

National Aeronautics and
Space Administration



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

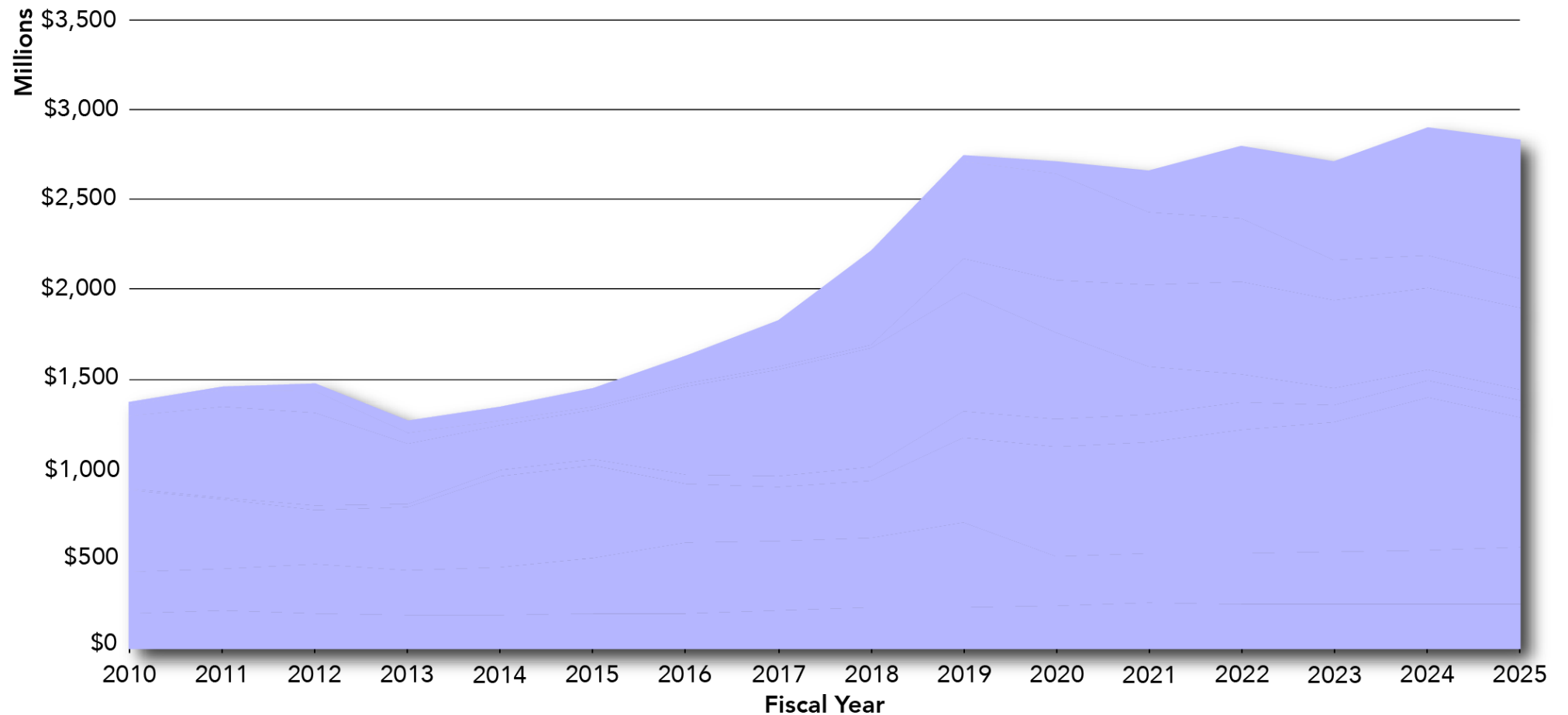
- Overview of top-level budget
 - Scenarios going forward – realism vs. aspiration
- Mars Sample Return – what costs to use
- Competed mission costs and strategies
- Mission Concept studies
 - Costing of existing studies
 - New studies
- R&A
- Technology



