

Results from the 2011 Survey of the Planetary Science Workforce

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Overview of Respondents

The survey was sent to 4,252 contacts. We received responses from 2,622, which represents a 62% response rate. (See Appendix A for more information about the survey mechanics.) We received responses from 1,518 participants who lived in the US and had earned a doctorate. About two-thirds of this group (1,070) identified themselves as planetary scientists. Not all of the planetary scientists were employed full-time at the time of the survey.

	Do you consider yourself to be a planetary scientist?			
	Yes	No	No Answer	Total
Working Full Time	946	375	3	1,324
Working Part Time	56	20	-	76
Not Working, Seeking Employment	16	7	-	23
Not Working, Not Seeking Employment	3	3	-	6
Retired	49	33	1	83
No Answer	-	-	6	6
Total	1,070	438	10	1,518

Table 1: Employment Status by Professional Self-Identification

We also asked respondents who were working full-time whether or not their job was primarily in planetary science.

	Self-identifies as a Planetary Scientist	Does not identify as a Planetary Scientist	Did not answer	Total
Job is primarily in planetary science	707	34	-	741
Job is in the enterprise of science and engineering, not planetary science	218	315	2	535
Job is in a different, non- science field	16	24	1	41
Total	941	373	3	1,317

Note: Seven of the 1,324 respondents who were working full-time either dropped out of the questionnaire or did not respond to the question about their job description

Table 2: Professional Self-Identification by Job Description

We focus the rest of our analysis on the 1,240 respondents who identify as planetary scientists working in planetary science (707), planetary scientists whose jobs are in the enterprise of science and engineering (218) and non-planetary scientists whose jobs are in the enterprise of science and engineering (315). The group of 34 respondents who work in planetary science but do not identify as

planetary scientists is too small for a meaningful separate analysis. Responses from all of the other respondents are detailed in Appendix B.

Employment

We asked respondents about their employment sector. Almost two-thirds (63%) of the planetary scientists who work in the enterprise of science and engineering report working at a university (Figure 1). It is likely that these respondents do not consider themselves to be planetary scientists because they do not spend the bulk of their time in research. Less than half of the planetary scientists working in planetary science were employed at a university.

Federally-funded research and development centers (FFR&DCs), NASA labs, and other federal labs and agencies account for

- about one-third of the planetary scientists working in planetary science (31%, with NASA labs at 14%),
- about one-fifth of the planetary scientists working in the enterprise of science and engineering (18%), and
- almost one-fourth of the non-planetary scientists working in the enterprise of science and engineering.

Overall, about 11% of the 1,240 respondents are employed at a NASA lab. If we consider planetary scientists only, about 12% of the 925 are employed at a NASA lab. The employment sectors are depicted in Figure 1.

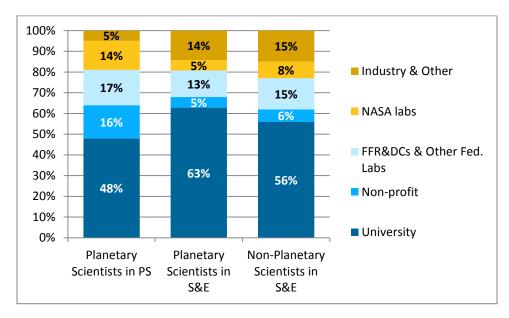


Figure 1: Employment Sector by Self-Identification & Job Description

Note: The University sector includes university affiliated observatories and research institutes. FFR&DCs include JPL, APL, and LPI. Non-profit includes SwRI, SSI, and PSI.

Career breaks and part-time employment. About 6% of these respondents reported having a break of six months or more in their career at some point; an equal number reported a period of working part-

time for at least six months. In both cases, a higher proportion of the women who responded reported having taken a break or working part-time than the men. Nine percent of the women reported having a break versus 5% of the men; for the part-time work, it was 12% of the women versus 6% for the men.

Education

Many doctoral students take post-doc appointments upon completing their degree. This is true for the respondents to this survey, with 79% of the respondents either having completed a post-doc or currently serving as a post-doc. More of the 707 respondents who consider themselves to be planetary scientists working in planetary science served as a post-doc (~86%) versus members of the other two groups (~70%). The median time to serve as a post-doc was three years.

