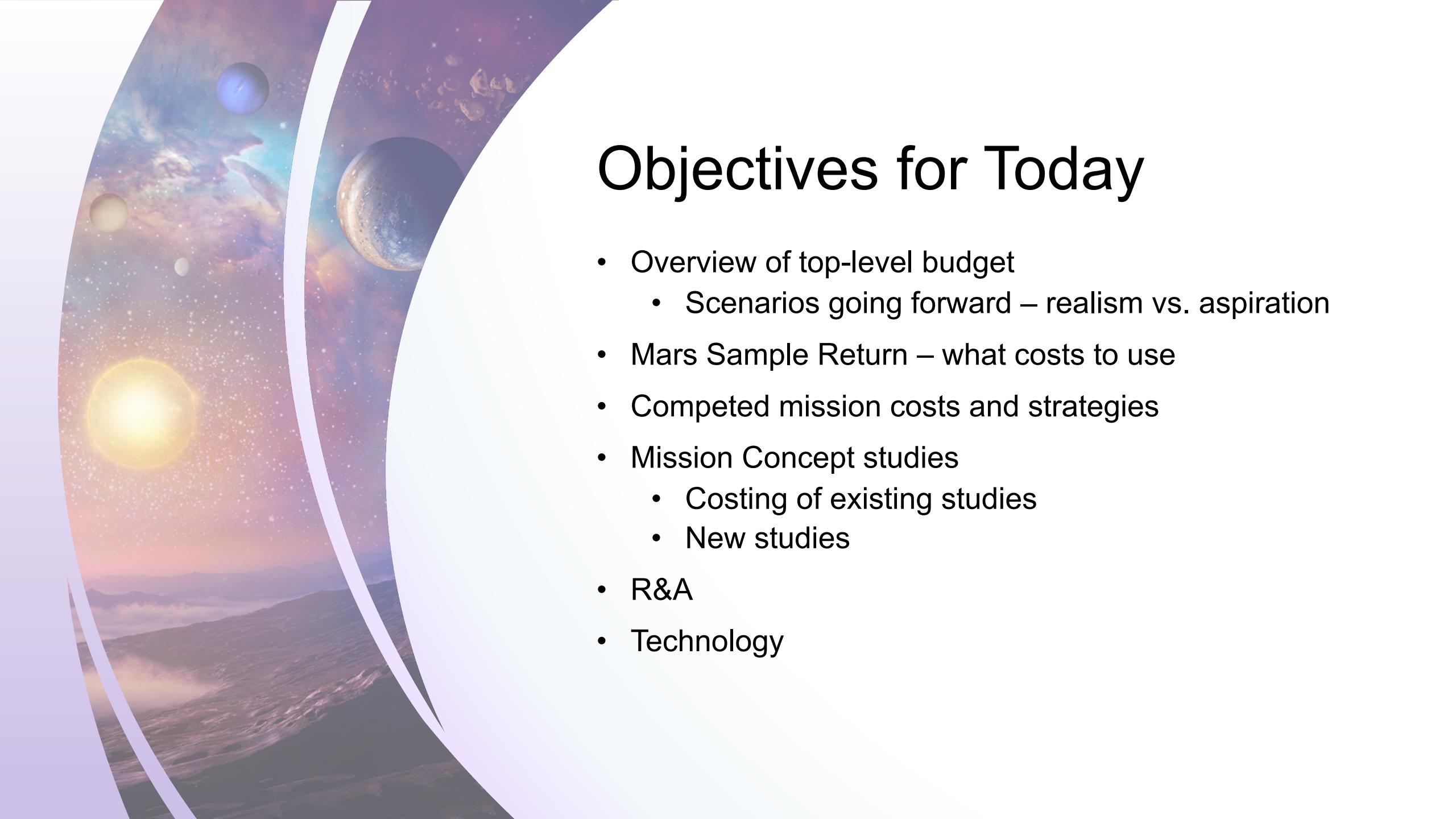


EXPLORE SOLAR SYSTEM&BEYOND

Lori S. Glaze, Ph.D.
NASA Planetary Science Division Director

2023–2032 Planetary Science and Astrobiology Decadal Survey
Steering Committee Meeting
October 16, 2020



Objectives for Today

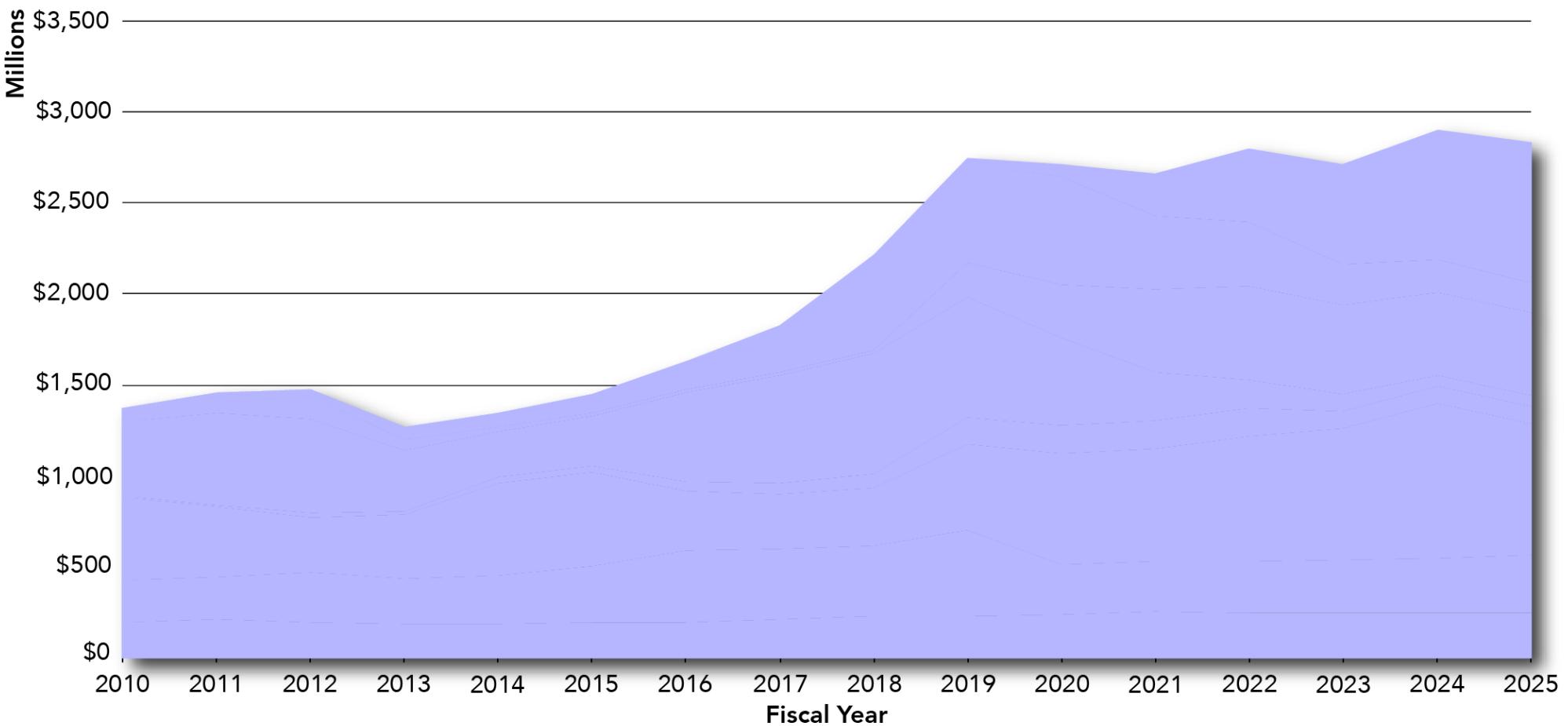
- Overview of top-level budget
 - Scenarios going forward – realism vs. aspiration
- Mars Sample Return – what costs to use
- Competed mission costs and strategies
- Mission Concept studies
 - Costing of existing studies
 - New studies
- R&A
- Technology



