

Flat-funding NASA Planetary Science at the FY12 Level (\$1501.4M) at a Minimum, Allows Most Decadal Recommendations to be Implemented, and Offers a Path for Restoring Mars Exploration

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NASA solar system exploration has been a highly successful, highly visible program at the cutting edge of American science, technology and innovation. The United States has been the undisputed world leader in this area, which has inspired generations of Americans to careers in science, engineering and education. The President's FY13 budget proposal to cut this program more than 20% threatens permanent damage to this program and American leadership in solar system exploration.

Recognizing the present difficult economic context that faces Appropriators, it is unreasonable to push for significant expansion of funding to achieve our most ambitious solar system exploration goals. However, by maintaining the NASA Planetary Science budget at its FY12 level, and giving NASA direction to assume that funding level for planning the next several years, NASA should be able to implement most of the highest priority recommendations of the recent NRC Planetary Decadal Survey, begin a restoration of the Mars exploration program (excluding sample return), and maintain American preeminence in space.

Using NASA and Decadal Survey sources, the following table details the basis for this statement. While there are necessary deficiencies in the details, and NASA would likely update many of the numbers, this still represents a credible argument for the importance of ensuring that the NASA Planetary Science budget be sustained at the FY12 level in the coming years, until such time as the economy improves.

Decadal recommendations implemented in the budget below include funding for Research and Analysis programs, funding technology programs at 6-8% of the Planetary Science Division budget, support for continuing missions, putting the Discovery on a 24-month cadence, putting New Frontiers on a 5 year cadence, and allowing for a possible Outer Planets flagship mission in the out-years. The recommendation for a sequence of missions resulting in a Mars sample return has been rejected by the Administration and is not possible within this budget profile.

NASA PLANETARY SCIENCE DIVISION BUDGET - NOTIONAL

	FY13	FY14	FY15	FY16	FY17	Notes
Program Core Functions	134.1	138.2	165.5	130.8	133.6	(1)
Outer Planets Programs	65.8	70.3	72	65.7	67.3	(1)
Lunar Programs	48.1	2.2	2.2	2.3	2.4	(1)
Supporting R&A	244.3	254.3	261.5	277.1	296.5	(2)
General Technology	95.4	97.7	100.0	102.4	104.9	(3)
MSL	65.0	38.5	38.5	38.5	38.5	(4)
MAVEN	146.4	37.6	17.3	5.3	0.0	(5)
Mars Programs	252.0	336.8	293.5	241.1	241.1	(6)
Discovery	205.1	245.7	300.0	360.0	330.0	(7)
New Frontiers Ongoing	224.6	231.9	244.9	231.6	118.4	(8)
New Frontiers 4	0.0	0.0	19.4	56.9	88.1	(9)
New Frontiers 5	0.0	0.0	0.0	0.0	20.3	(10)
Subtotal	1480.8	1453.2	1514.8	1511.7	1441.1	

FLAGSHIP OPTIONS FROM THE PLANETARY DECADAL SURVEY (11)

MSR Technology	30.0	50.0	50.0	50.0	50.0
MAX-C	41.6	205.5	466.6	634.9	566.4
MSR-Orbiter	0.0	0.0	0.0	7.1	7.2
MSR-Lander	0.0	0.0	0.0	0.0	0.0
Uranus Orbiter/Probe	0.0	0.0	0.0	20.0	20.4
JEO	36.7	95.3	250.8	423.7	601.7

NOTES:

- (1) From the source table for Fig. E.1 (Vision and Voyages for Planetary Science in the Decade 2013-2022, the NRC planetary decadal survey, hereafter "V&V", <http://www.nap.edu/catalog/13117.html>), provided in Source Material, Section A, below.
- (2) "Supporting Research and Analysis" in the source table for Fig. E.1 (1) is summed with "SRA" in the source table for Fig. 9.1, V&V, provided in Source Material, Section B, below. This allows for both the Decadal recommendation and separate continuing obligations in this category to be implemented.
- (3) From "General Technology" in the source table of Fig 9.1, V&V, in Source Material, Section B, below. The Decadal recommended that technology development be supported at 6-8% of the total PSD budget. At \$1.5B, this corresponds to a range between \$90M and \$120M.