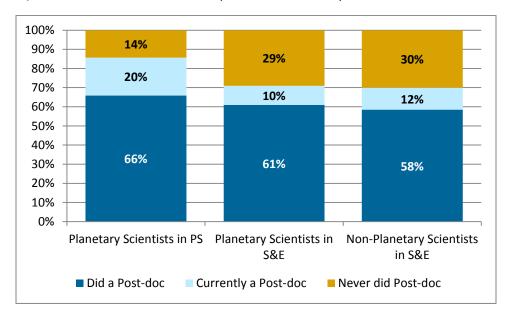


Figure 2: Post-Doc Experience by Self-Identification & Job Description

This difference in post-doc experience might lead one to ask about differences in factors that might lead to a post-doc. Half of the planetary scientists working in planetary science earned their doctorate in 1998 or later, and three-fourths have earned their doctorate since 1987. Respondents in the other two groups had typically earned their degrees two to four years earlier; thus, they were further along in their post-graduate career. Figure 3 (on the following page) depicts the median and upper and lower quartiles for the year the doctorate was earned.

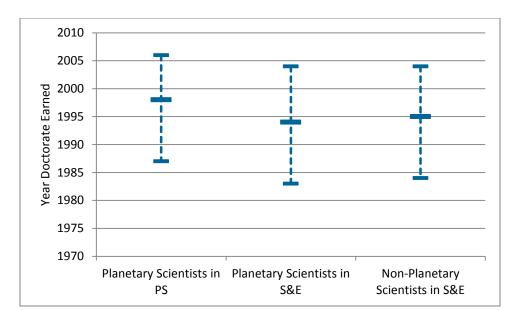


Figure 3: Distribution of Year Doctorate Earned by Self-Identification & Job Description: Median and Upper & Lower Quartiles

Physics was the most common field of study for bachelor's degrees, with 37% of the respondents naming it as their major; those identifying as planetary scientists were more likely to have been a physics major than the 315 respondents who did not self-identify as a planetary scientist. Other common majors are shown in Figure 4. These five fields account for 80% of the majors for the bachelor's degree earned by respondents. Earth science (5%), biology (4%), planetary science (2%), and math (2%) were only other fields which accounted for more than 1% of the responses. The self-identified planetary scientists have similar undergraduate major profiles, whether they work in the field or not.

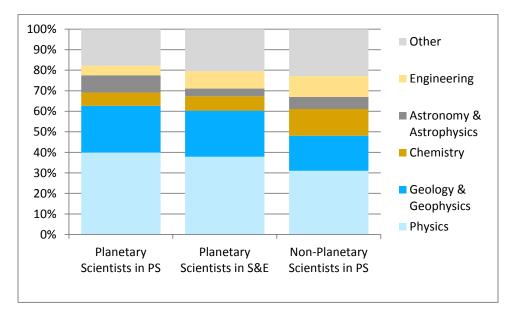


Figure 4: Undergraduate Major by Self-Identification & Job Description

About 70% of the respondents (851) reported having earned a master's degree. As with the bachelor's degrees, physics and geology & geophysics (22% each) are the two most commonly reported fields of study. As with the undergraduate majors, the field of the master's degree is similar for self-identified planetary scientists, except for those earning the degree in planetary science. These are shown in Figure 5 (below).

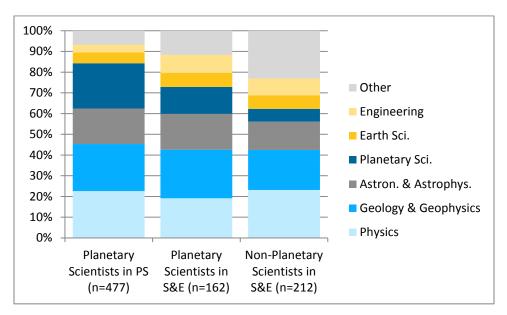


Figure 5: Field of Master's by Self-Identification & Job Description

Very few respondents earned bachelor's degrees in planetary science, and about 16% earned a master's degree in the field. It is the most commonly named field for doctorates among the respondents. Overall, about 30% of the respondents earned their doctorate in planetary science, and over 90% of these self-identify as planetary scientists. The profiles for the field of doctorate for the three different groups of respondents are very different and are shown in Figure 6 (below).