Budget: Past, Present, Future

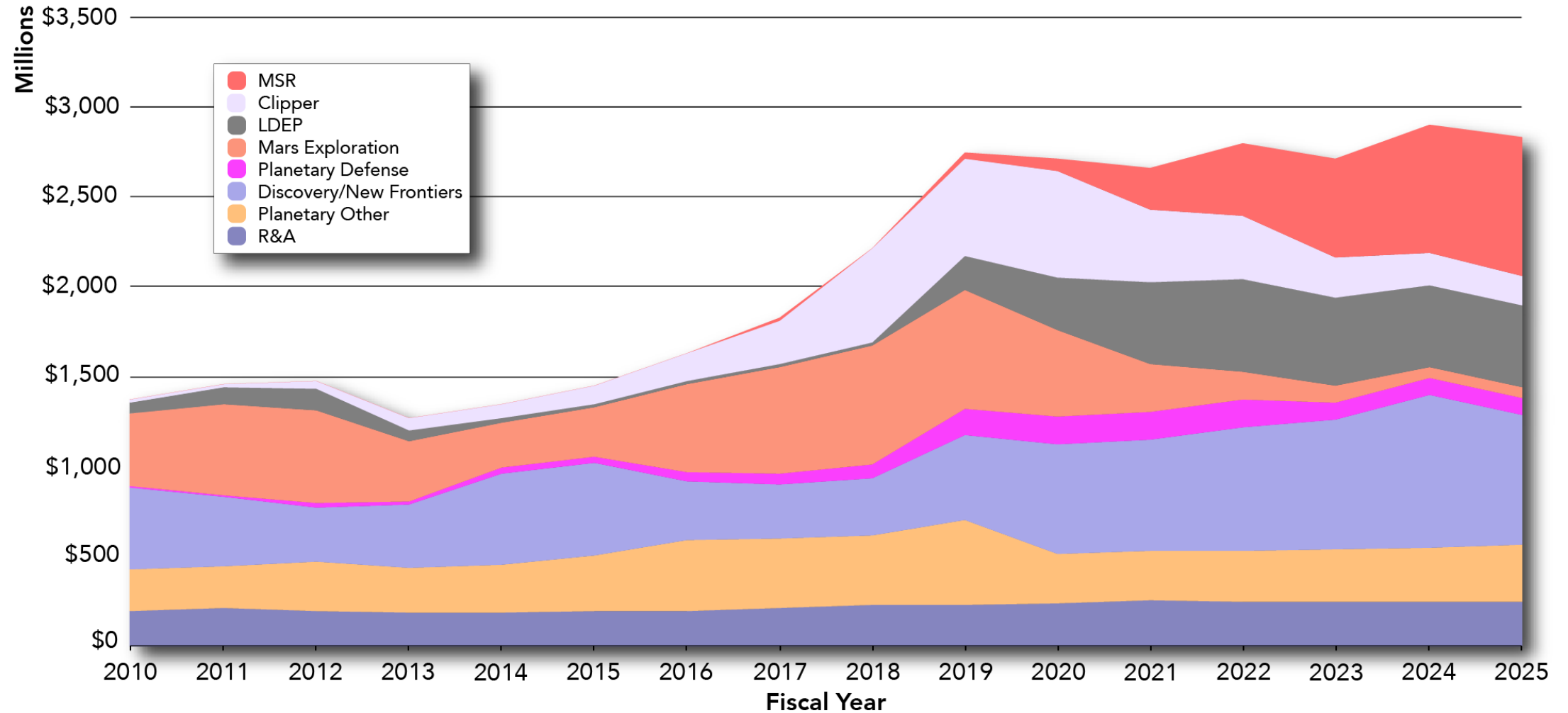


Inspirational Decadal Survey Drives Aspirational Planetary Science Budget



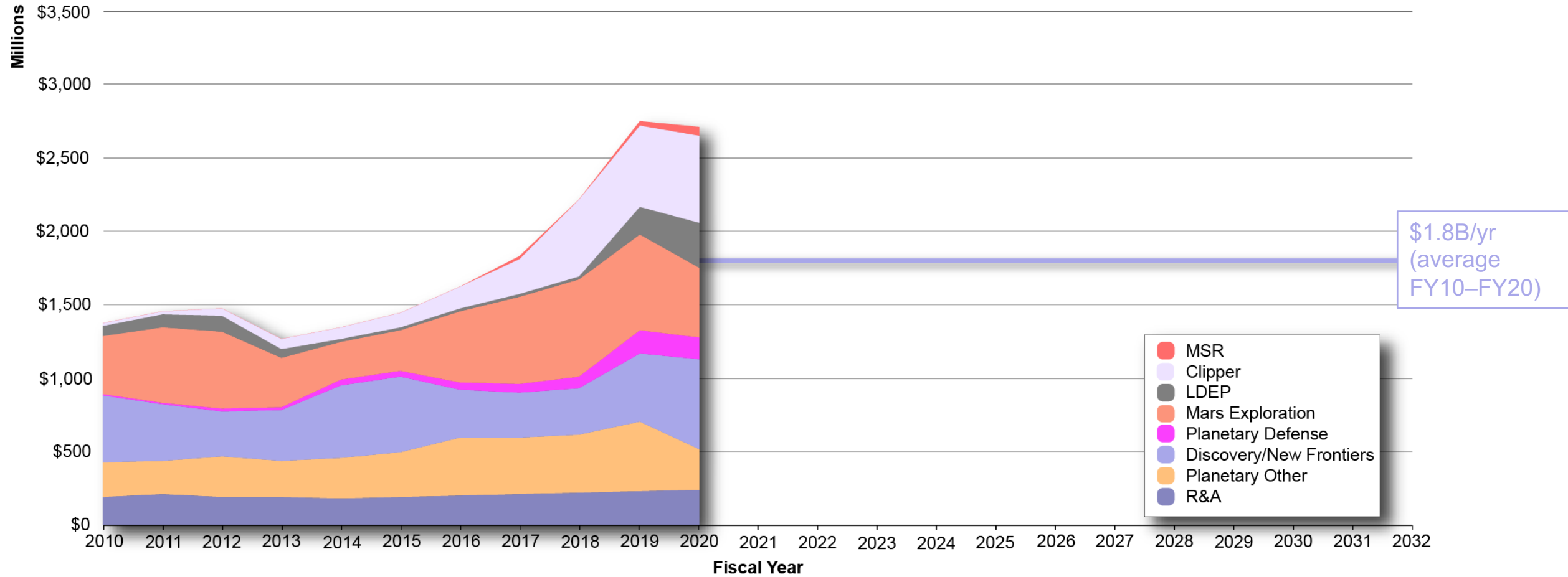
FY 2021–2025 based upon FY 2021 President's Budget Request to Congress