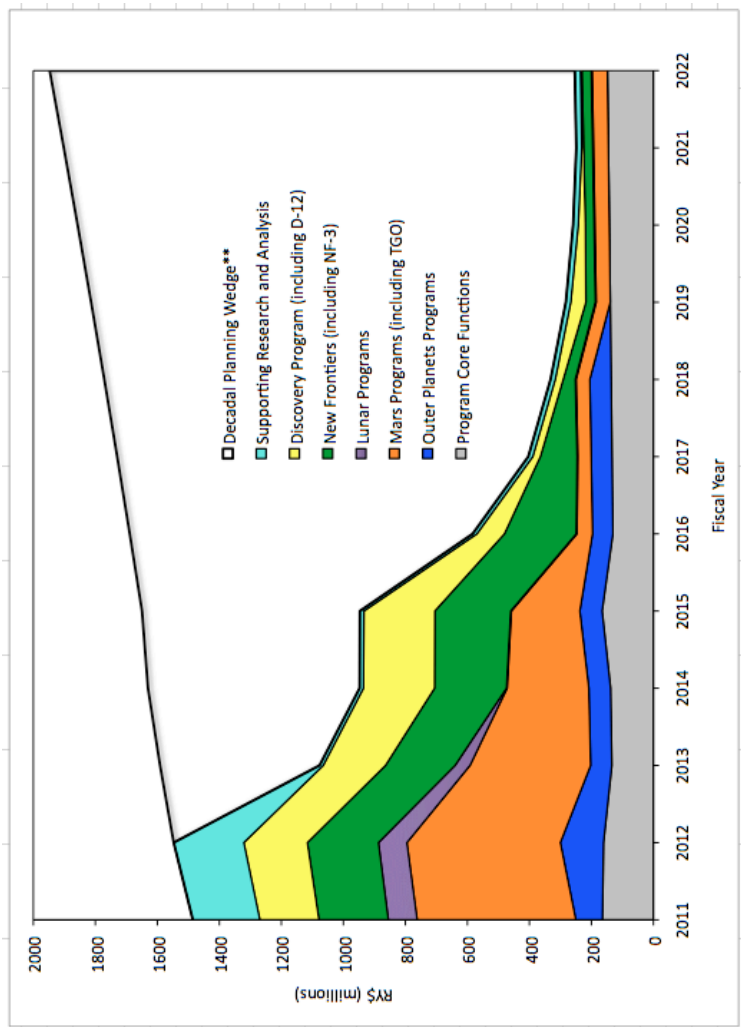
- (4) For the most up to date numbers, these are taken from "2011 Mars Science Laboratory" in the President's FY13 Request and out-years. See Source Material, Section C. The funding is continued at the FY14 level through the subsequent out-years, given the long operational design life of the rover (possibly exceeding a decade) and the unlikelihood that it would be simply turned off. This is consistent with the Decadal recommendation to support continuing missions.
- (5) For the most up to date numbers, these are taken from "MAVEN" in the President's FY13 Request and out-years. See Source Material, Section D. This is consistent with the Decadal recommendation to support continuing missions.
- (6) From the out-years of "Other Missions and Data Analysis" in the President's FY12 request, which includes ongoing missions and future Scouts. See Source Material, Section E. These numbers were chosen over those in the FY13 budget request since the latter reflects planned cuts by the Administration. This is consistent with the Decadal recommendation to support continuing missions and addresses the need to have some level of restoration of the Mars program (e.g., http://www.psi.edu/position/mars_restoration.html)
- (7) These numbers are extracted from the FY13 and FY14 out-years for Discovery in the President's FY12 Request, since they do not reflect cuts in the FY13 Request. See Source Material, Section F. For FY15 and later, numbers were measured from a figure provided by Jim Green, PSD Director, which models the cost of the Discovery program assuming 24-month calls, as recommended by Decadal. See Source Material, Section G.
- (8) From the source table for V&V Fig. E.1 (See Source Material, Section A), under "New Frontiers (Including NF-3)". This is consistent with the Decadal recommendation to support continuing missions.
- (9) From the source table for V&V Fig. 9.1 (See Source Material, Section B), under "New Frontiers 4". This supports the decadal recommendation to execute NF4.
- (10) From the source table for V&V Fig. 9.1 (See Source Material, Section B), under "New Frontiers 5". This supports the decadal recommendation to execute NF5.
- (11) From the source table for V&V Fig. 9.1 (See Source Material, Section B). The budget may allow for adding the Uranus Orbiter/Probe flagship mission, assuming the ability to increase funding in later years.