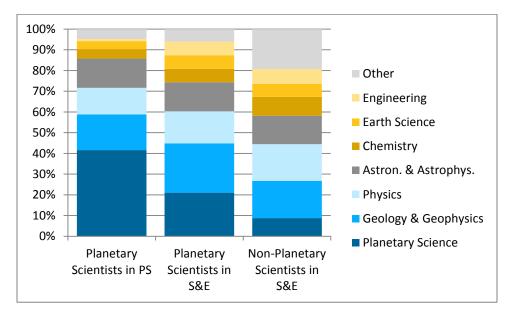


Figure 6: Field of Doctorate by Self-Identification & Job Description

We asked respondents to rate the preparation they received in their doctoral program in a variety of areas. Respondents could select from the following: not covered, weak, fair, good, very good. Their responses are summarized in Figures 7a and 7b. Respondents indicate that the weakest areas of preparation included managing people and information on non-academic careers.

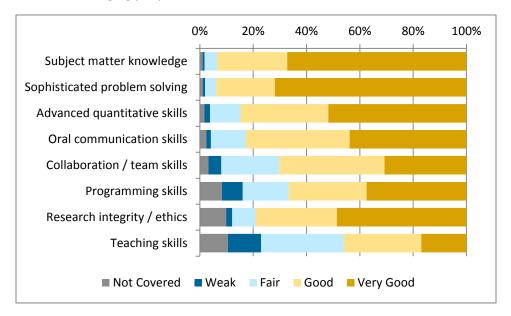


Figure 7a: Respondents Ratings of How Well their Doctoral Program Prepared Them

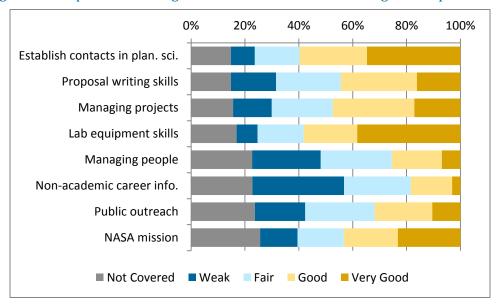


Figure 7b: Respondents Ratings of How Well their Doctoral Program Prepared Them

We also asked respondents to tell us a primary and a secondary area in which they felt their careers could have benefited from more training or emphasis in their doctoral program. Respondents had to choose from the list shown in Figures 7a and 7b. Figures 8a and 8b show the results.

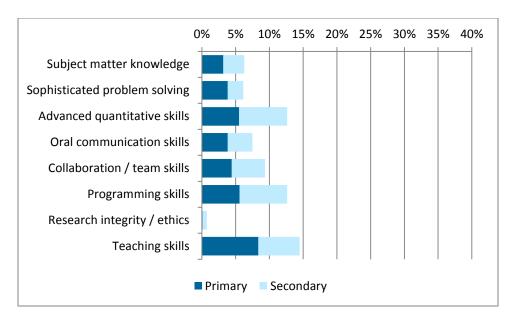


Figure 8a: Areas in Which My Career Could Have Benefitted from More Training in Doctoral Program

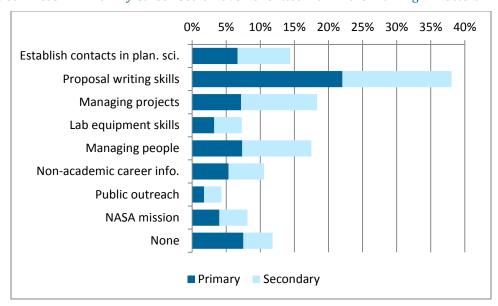


Figure 8b: Areas in Which My Career Could Have Benefitted from More Training in Doctoral Program

Overall satisfaction. 53% of the respondents were very satisfied with their doctoral program, and 38% were satisfied; 5% were dissatisfied, and 4% were very dissatisfied.

Grants & External Funding

We asked respondents to indicate when they first served as primary author for a proposal for grant funding, whether or not the proposal was funded. About 10% of the respondents had not served as primary author for a proposal. Figure 9 details the responses.

About one respondent in five submitted a successful proposal while in graduate school. The median time for those who submitted a successful proposal after earning their degree and serving any post-docs was three years.