Budget: Past, Present, Future

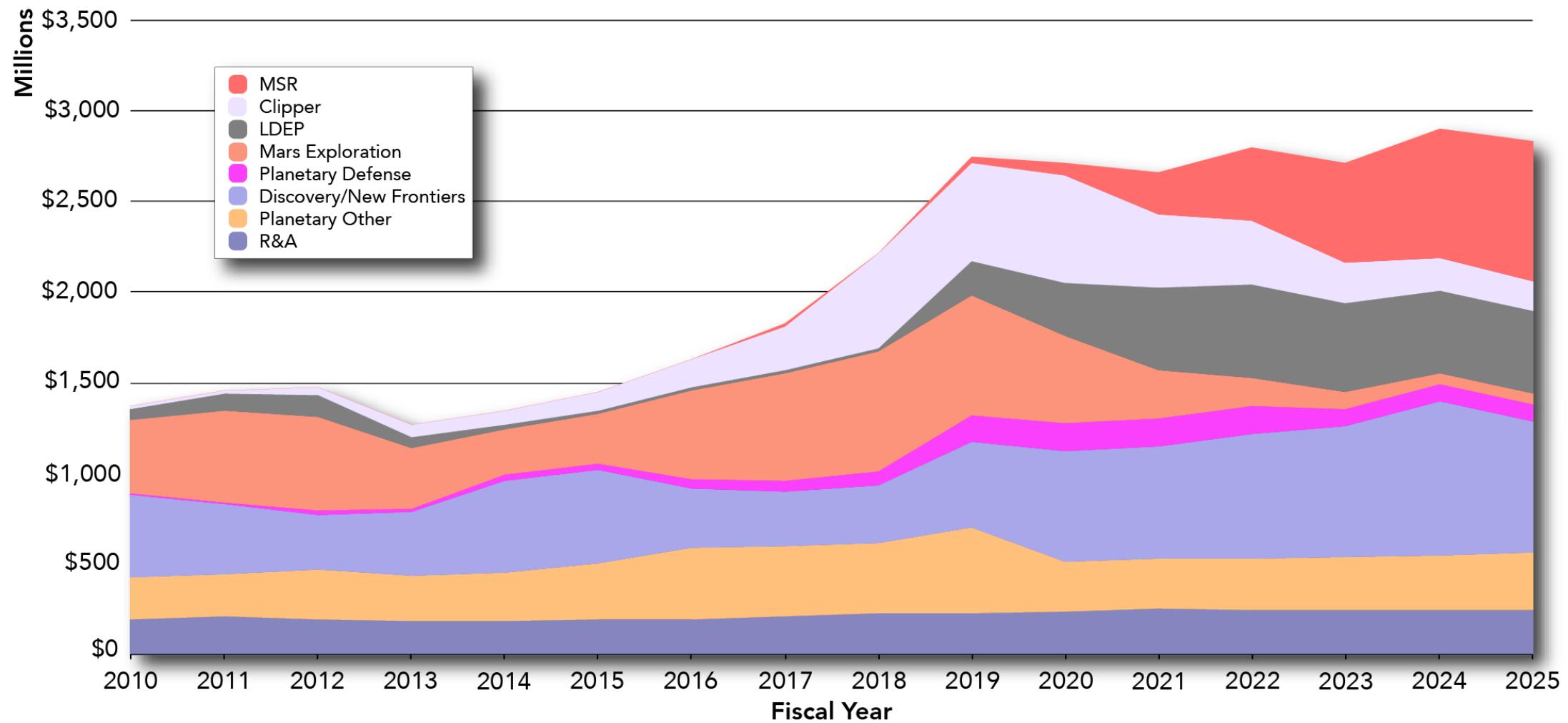


Inspirational Decadal Survey Drives Aspirational Planetary Science Budget



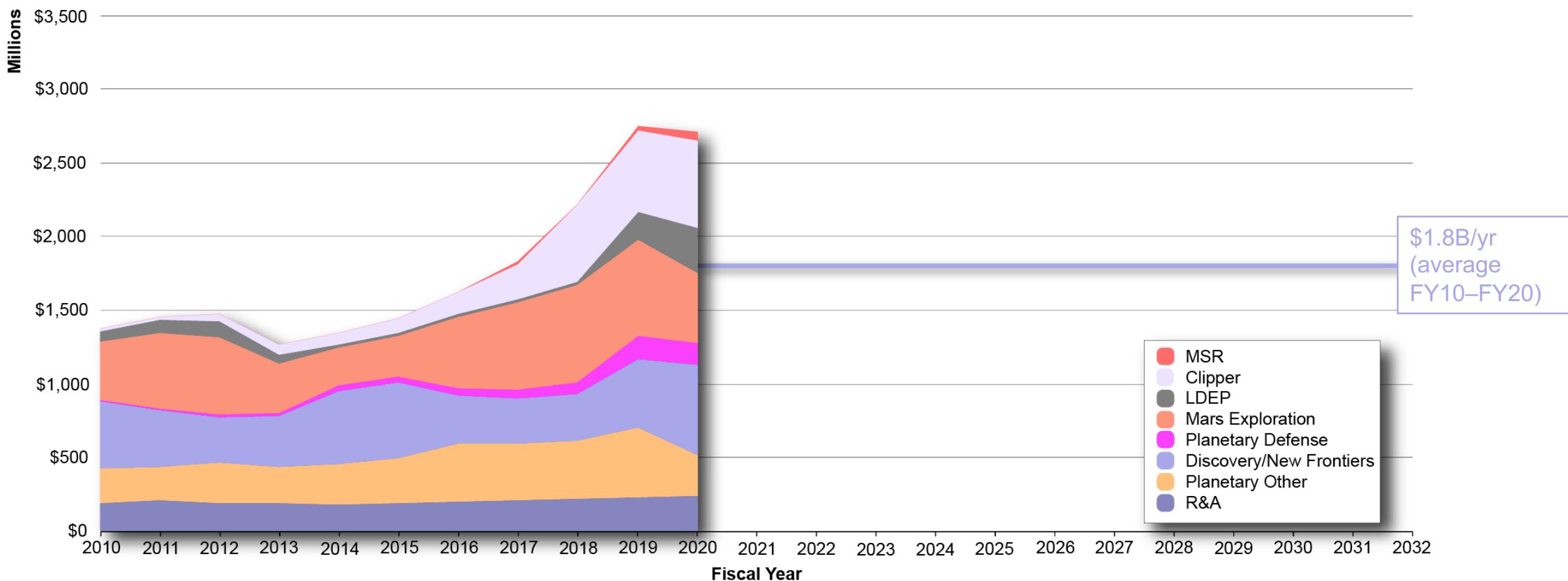
FY 2021–2025 based upon FY 2021 President's Budget Request to Congress