SOURCE MATERIAL

Section A

V&V Fig. E.1. Source table, provided by Dr. Laurence A Soderblom, lsoderblom@usgs.gov

These data were derived from a PSD budget model supplied to the Decadal Survey by J. Green's office													
	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Runout of PSD Commitments:													
Program Core Functions	130.2	164.6	160.9	134.1	138.2	165.5	130.8	133.6	136.4	139.3	142.3	145.4	148.5
Outer Planets Programs	87.7	85.7	139.4	68.5	70.3	72.0	65.7	67.3	68.9				
Mars Programs (including TGO)	402.9	511.8	495.0	389.1	263.5	220.7	50.3	43.1	44.2	45.4	46.6	47.9	49.2
Lunar Programs	66.2	93.0	91.6	48.1	2.2	2.2	2.3	2.4	2.5	2.7	2.8	2.9	3.1
New Frontiers (including NF-3)	274.6	223.8	229.5	224.6	231.9	244.9	231.6	118.4	39.0	30.5	27.8	29.0	30.1
Discovery Program (including D-12)	179.1	190.5	204.9	200.8	229.3	228.5	88.7	24.5	25.6	48.8	22.9	6.2	4.5
Supporting Research and Analysis	199.6	216.2	225.9	11.8	12.3	13.0	13.6	14.3	15.0	15.7	16.5	17.4	18.2
PSD Total Budget Projection*	1340.2	1485.7	1547.2	1591.2	1630.1	1649.4	1689.0	1729.5	1771.0	1813.5	1857.0	1901.6	1947.2
*based on President's FY2011 Budget request for FY2011-2015 and a PSD-NASA standard 2.4% inflation model thereafter													
Decadal Planning Wedge**				514.4	682.5	702.6	1105.9	1325.9	1439.3	1531.1	1598.0	1652.9	1693.6
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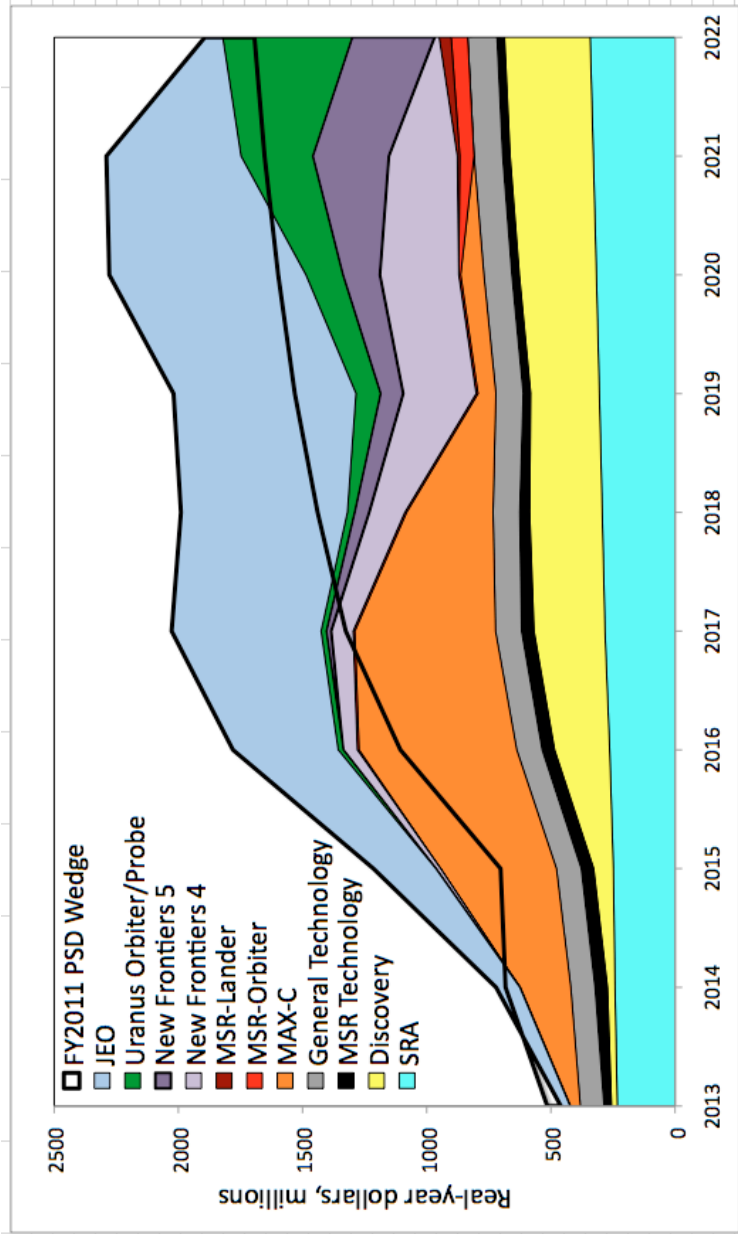