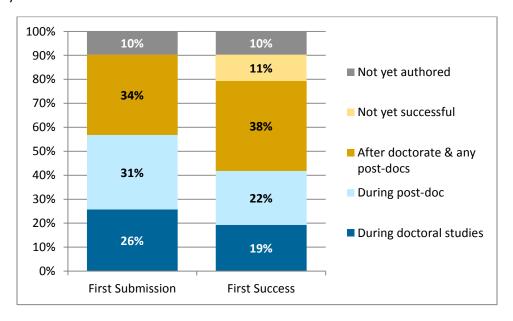


Figure 9: First Submission and First Successful Submission as Primary Author for Grant Funding

Review panels. We asked about service on review panels. About 66% of the respondents had served on a NASA review panel, and 26% on an NSF review panel. Sixteen percent had served on other review panels including ESA, DOE, and other international and state-based agencies. Twenty-seven percent had not served on any review panels. (Respondents could indicate service on more than one type of review panel, so the totals do not sum to 100%.)

Funding for current research. About 94% of the respondents indicated that they were involved in research, and about 83% of these received external funding to support their research. With respect to this external funding, most of those receiving external funding were receiving funds from NASA. Some of the respondents were not engaged in research, and others received no funding for their research. This is depicted in Figure 10.

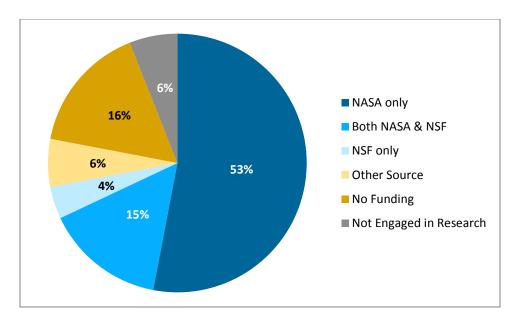


Figure 10: Source of Funds to Support Research

We also asked what proportion of their research was supported by these funds. The responses are detailed in Table 3. Those receiving funding from NASA appear to receive a larger portion of their research support from the agency.

Agency	25 th Percentile	Median	75 th Percentile
NASA	50	95	100
NSF	20	40	66

Note: Respondents were asked to indicate what percent of their research funding was provided by the agency; these figures are percents, not dollar amounts.

Table 3: Percent of Research Funding Received by Agency

Participation in NASA Missions, Working Groups, and Subcommittees

We asked respondents about their participation in NASA flight missions over the last ten years. Table 4 outlines the responses for those who reported having worked on a NASA flight mission over the last ten years.

Over the last 10 years, I have (select all that apply)	Number
Served as NASA PI	31
Served as NASA Co-I	202
Served as NASA instrument PI	45
Served on NASA PSP	104
Been funded, but not named	288
Participated in some other way	223
Total who were indicated involvement in some way	620
Total who indicated no involvement in a NASA mission	578

Table 4: Worked on NASA Flight Missions over the Last 10 Years

For those who had served as a PI, only 5 had been a PI on more than one mission; however, about half (93) of those who had been a Co-I had participated at least twice. Seventeen of the instrument PI had been an instrument PI more than once.

We also asked about proposing flight missions and proposing instruments on large missions. Tables 5 and 6 outline the responses to these questions. Respondents were more likely to have proposed a mission than to have proposed an instrument.

Over the last 10 years, I have		Number with
(select all that apply)	Number	Multiple Proposals
Proposed a NASA flight mission as PI	82	36
Proposed a NASA flight mission as Co-I	303	201
Participated in preparing a proposal for a mission, but not been named	86	53
Not proposed a NASA flight mission	835	

Table 5: Proposed a NASA Flight Mission During the Last 10 Years

Over the last 10 years, I have	Niverbau	Number with
(select all that apply)	Number	Multiple Proposals
Proposed an instrument on a NASA flight mission as PI	42	21
Proposed an instrument on a NASA flight mission as Co-I	124	63
Participated in preparing a proposal for an instrument, but not been named	27	11
Not proposed an instrument for a NASA flight mission	1029	

Table 6: Proposed an Instrument on a NASA Flagship Mission During the Last 10 Years

NASA working groups and subcommittees. Most respondents have not served in any of the capacities listed on the question about NASA working groups and subcommittees (Table 7).