PSD Budget 2010–2025

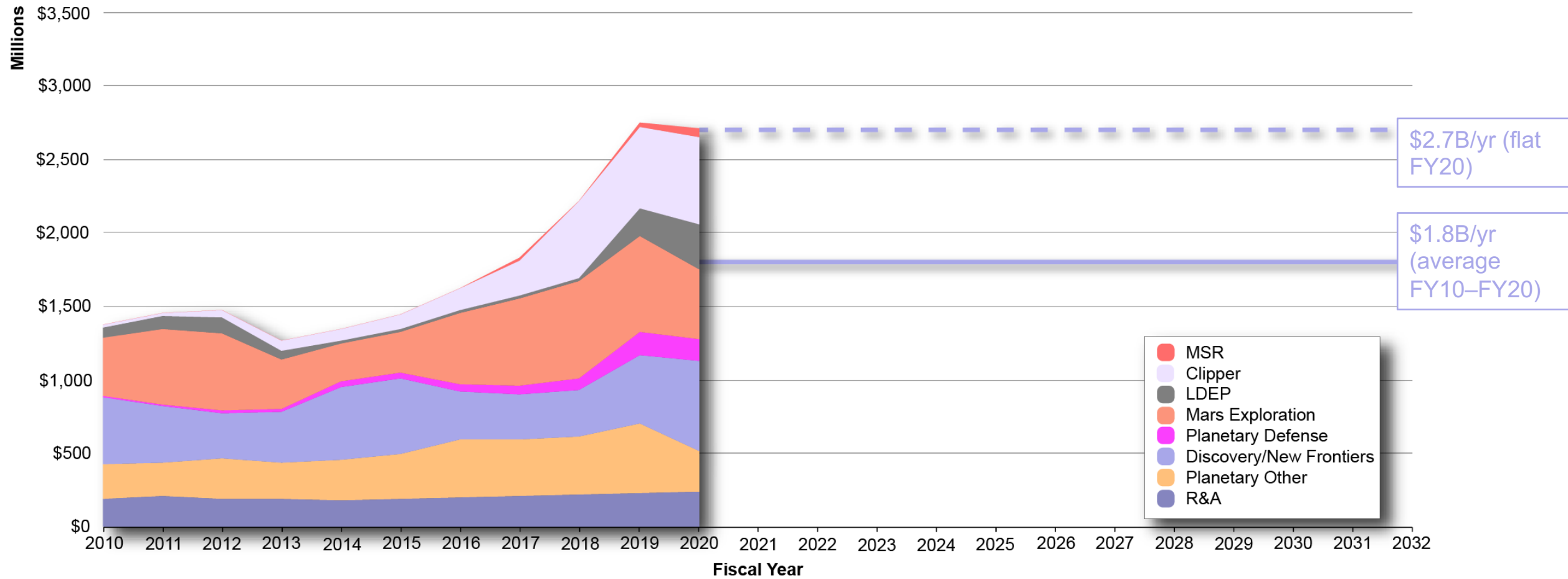


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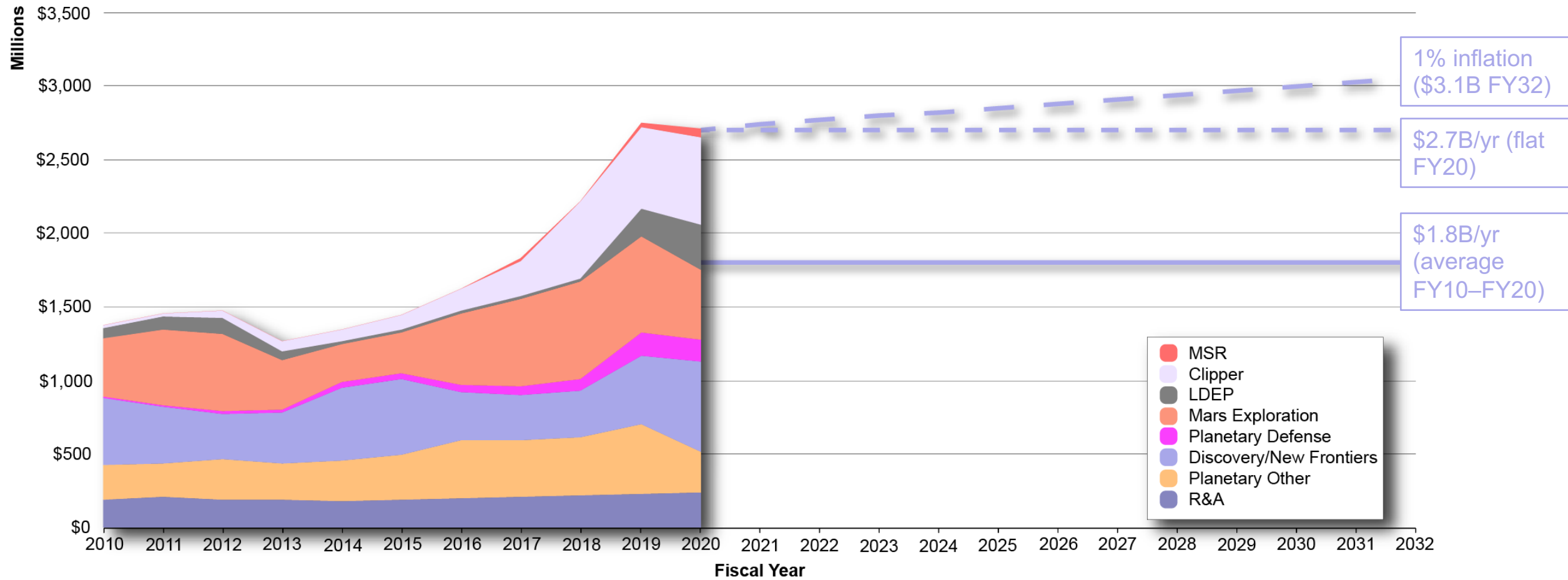
PSD Budget: Post 2020?



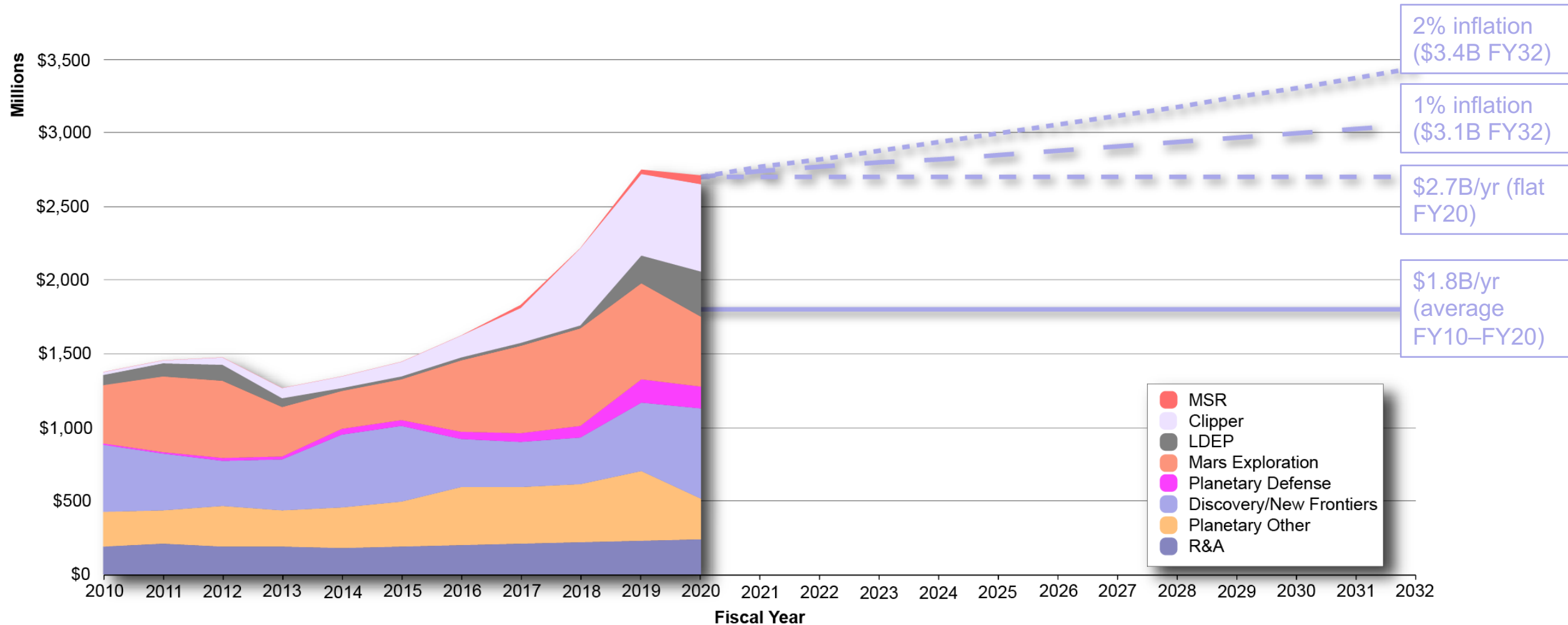
PSD Budget: Post 2020?