PSD Budget 2010–2025

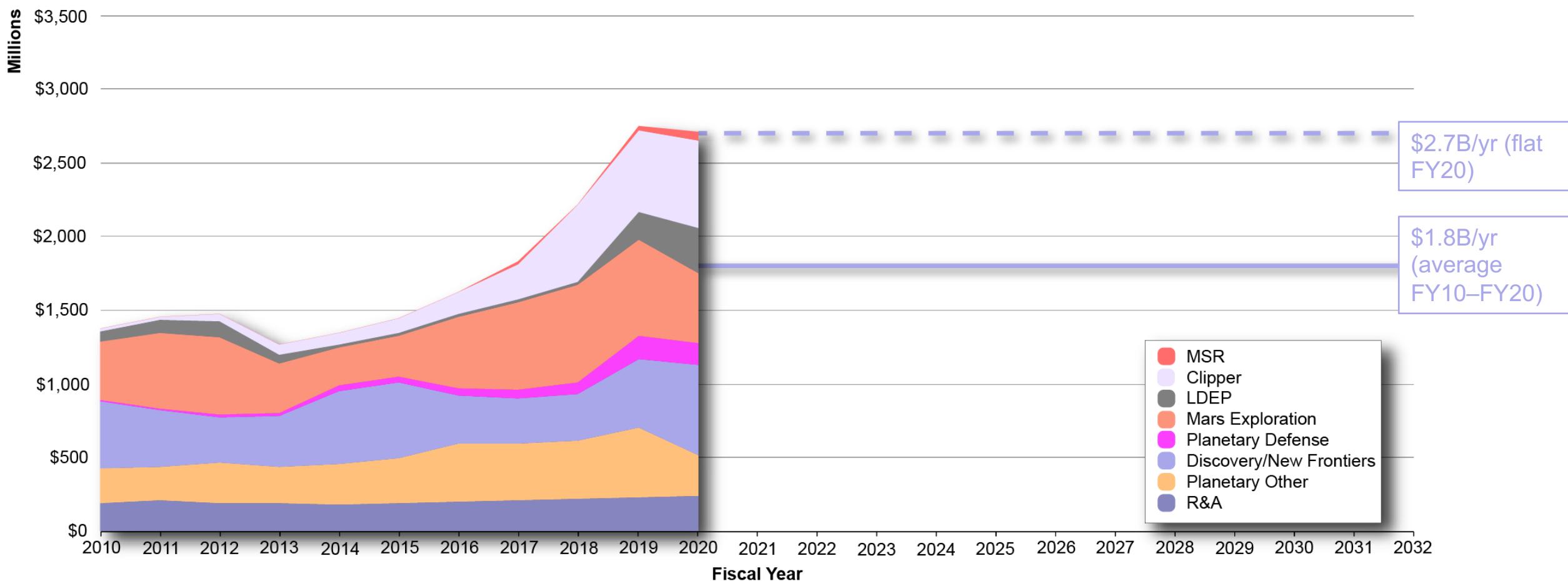


FY 2021–2025 based upon FY 2021 President's Budget Request to Congress

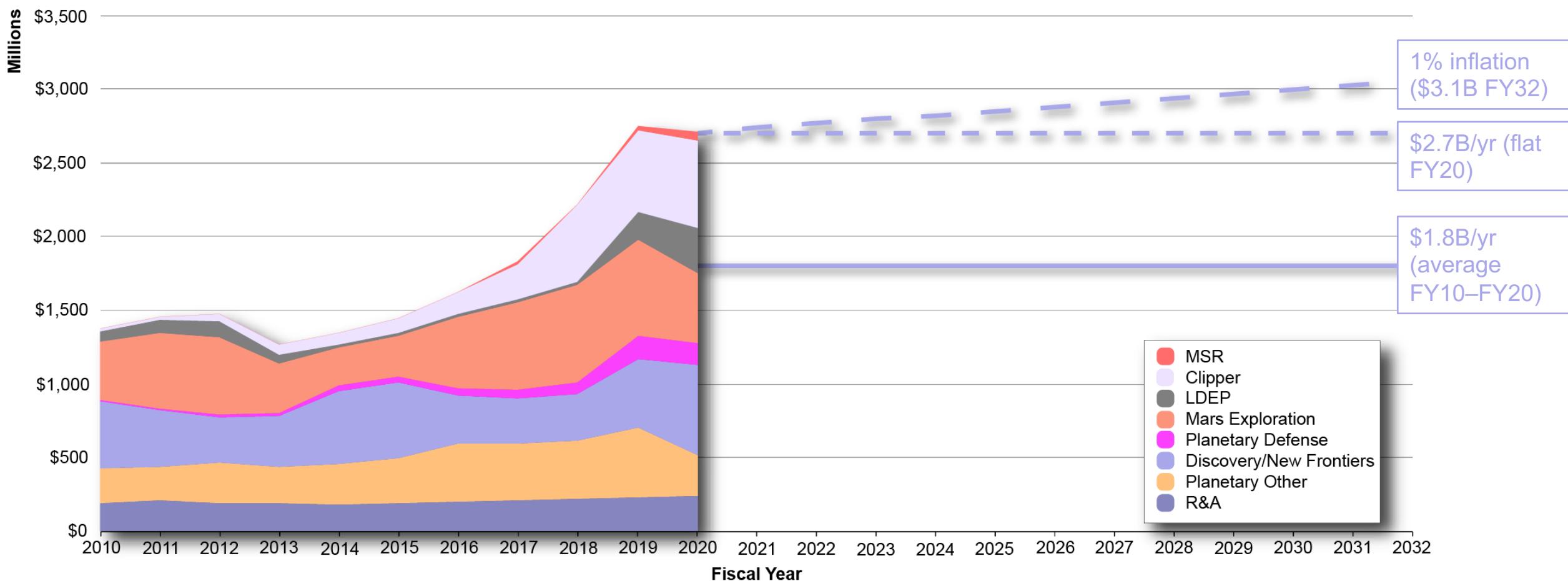
PSD Budget: Post 2020?



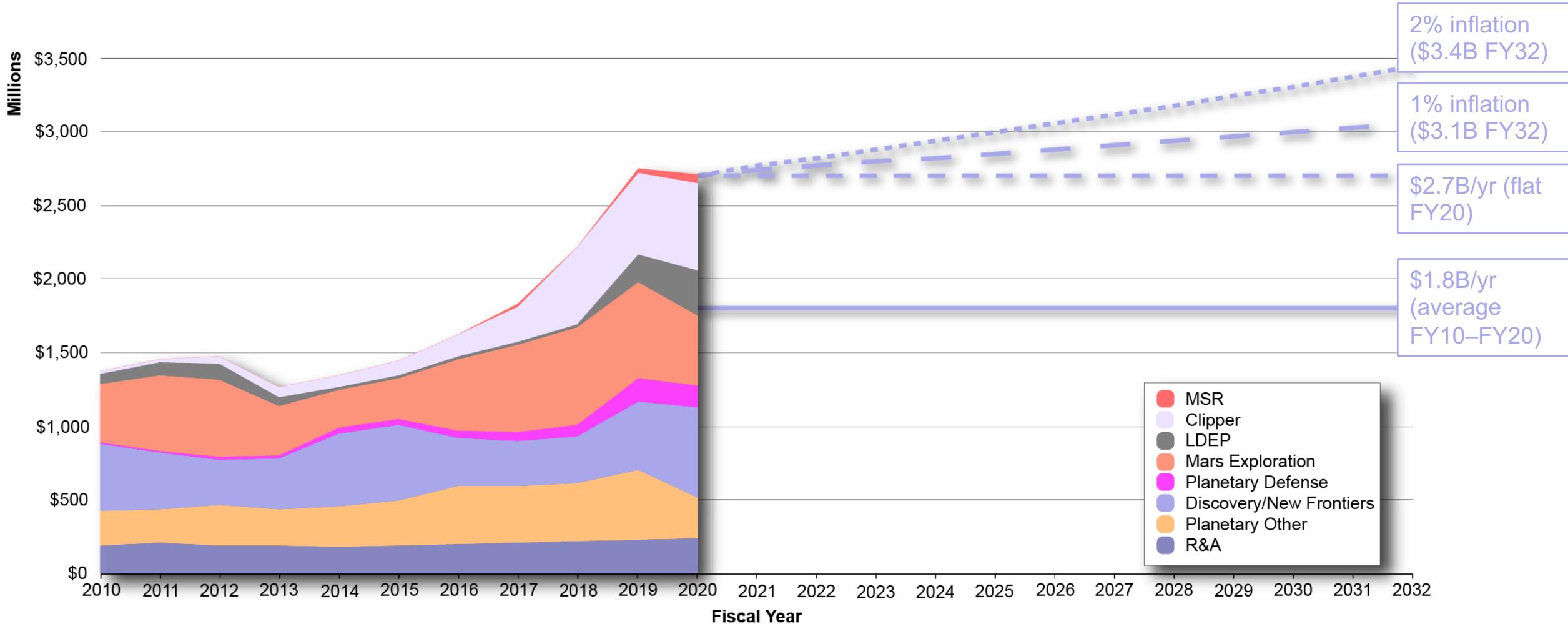
PSD Budget: Post 2020?



PSD Budget: Post 2020?



PSD Budget: Post 2020?