During the last 10 years, I have	
(select all that apply)	Number
Served on the SMD-wide advisory group	22
(previously called the SSAC)	22
Served on the Planetary Science Subcommittee (or	57
its predecessors)	57
Served on an SDT	131
Served on another working group or	176
subcommittee	170
Not served on any of these but have participated	
in open meetings of assessment groups for my	226
discipline (OPAG, SBAG, MEPAG, etc.)	
Not served in any of these capacities	694

Table 7: Service on NASA Working Groups and Subcommittees

Family Life

Almost three-fourths (72%) of the women who responded indicated that they were married or in a similar relationship; this is true of 84% of the men who responded. We asked about the academic background of respondents' spouses or partners, and we asked about the sector in which the respondent's spouse or partner worked. Figures 11 and 12 (on the following page) reveal stark differences in the responses by the respondent's sex. Women's spouses and partners were more likely to have a degree in planetary science, and men's were more likely not to have an earned PhD or a degree at any level in science, math, or engineering. The contrast is also exhibited in the spouse or partner's work. Over 70% of the women respondents told us that their spouse or partner worked in planetary science or another science field or math or engineering; this is true for less than 30% of the men's spouses or partners. About one-fourth of the men who responded told us that their spouse or partner did not work outside the home; this was true for less than 5% of the women.

We also asked whether or not respondents had relocated because their spouse or partner had to relocate. Almost a third of the women (31%) had done so; about one man in six (17%) had relocated because his spouse or partner had to relocate. The numbers are similar when respondents told us whether or not they had turned down a job offer because their spouse or partner could not find work in the area: 32% of the women had turned down a job offer for this reason, and 16% of the men had done so.

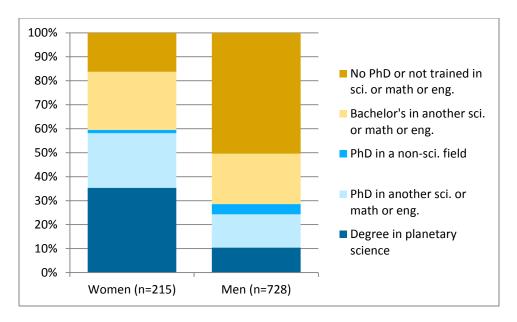


Figure 11: Spouse's or Partner's Academic Training by Sex of the Respondent

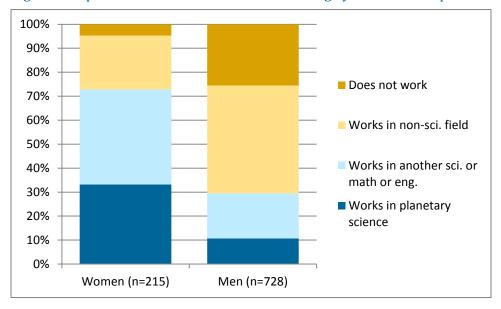


Figure 12: Spouse's or Partner's Current Employment Status by Sex of the Respondent

We also asked about children. About 51% of the respondents had children who had lived at home within the last ten years, and another 7% had children who had not lived at home in the last ten years. When we look at these by sex, we find differences between the two groups of respondents. These are detailed in Table 8. Some of the differences in whether or not the respondent has children or has had children living at home in the last ten years could be explained by the age profile of the men and women; this is shown in Table 9.

	Men Respondents	Women Respondents
l	(%)	(%)
Have children who have lived at home within the last 10 years	53	41
Have children who have <u>not</u> lived at home within the last 10 years	10	1
Do not have children	36	58
Have one child	18	16
Have two children	32	20
Have more than two children	13	5
Median number of children (n)	2	2

Table 8: Respondents with Children by Sex of Respondent

	Men	Women
Age	Respondents	Respondents
Lower quartile	38	33
Median	48	38
Upper quartile	58	48

Table 9: Age by Sex of Respondent: Median and Upper & Lower Quartile

Demographics

One respondent in four (25%) was female. With respect to race and ethnicity, we allowed respondents to select multiple categories. The responses are shown in Table 8 below.

Race	%
Asian or Asian American	7
Black or African American	1
Hispanic or Latino	1
White	87
Other	2
More than one race	2

Table 10: Race and Ethnicity of Respondents

Figure 13 details the age profiles of the respondents. The planetary scientists in planetary science are the youngest group, with about 40% of the respondents under the age of 40. Perhaps these age profiles are, in part, a function of scientists' progression from researcher to administrator.