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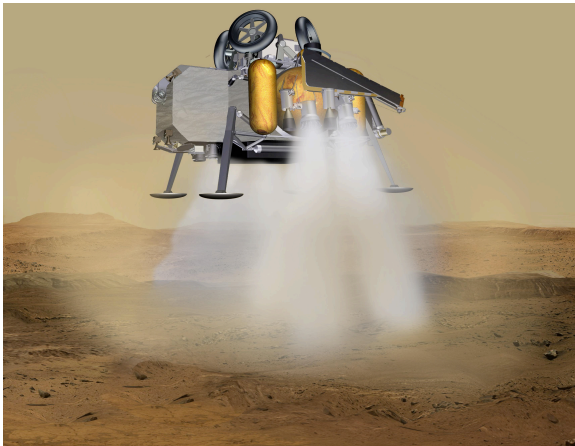




Mars Sample Return Cost Estimates



Mars Sample Return



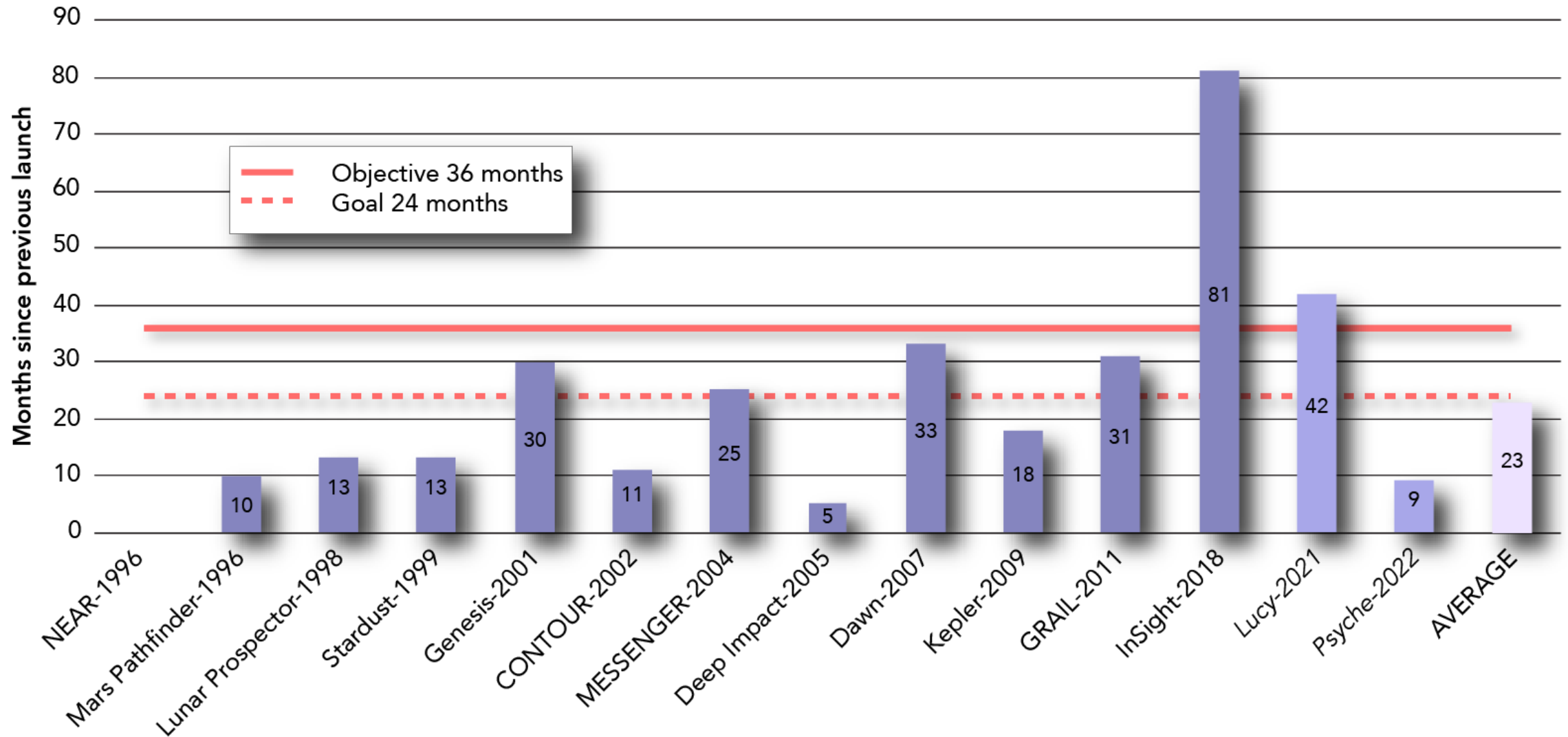
- SMD-commissioned Independent Review Board will present findings to SMD leadership later this month
 - Reviewed technical approach
 - Included independent assessment of program's cost and schedule
 - Two independent cost estimates were provided by Jacobs and Aerospace – **PSD can provide these upon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