Mars Sample Return Cost Estimates



Mars Sample Return



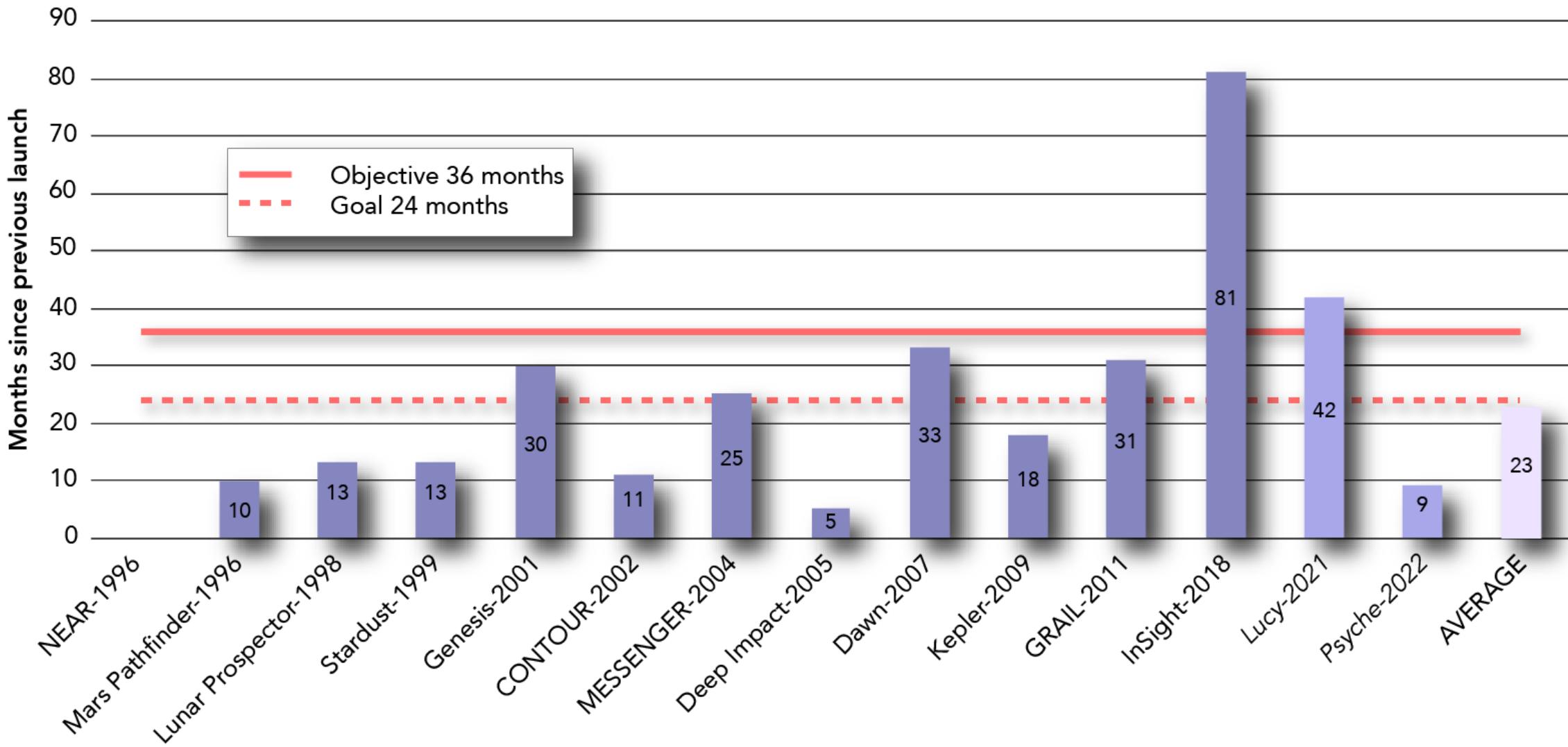
- SMD-commissioned Independent Review Board will present findings to SMD leadership later this month
 - Reviewed technical approach
 - Included independent assessment of program's cost and schedule
 - Two independent cost estimates were provided by Jacobs and Aerospace – **PSD can provide these upon request**
- Mission Concept Review is ongoing through October 19th