MissionName	Start Year	Launch Year	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
SRA	fixed	fixed	232.6	241.9	248.6	263.5	282.2	293.3	304.9	316.8	329.2	342.0
Discovery	fixed	fixed	23.5	30.4	79.2	221.8	285.9	292.2	276.7	310.3	335.1	345.0
MSR Technology	fixed	fixed	30.0	50.0	50.0	50.0	50.0	40.0	30.0	30.0	30.0	30.0
General Technology	fixed	fixed	95.4	97.7	100.0	102.4	104.9	107.4	110.0	112.6	115.3	118.1
MAX-C	2011	2018	41.6	205.5	466.6	634.9	566.4	348.1	72.1	93.7	0.0	0.0
MSR-Orbiter	2016	2028	0.0	0.0	0.0	7.1	7.2	7.4	7.6	7.8	57.2	66.6
MSR-Lander	2021	2030	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	10.1	48.2
New Frontiers 4	2015	2021	0.0	0.0	19.4	56.9	88.1	143.1	293.2	317.1	275.4	18.4
New Frontiers 5	2017	2023	0.0	0.0	0.0	0.0	20.3	59.7	92.4	150.1	307.5	332.5
Uranus Orbiter/Probe	2016	2025	0.0	0.0	0.0	20.0	20.4	28.2	98.0	148.2	288.0	520.5
JEO	2011	2021	36.7	95.3	250.8	423.7	601.7	670.2	734.5	791.5	542.0	72.3
Sum			459.8	720.8	1214.6	1780.3	2027.2	1989.7	2019.3	2278.1	2289.8	1893.6
FY2011 PSD Wedge		Delta from total above	54.6	-38.3	-512.0	-674.3	-701.2	-550.4	-488.2	-680.1	-636.9	-200.0
PSD Uncommitted Wedge (7/21/10)			514.38	682.47	702.57	1105.9	1325.9	1439.3	1531.1	1598	1652.9	1693.6

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Section B

V&V Fig. 9.1. Source table, provided by Dr. Laurence A Soderblom, Isoderblom@usgs.gov



Section C

SCIENCE: PLANETARY SCIENCE: MARS EXPLORATION OTHER MISSIONS AND DATA ANALYSIS

Formulation	Development	Operations
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FY 2013 BUDGET