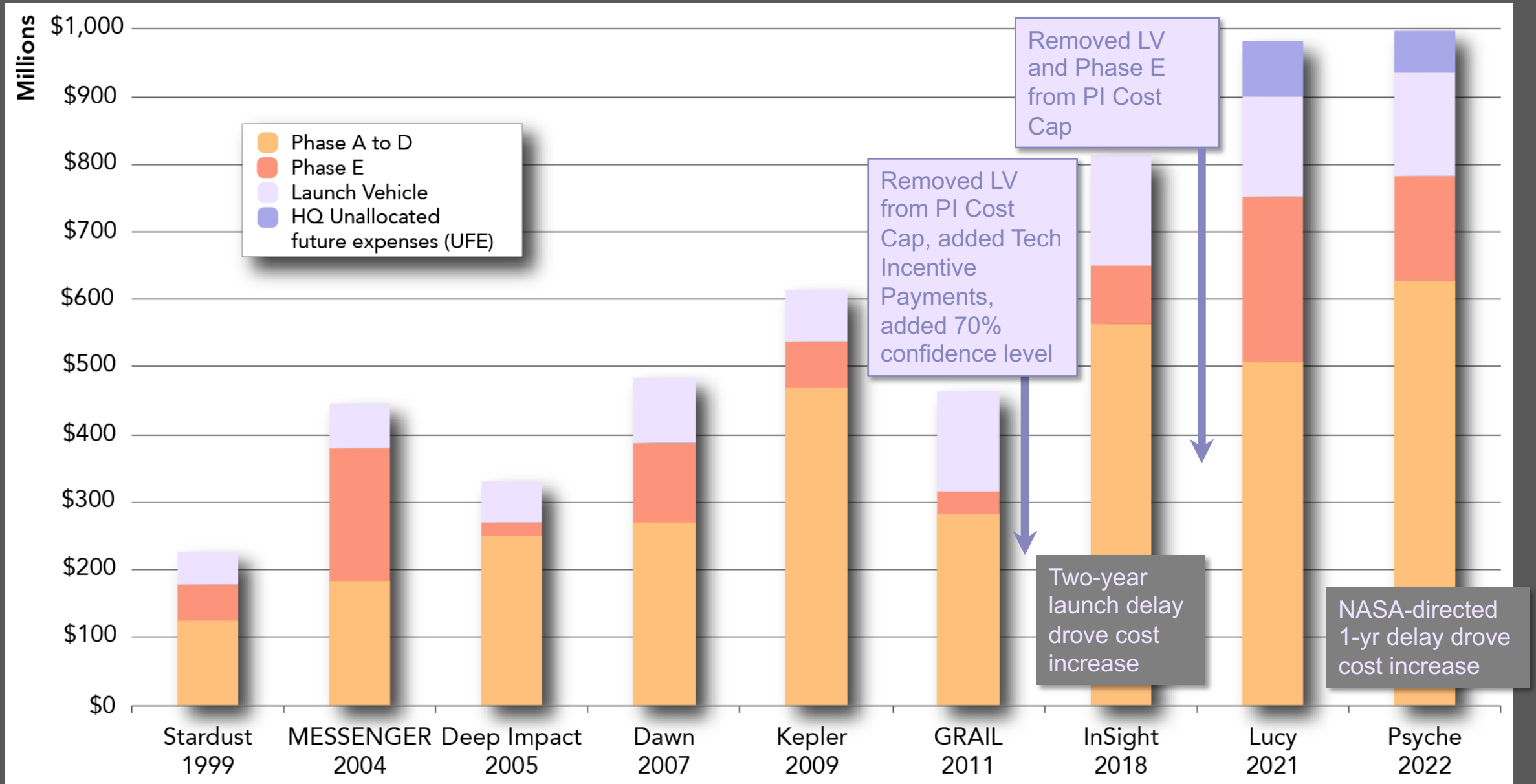
Competed Mission Costs and Strategies



Historical and Future Discovery Cadence

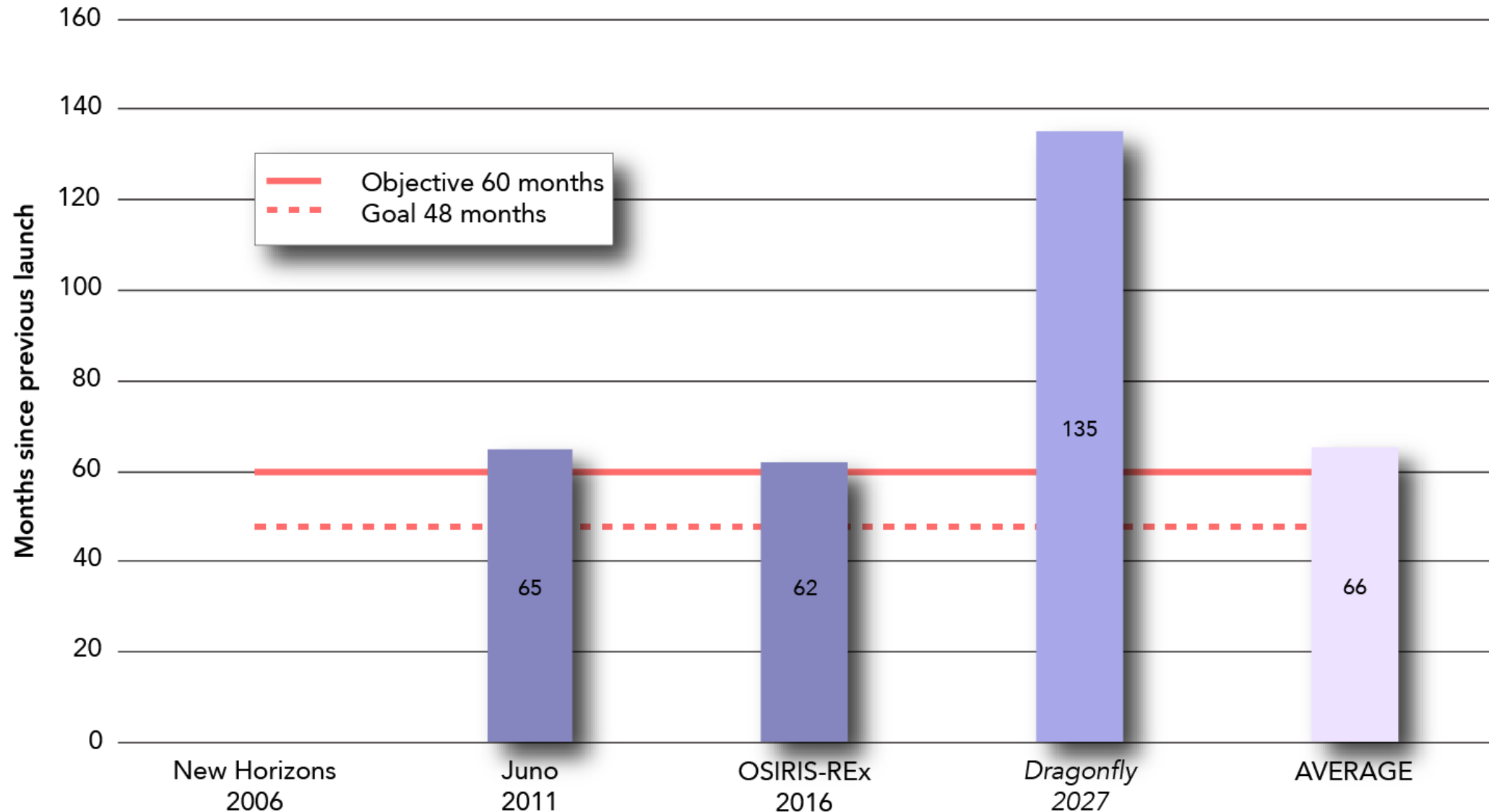


Discovery Cost Growth* from Strategic Decisions (RY\$)