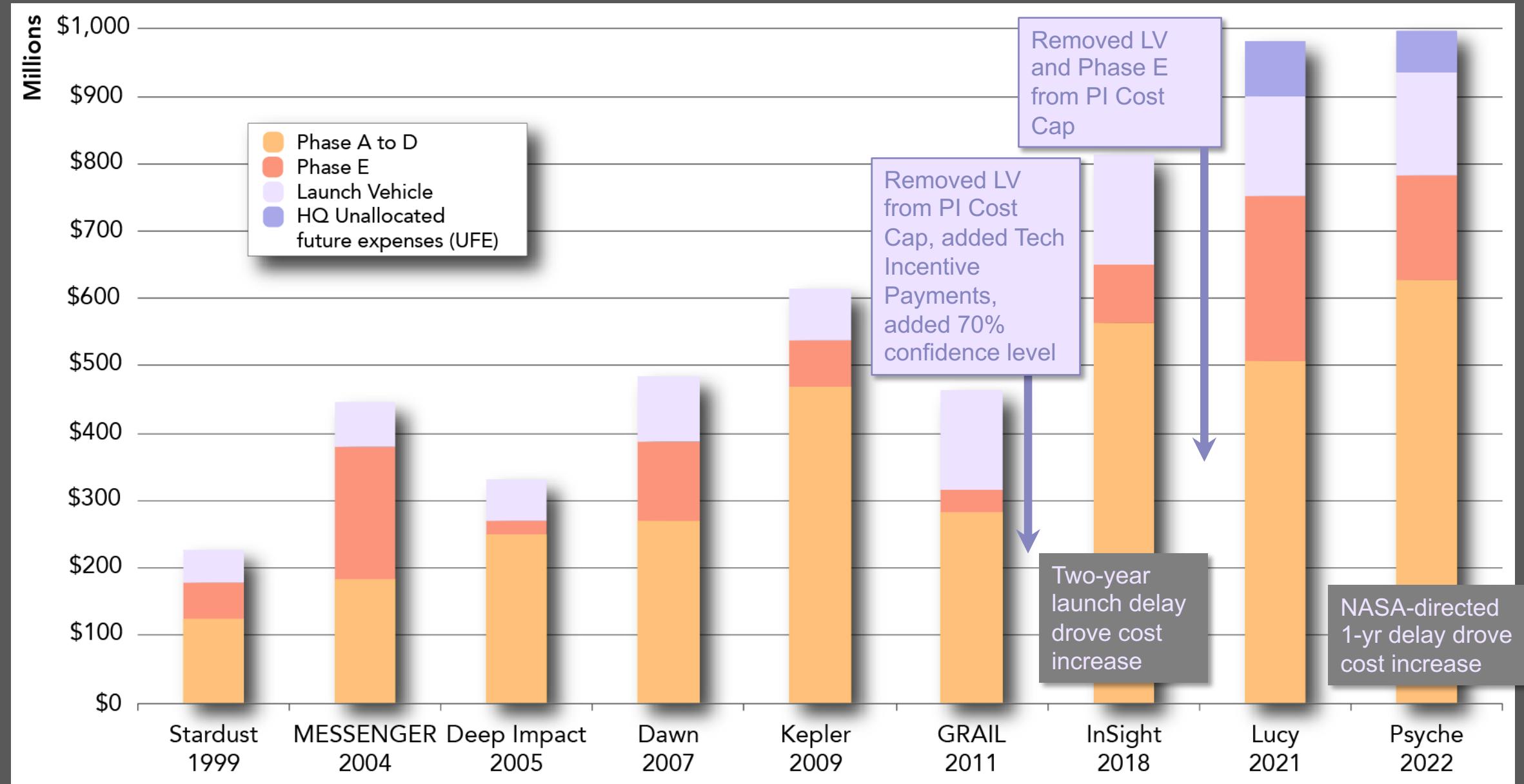
Competed Mission Costs and Strategies



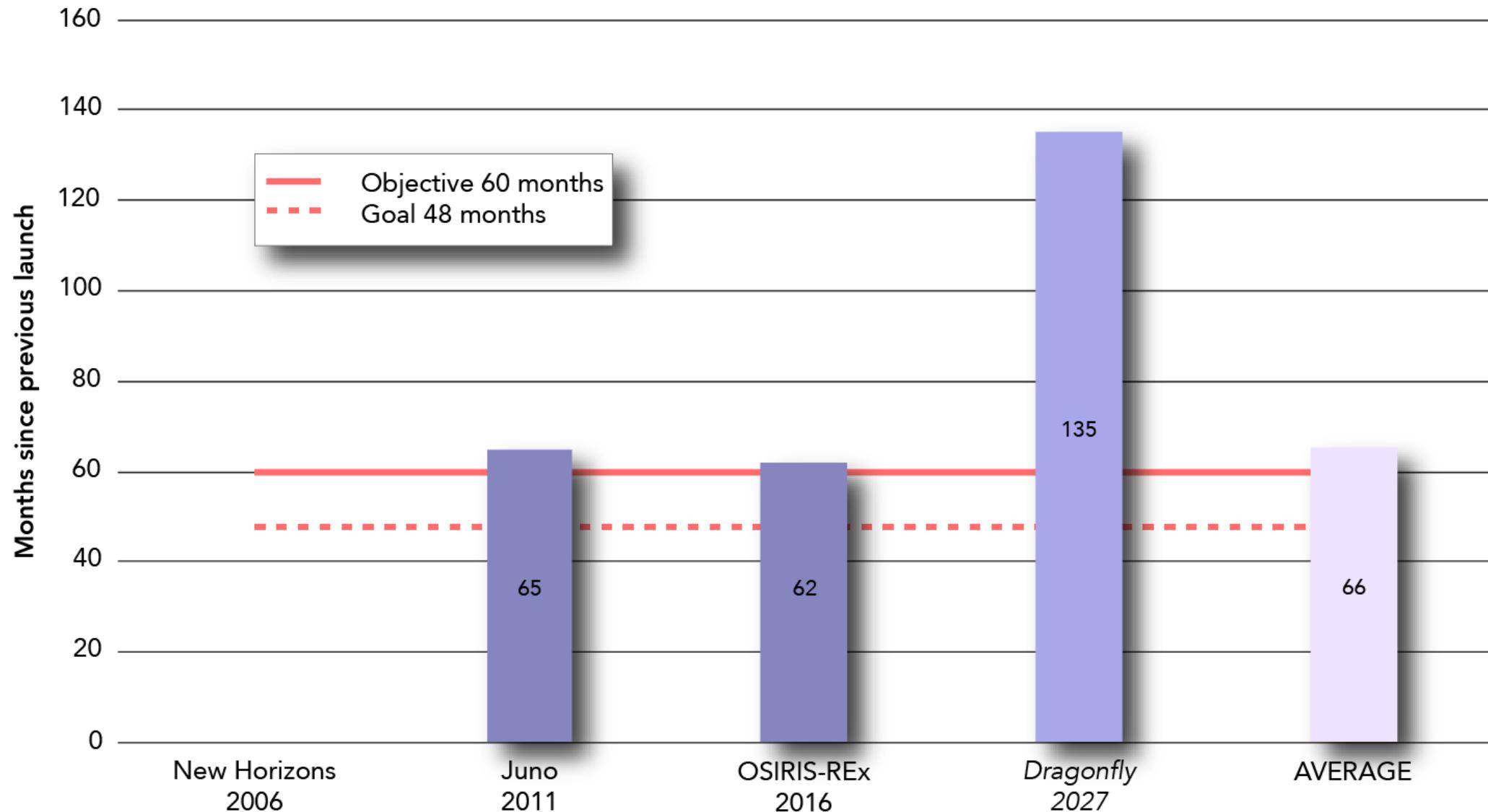
Historical and Future Discovery Cadence



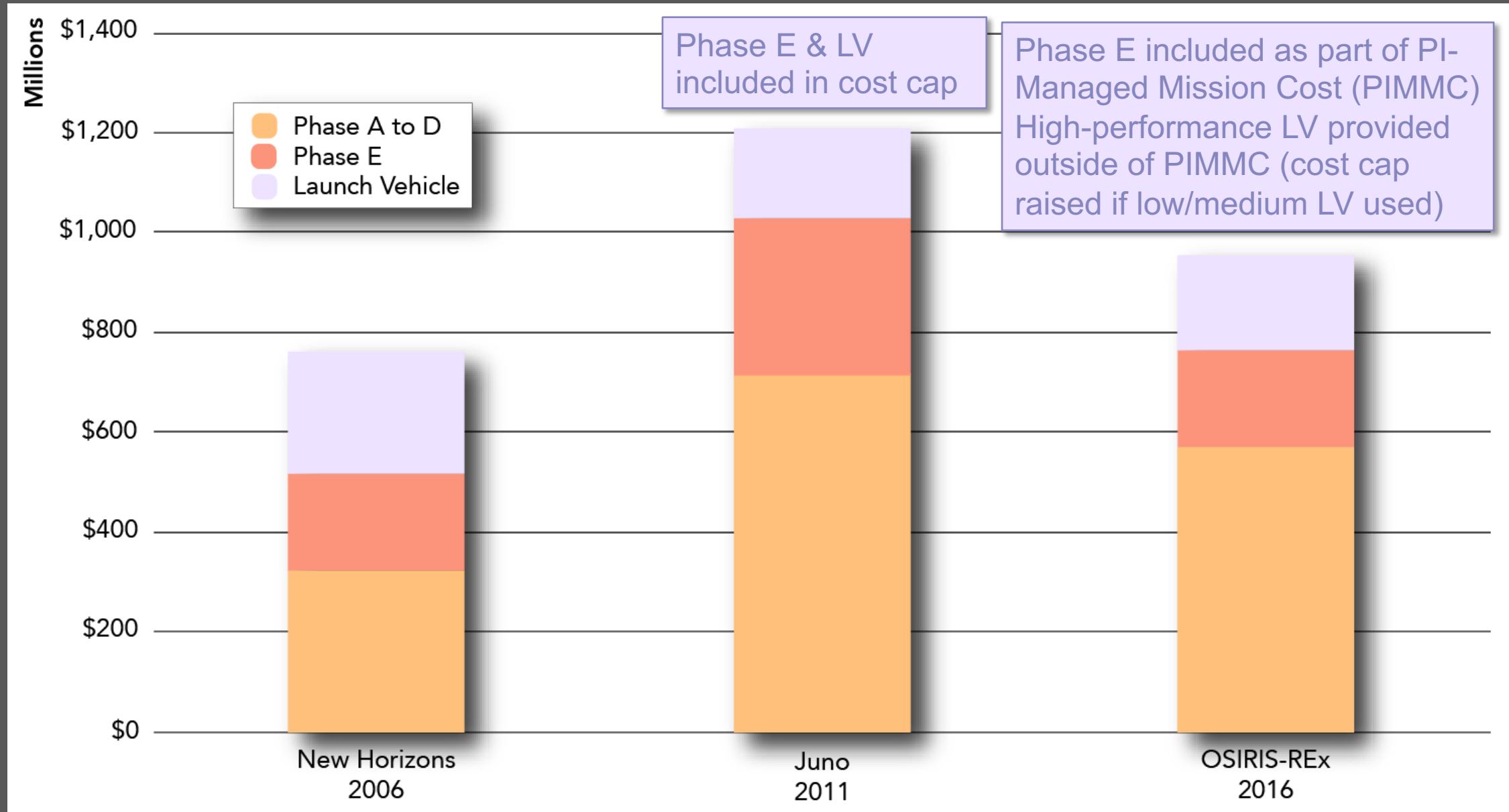
Discovery Cost Growth* from Strategic Decisions (RY\$)



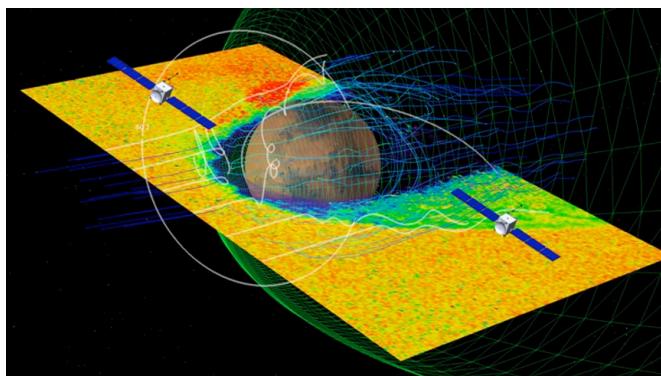
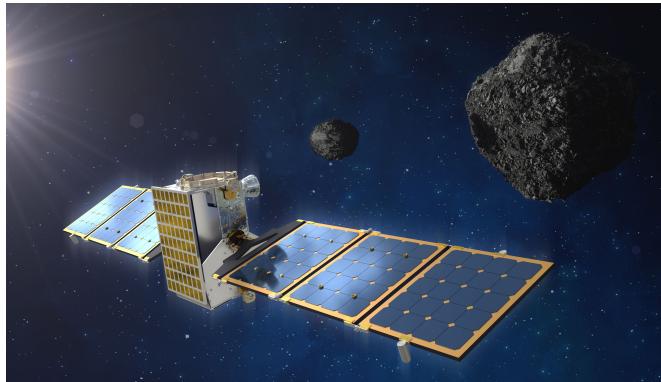
Historical and Future New Frontiers Cadence