Budget Authority (in \$ millions)	Actual	Estimate	FY 2013	Notional			
	FY 2011	FY 2012		FY 2014	FY 2015	FY 2016	FY 2017
FY 2013 President's Budget Request	386.8	341.4	214.4	190.1	171.4	261.6	503.1
Mars Research and Analysis	17.4	19.0	15.2	15.2	15.3	15.3	15.3
Mars Technology	2.5	5.0	3.0	4.0	7.0	23.0	75.0
Mars Mission Operations	1.6	1.8	1.8	1.8	1.9	1.9	1.9
Mars Extended Operations	0.0	0.0	53.7	40.1	56.3	51.2	51.4
Mars Next Decade	8.0	4.3	62.0	72.8	72.8	151.7	346.1
Mars Program Management	21.0	27.5	13.5	17.6	18.1	18.5	13.4
2001 Mars Odyssey	10.1	12.8	0.0	0.0	0.0	0.0	0.0
2003 Mars Exploration Rover	13.6	15.0	0.1	0.0	0.0	0.0	0.0
Mars Express	0.9	2.1	0.0	0.0	0.0	0.0	0.0
2005 Mars Reconnaissance Orbiter	30.1	40.4	0.1	0.0	0.0	0.0	0.0
2011 Mars Science Laboratory	242.9	174.0	65.0	38.5	0.0	0.0	0.0
Mars Organic Molecule Analyzer	6.0	11.9	0.0	0.0	0.0	0.0	0.0
2016 ExoMars Trace Gas Orbiter	32.6	27.6	0.0	0.0	0.0	0.0	0.0
Change From FY 2012 Estimate	--	--	-127.0				
Percent Change From FY 2012 Estimate	--	--	-37.2%				

Section D

SCIENCE: PLANETARY SCIENCE MARS EXPLORATION

FY 2013 BUDGET

Budget Authority (in \$ millions)	Actual	Estimate	FY 2013	Notional			
	FY 2011	FY 2012		FY 2014	FY 2015	FY 2016	FY 2017
FY 2013 President's Budget Request	547.4	587.0	360.8	227.7	188.7	266.9	503.1
MAVEN	160.6	245.7	146.4	37.6	17.3	5.3	0.0
Other Missions and Data Analysis	386.8	341.4	214.4	190.1	171.4	261.6	503.1
Change From FY 2012 Estimate	--	--	-226.2				
Percent Change From FY 2012 Estimate	--	--	-38.5%				

Section E

Mission Directorate:	Science
Theme:	Planetary Science
Program:	Mars Exploration

FY 2012 Budget Request

Budget Authority (\$ millions)	FY 2010	Ann CR. FY 2011	FY 2012	FY 2013	FY 2014	FY 2015	FY 2016
FY 2012 President's Budget Request	<u>438.2</u>	-	<u>594.4</u>	<u>433.1</u>	<u>408.7</u>	<u>309.0</u>	<u>245.9</u>
2009 Mars Science Lab	258.4	-	136.4	40.5	37.0	0.0	0.0
MAVEN	48.1	-	240.3	140.6	34.9	15.4	4.7
Other Missions and Data Analysis	131.7	-	217.7	252.0	336.8	293.5	241.1

Section F

Mission Directorate:	Science
Theme:	Planetary Science
Program:	Discovery

FY 2012 Budget Request

Budget Authority (\$ millions)	FY 2010	Ann CR. FY 2011	FY 2012	FY 2013	FY 2014	FY 2015	FY 2016
FY 2012 President's Budget Request	184.5	-	175.6	205.1	245.7	265.5	242.8
Gravity Recovery and Interior Laboratory (GRAIL)	124.1	-	40.5	4.4	0.0	0.0	0.0
Other Missions and Data Analysis	60.4	-	135.1	200.6	245.7	265.5	242.8

Section G

24 Month Discovery AO Cycle