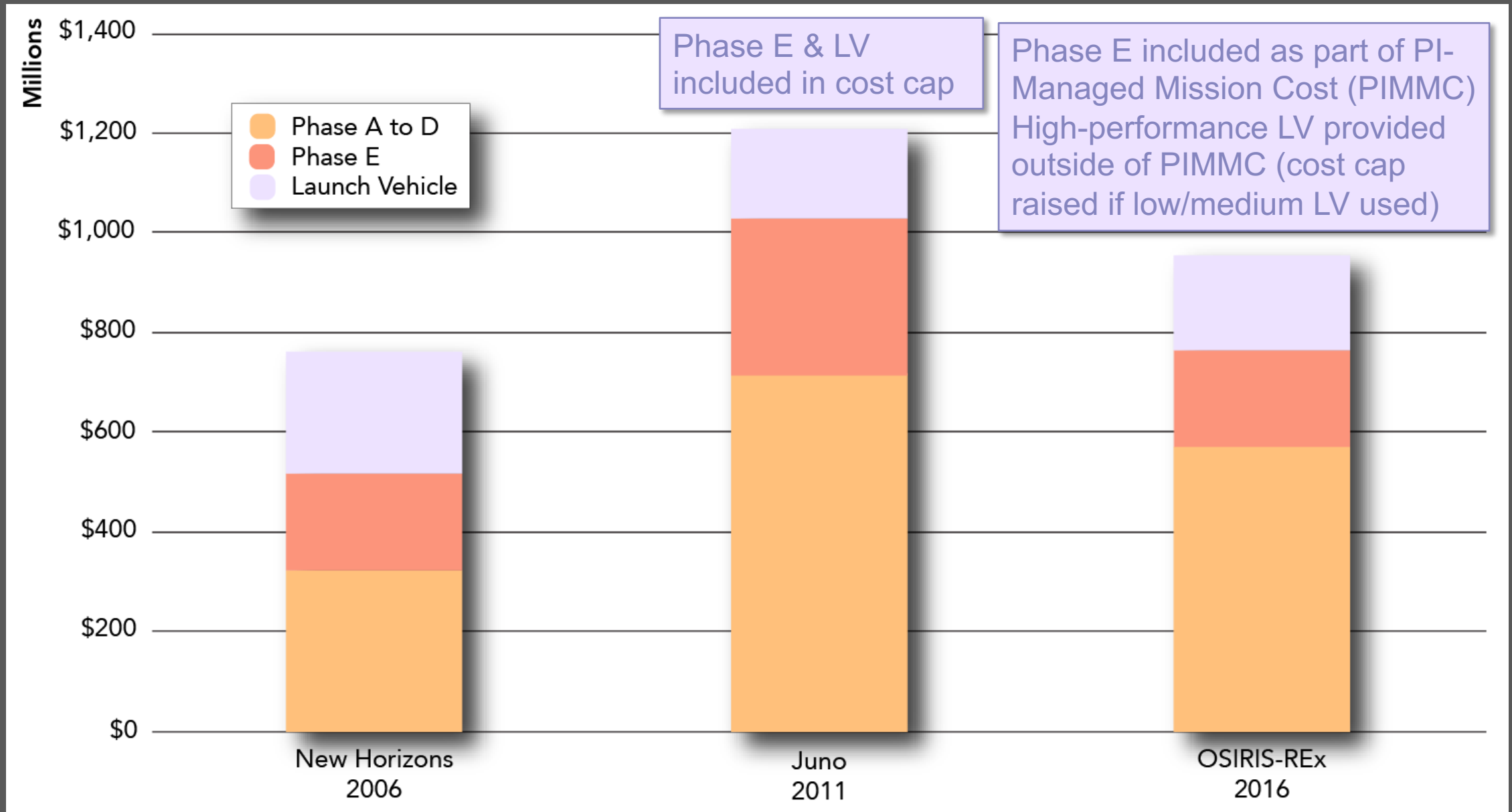


*Cost data from CADRE

Historical and Future New Frontiers Cadence

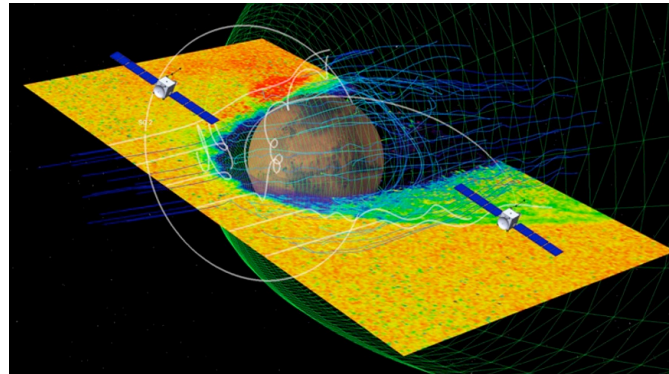
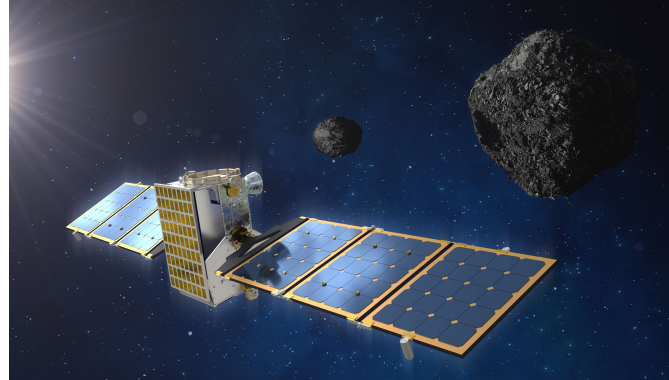
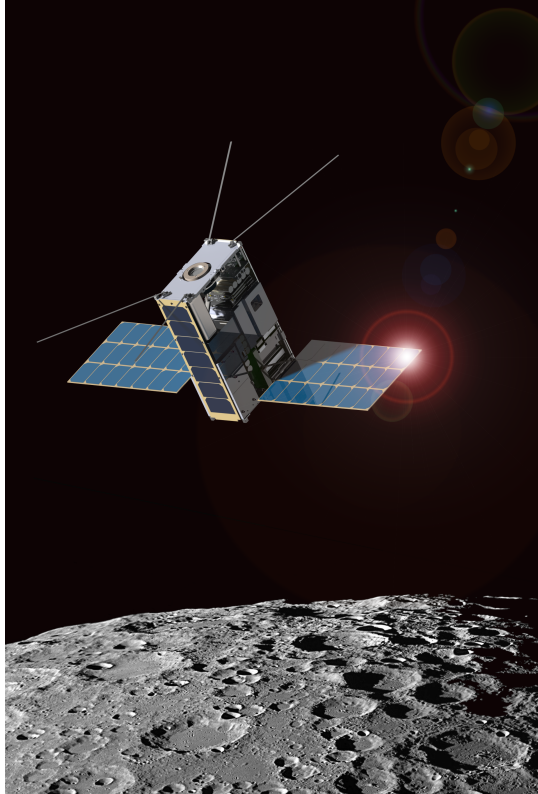