New Frontiers Cost Growth* from Strategic Decisions (RY\$)



SIMPLEX

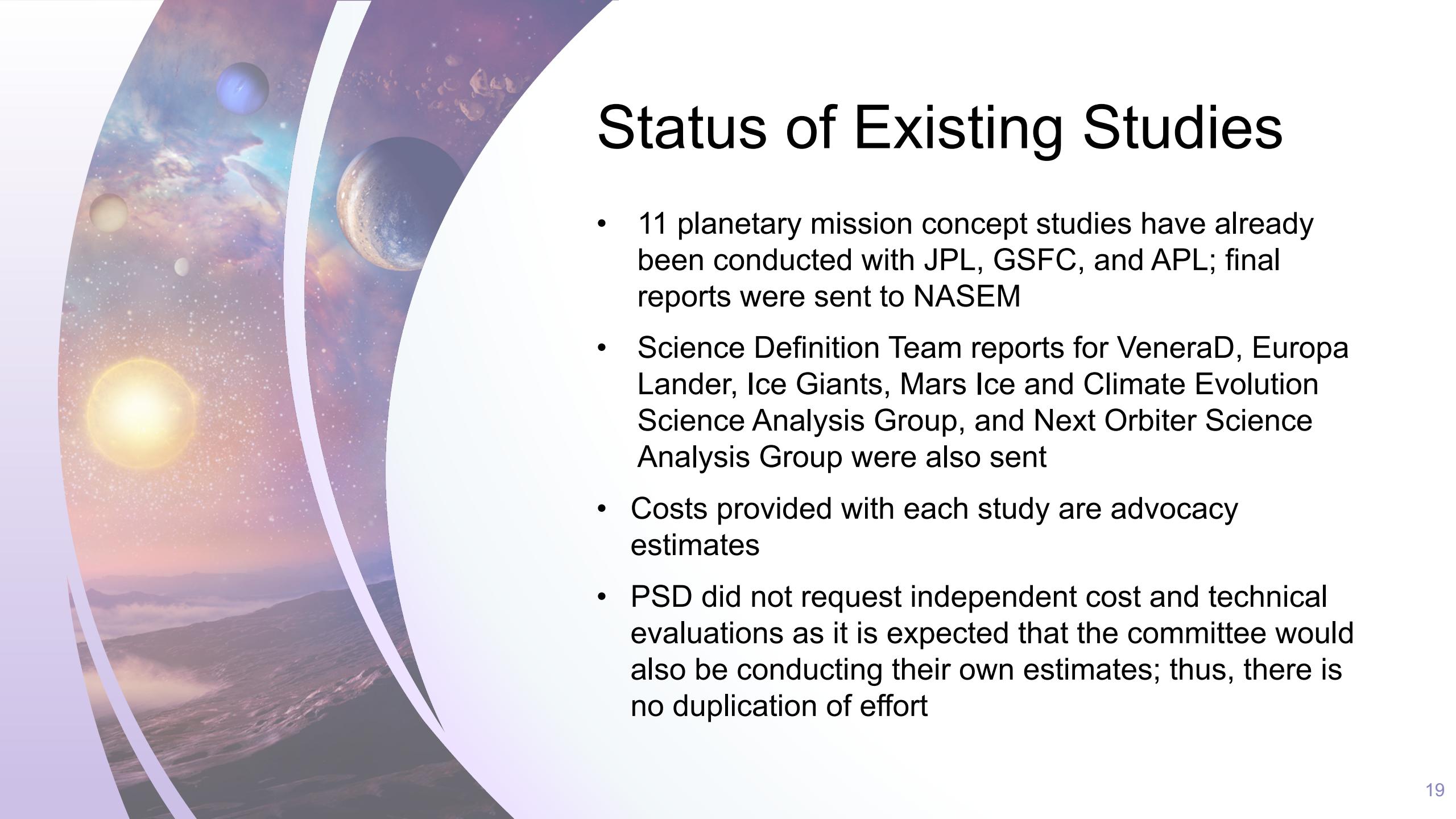


- Cost cap in SIMPLEx-2 AO was \$55M
- Is this the right cost cap?
- We are still learning many lessons from the most recent call
- How do we interleave SIMPLEx with Discovery and New Frontiers?
 - Desire to provide frequent opportunities
 - Many SIMPLEx missions require a ride on another planetary mission



Mission Concept Studies





Status of Existing Studies

- 11 planetary mission concept studies have already been conducted with JPL, GSFC, and APL; final reports were sent to NASEM
- Science Definition Team reports for VeneraD, Europa Lander, Ice Giants, Mars Ice and Climate Evolution Science Analysis Group, and Next Orbiter Science Analysis Group were also sent
- Costs provided with each study are advocacy estimates
- PSD did not request independent cost and technical evaluations as it is expected that the committee would also be conducting their own estimates; thus, there is no duplication of effort



New Studies

- The committee may want to:
 - Explore implications of small changes to the submitted studies
 - Identify new studies based on community papers that were not previously supported
- GSFC, APL, and JPL are available to participate in additional mission concept studies and analyses, as required
- **Requests for additional studies should be sent to PSD by the end of 2020** (including level of detail required)
 - \$4M in PSD available to support additional studies
 - For reference: PMCS studies lasted ~6 months and cost ~\$1M each, on average
 - PSD expects that new studies will be shorter and smaller in scope



R&A and Technology Investments

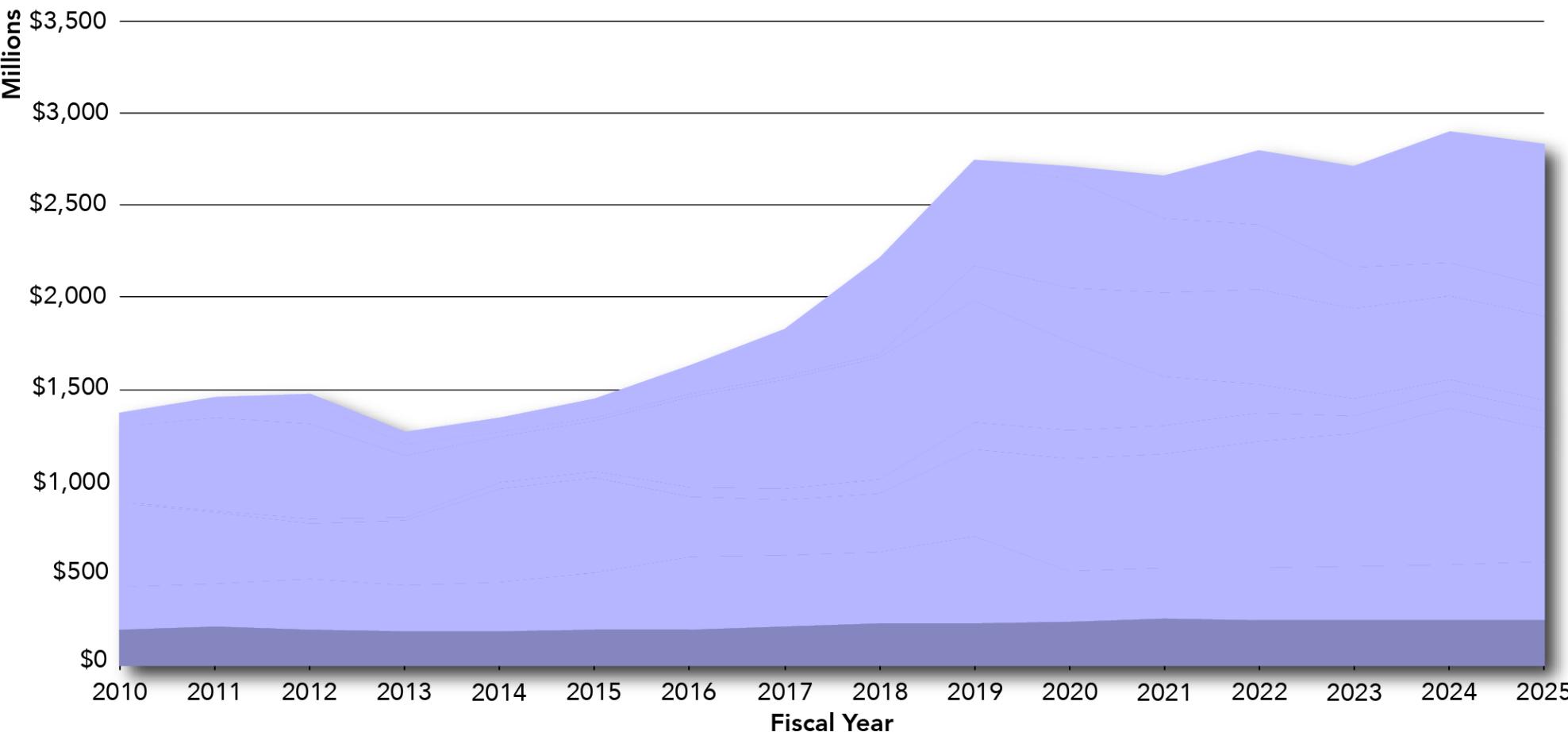




Planetary Science Research & Analysis

- Research & Analysis (R&A) is the backbone of everything we do
 - Missions provide critical data needed to answer NASA's science questions
 - Missions and R&A provide analysis of these data; R&A goes beyond the mission science
 - R&A provides the context for future missions
- NASA is the primary source of funding for Planetary Science research in the U.S.
- R&A provides broad support across the **entire** planetary science community
 - From 2015–2020, R&A supported over 1,500 unique Principal Investigators across ~250 institutions
- R&A directly addresses science prioritized by the Decadal (Core Programs, Astrobiology), data from missions (Data Analysis Programs, Participating Scientist Programs (PSPs)), Technology Development, and more
 - R&A programs tie directly into national priorities (e.g., Artemis)
- R&A is the most nimble PSD program, and therefore leads on responses to new initiatives and changes in national priorities

R&A Budget



FY 2021–2025 based upon FY 2021 President’s Budget Request to Congress

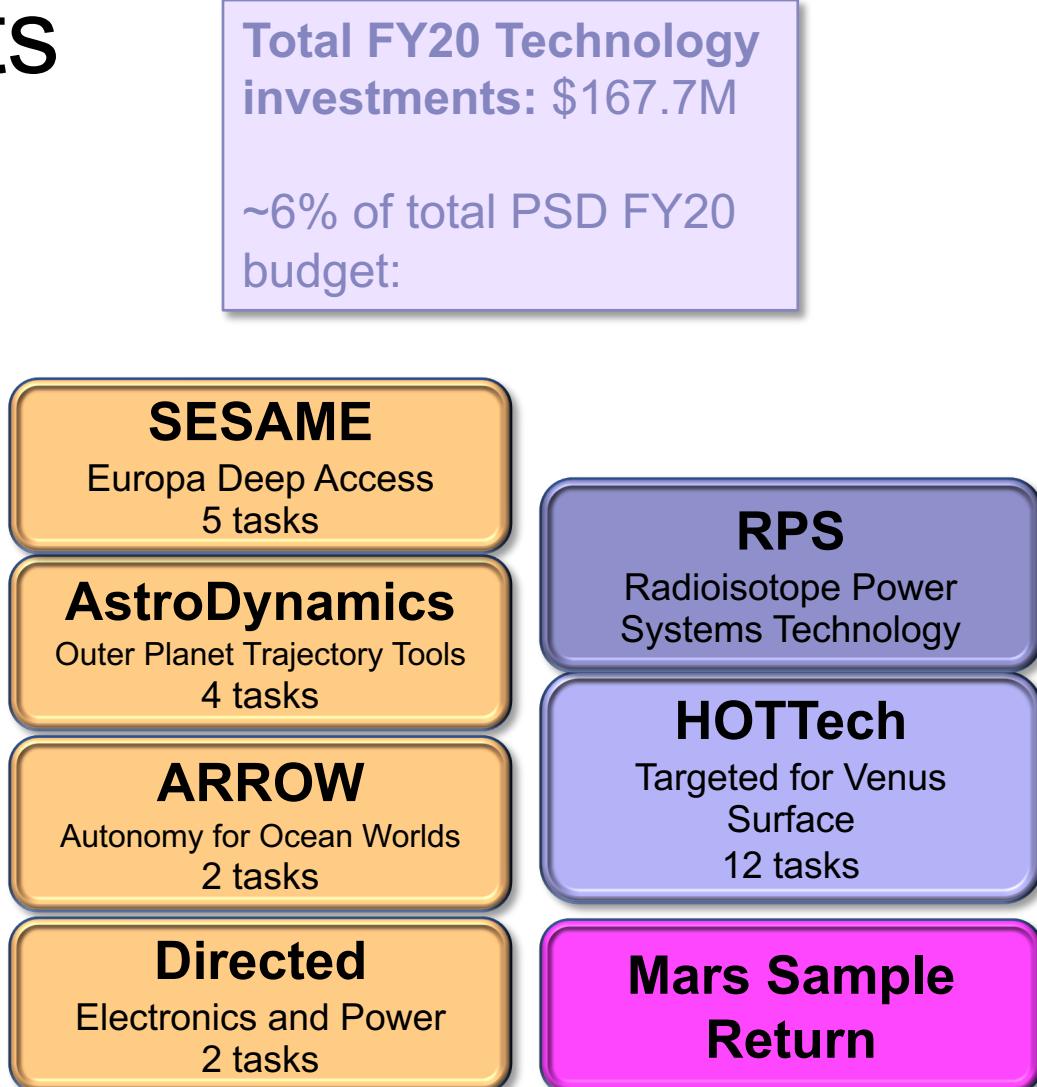
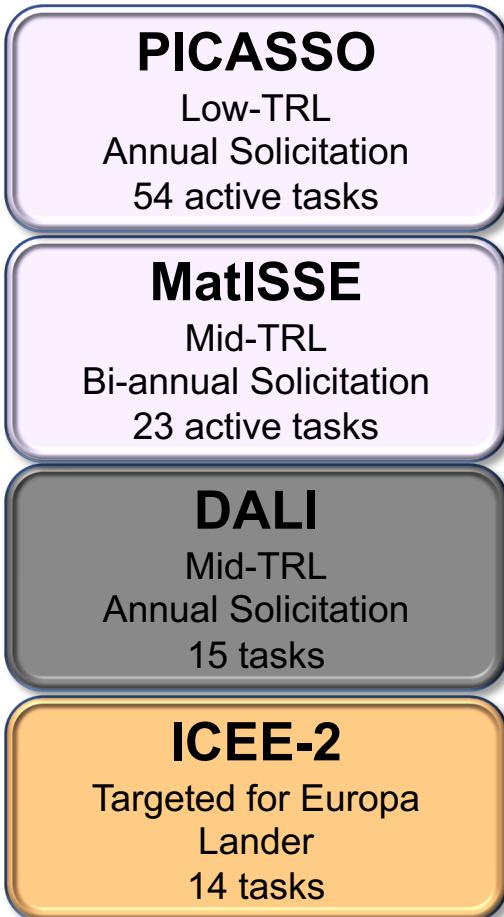
ROSES-2020 PSD Program Elements

| Core Programs | | PSPs not included | |
|--|---|-------------------------|----------------------------|
| Early Career Award | Solar System Workings | | *Not solicited in ROSES-20 |
| Emerging Worlds | Exobiology | | **Cross-divisional program |
| Exoplanets Research** | Habitable Worlds** | | |
| Laboratory Analysis of Returned Samples | Interdisciplinary Consortia for Astrobiology Research* | | |
| Planetary Data Archiving, Restoration, and Tools | Planetary Science and Technology Through Analog Research* | | |
| Planetary Protection Research* | Yearly Opportunities for Research in Planetary Defense | | |
| Solar System Observations | Planetary Major Equipment and Facilities | | |
| Technology Programs | | Data Analysis Programs | |
| Development and Advancement of Lunar Instrumentation | Cassini Data Analysis | Discovery Data Analysis | R&A |
| Maturation of Instruments for Solar System Exploration | Lunar Data Analysis | Mars Data Analysis | PDCO |
| Planetary Instrument Concepts for the Advancement of Solar System Observations | New Frontiers Data Analysis | | Astrobiology |
| | | | New Frontiers |
| | | | Technology |
| | | | LDEP |
| | | | Facilities |
| | | | Outer planets |
| | | | Discovery |
| | | | Mars |