New Frontiers Cost Growth* from Strategic Decisions (RY\$)



*Cost data from CADRE, Phase E data from other budget documents

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

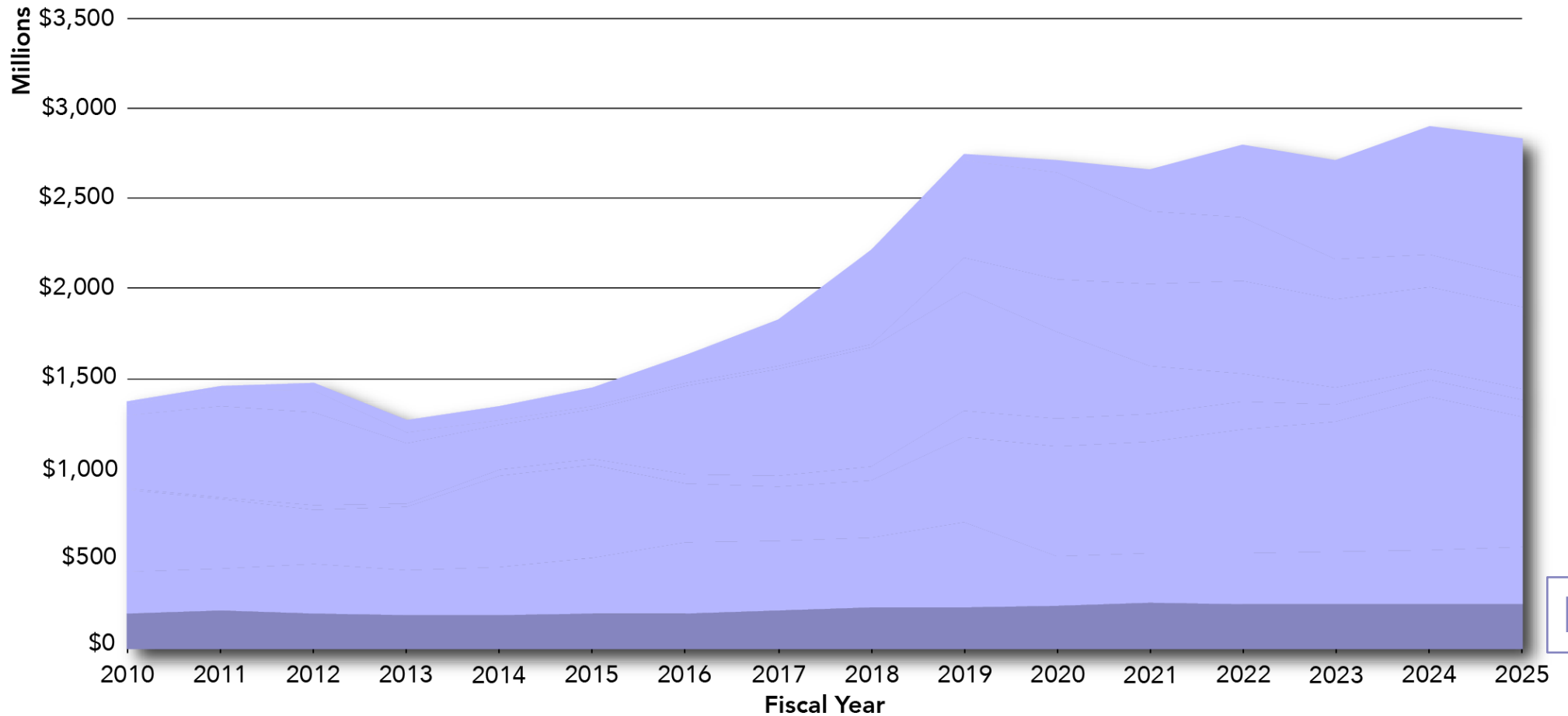




Planetary Science Research & Analysis

- 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		
Early Career Award	Solar System Workings	
Emerging Worlds	Exobiology	
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
Maturation of Instruments for Solar System Exploration	Lunar Data Analysis	Mars Data Analysis
Planetary Instrument Concepts for the Advancement of Solar System Observations	New Frontiers Data Analysis	

PSPs not included

*Not solicited in ROSES-20

**Cross-divisional program

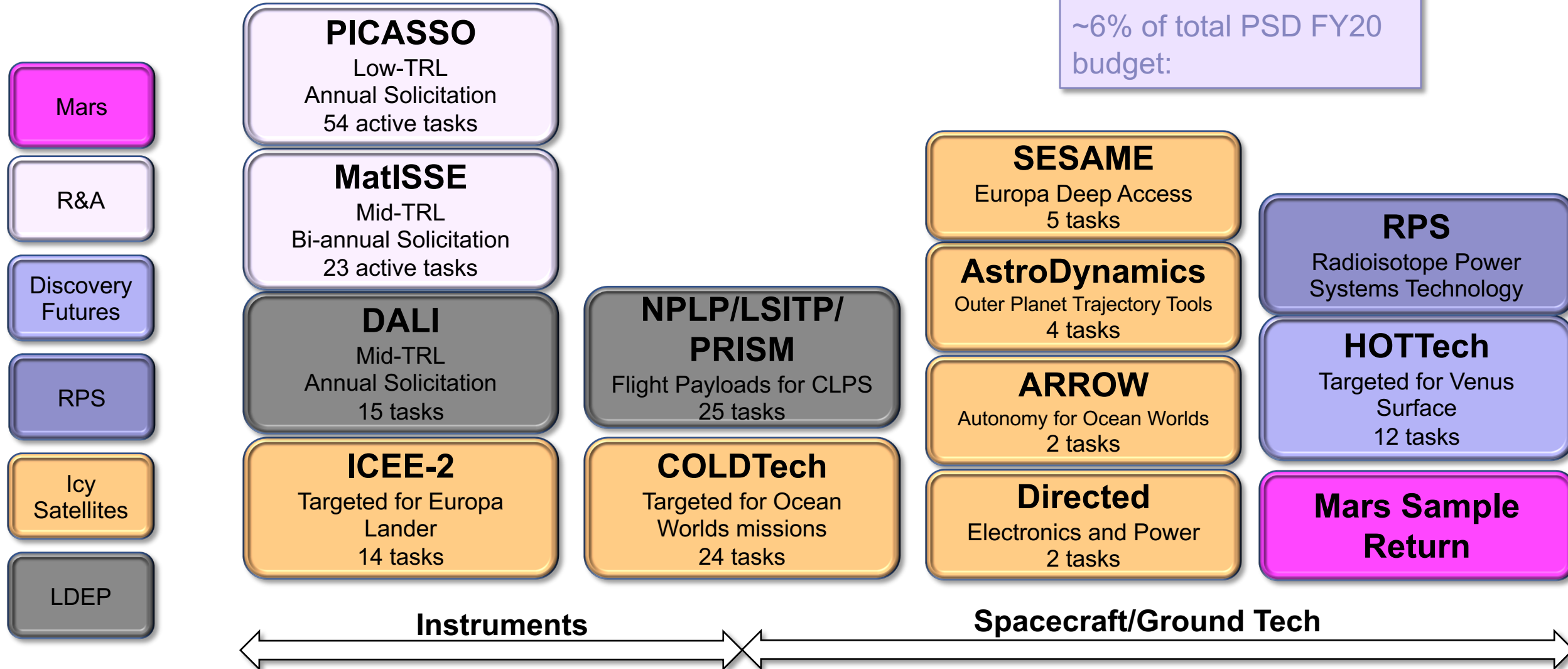
Funding Source:

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

Technology Program Elements

Total FY20 Technology investments: \$167.7M

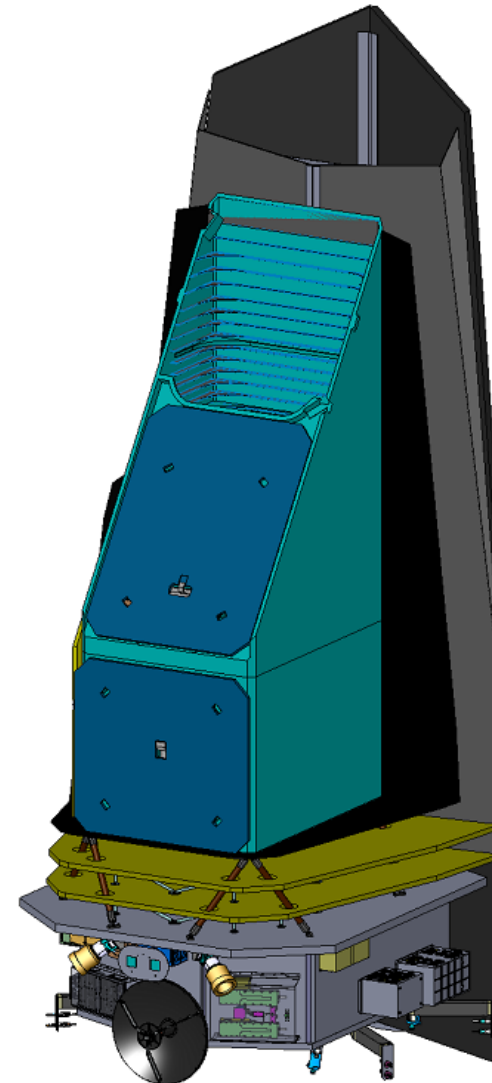
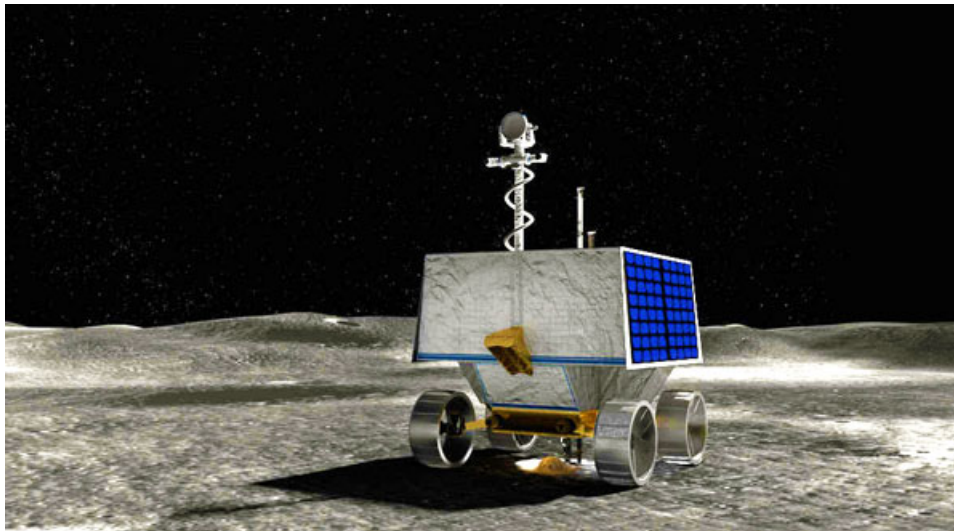
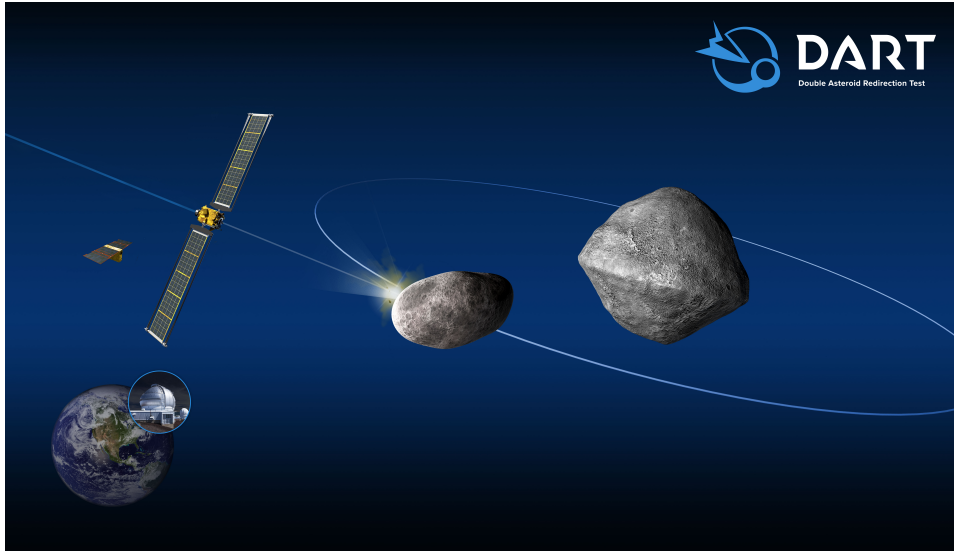
~6% of total PSD FY20 budget:





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

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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