Funding Source:

| | |
|--------------|---------------|
| R&A | PDCO |
| Astrobiology | New Frontiers |
| Technology | Outer planets |
| LDEP | Discovery |
| Facilities | Mars |

Technology Program Elements



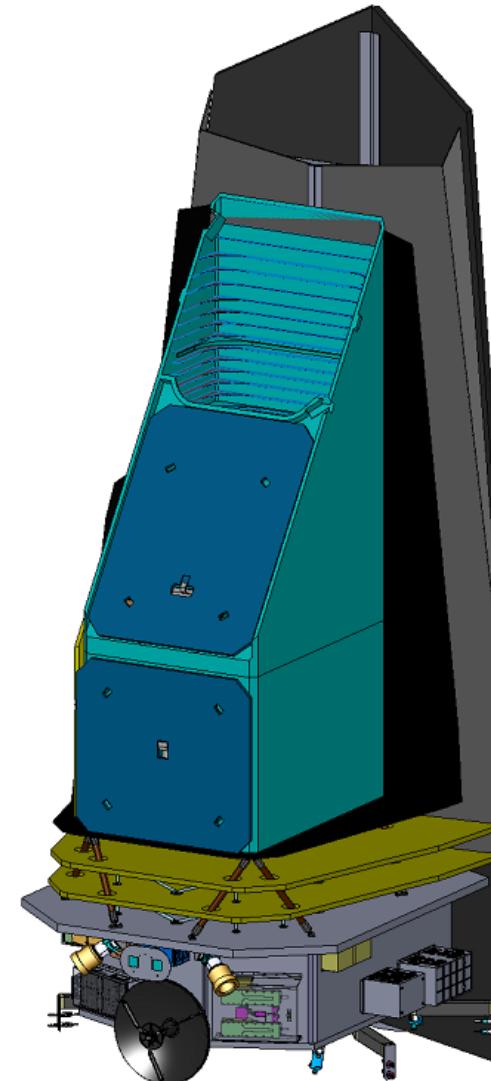
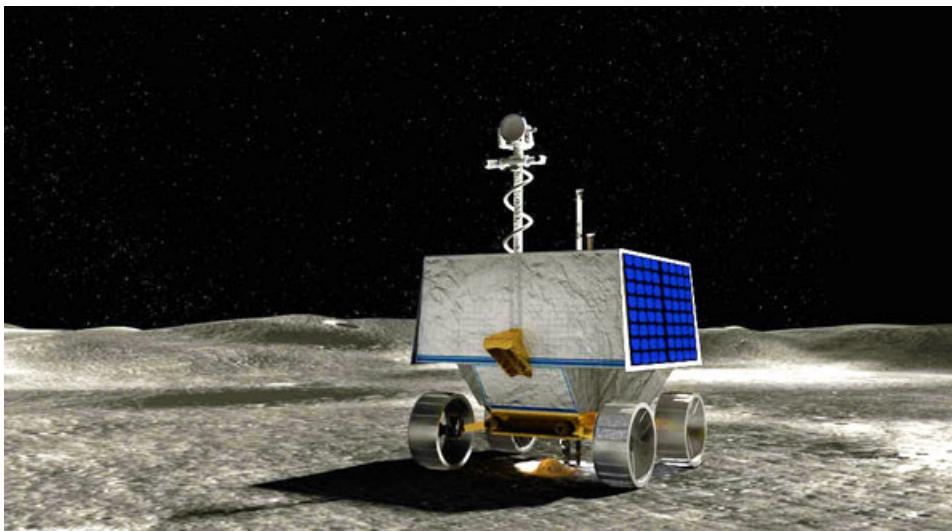
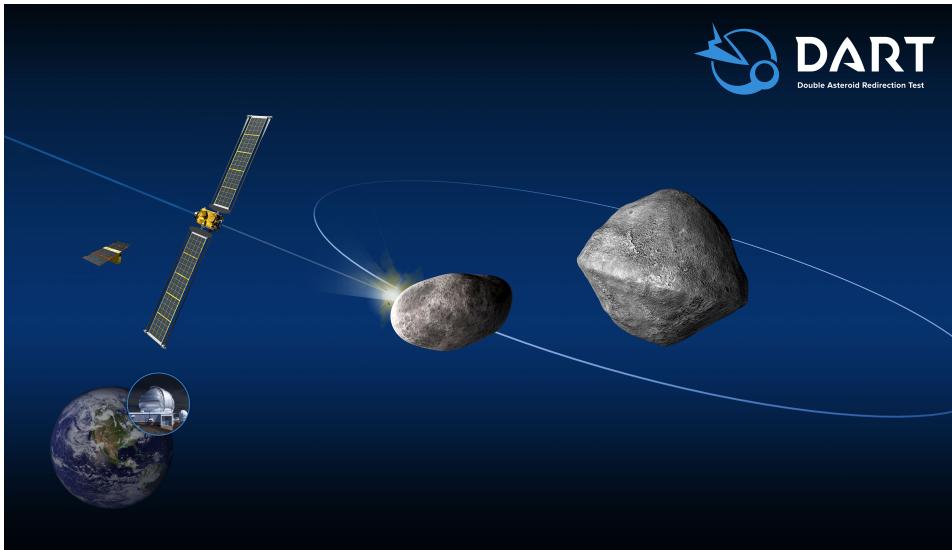
Total FY20 Technology investments: \$167.7M

~6% of total PSD FY20 budget:



Planetary Defense & LDEP





Planetary Defense

- Sustained support of near-Earth object observations
- Completion of DART
- NEO Surveillance Mission (NEOSM)

LDEP

- Delivering CLPS payloads
- VIPER
- Lunar Trailblazer

What's next?





Backup Information

PSD Budget 2010–2025

| Fiscal Year | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 |
|----------------------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|
| PSD Total (Millions) | \$1,372 | \$1,454 | \$1,474 | \$1,269 | \$1,346 | \$1,447 | \$1,628 | \$1,828 | \$2,218 | \$2,747 | \$2,713 |
| Fiscal Year | 2021 | 2022 | 2023 | 2024 | 2025 | | | | | | |
| PSD Total (Millions) | \$2,660 | \$2,801 | \$2,715 | \$2,905 | \$2,831 | | | | | | |

FY 2021–2025 based upon FY 2021 President's Budget Request to Congress

New Frontiers Historical Cadence by Launch Date

| AO Release | Mission 1 | Launch |
|------------|--------------|----------|
| 2001 | New Horizons | Jan 2006 |
| 2004 | Juno | Aug 2011 |
| 2009 | OSIRIS-REx | Sep 2016 |
| 2016 | Dragonfly | 2027* |

* Planned

Discovery Historical Cadence (Stand Alone Missions) by Launch Date

| AO Release | Mission 1 | Launch | Mission 2 | Launch |
|------------|------------------|-----------|-----------------|-----------|
| N/A | NEAR Shoemaker | Feb 1996 | Mars Pathfinder | Dec 1996 |
| 1994 | Lunar Prospector | Jan 1998 | Stardust | Feb 1999 |
| 1996 | Genesis | Aug 2001 | CONTOUR | Jul 2002 |
| 1998 | MESSENGER | Aug 2004 | Deep Impact | Jan 2005 |
| 2000 | Dawn | Sep 2007 | Kepler | Mar 2009 |
| 2006 | GRAIL | Sep 2011 | | |
| 2010 | InSight | May 2018 | | |
| 2014 | Lucy | Nov 2021* | Psyche | Aug 2022* |

* Planned ABC