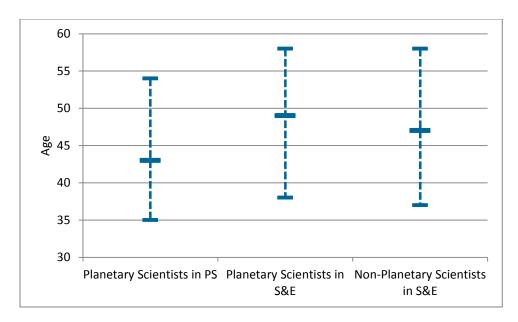


Figure 13: Age Profiles of Respondents: Median and Upper & Lower Quartiles

Appendix A: Survey Mechanics

We attempted to contact individuals using 4,898 unduplicated e-mail addresses with US extensions (.com, .edu, .org, .net, and .gov) obtained from the Lunar Planetary and Planetary Science Conference (LPSC), the AGU Section on Planetary Science, and the AAS Division of Planetary Science. Of these, 412 refused or disqualified themselves prior to accessing the web form. An additional 234 addresses bounced back as undeliverable. So, we were left with 4,252 eligible contacts. We received responses from 2,622 for a response rate of 62%. These are summarized in the tables below.

Names from the Lunar and Planetary Science Conference (LPSC), American Geophysical Union (AGU), and the American Astronomical Society Division of Planetary Sciences (DPS), 2011

	N	
Lunar and Planetary Science Conference	3,697	
AGU Section on Planetary Science	1,386	
AAS Division of Planetary Science	1,013	
Total US unduplicated	4,898	

Note: These numbers include only those with US email address extensions. Also, many members appeared in more than one list. The total US unduplicated number only counts these members once. Invitations were mailed to these 4898 US members.

Results after mailings, 2011							
	US	Refused or self-		Eligible	Website	Response	
	Population	disqualified	Undeliverable	contacts	respondents	rate	
	N	N	N	N	N	%	
Totals	4,898	412	234	4,252	2,622	62	

Note: Respondents were allowed to write back to indicate that they are living abroad, that they do not have PhDs, or that they refused to participate. They are included in the "refused or self-disqualified" column. Emails that returned indicating that they never reached their destinations are included under "undeliverable". Refused, self-disqualified and undeliverables are excluded from determining the response rate.

Almost half of the respondents (1,280 of the 2,622 or 49%) were included only on the LPSC list. About 10% were included only on the AGU list, and almost 14% were exclusively on the DPS list. Just over 6% were included on all three lists. The table below provides further detail.

Sources of Respondents' Contact Information					
LPSC AGU DPS All Three					
LPSC	1280	345	90		
AGU		264	124		
DPS			358		
All Three				161	

Note: The numbers in the highlighted cells on the diagonal belonged only to the named group; the off-diagonal numbers refer to the number of respondents belonging to the two respective groups.

A total of 1,876 were associated with the LPSC; 894 were members of AGU; and, 733 belonged to DPS.

Results from the 2011 Survey of the Planetary Science Workforce

We focus the bulk of our analysis on the 1,240 respondents who identify as planetary scientists working in planetary science (707), planetary scientists whose jobs are in the enterprise of science and engineering (218) and non-planetary scientists whose jobs are in the enterprise of science and engineering (315). Responses from all of the other respondents are detailed in Appendix B.

Appendix B: Responses from Other Respondents

Employment Sector	Number
University	46
Non-profit	7
FFR&DC	13
NASA lab	6
Other Federal labs & agencies	*
Industry	*
Other	*

^{*} is used where there are less than 5 respondents

Table B1: Employment Sector: Other Respondents

Post-doc Experience	Number
Did a post-doc	43
Currently a post-doc	11
Never did a post-doc	25

Table B2: Post-Doc Experiences: Other Respondents

The median length of time served in a post-doc is 2 years.

Since earning your doctorate and completing any post-docs, has there been any time during which you were not working or attending school full-time for six months or more? Number

Yes 11

No 68

Table B3: Any Breaks: Other Respondents

Since earning your doctorate and completing any post-docs, has there been any		
time during which you were working part-time for six months or more?	Number	
Yes	12	
No	67	

Table B4: Any Part-time Experience: Other Respondents

Year of Doctorate				
Lower Quartile	1989			
Median	1997			
Upper Quartile	2007			

Table B5: Year of Doctorate: Other Respondents

Field of Doctorate	Number
Planetary science	22
Geology & geophysics	10
Physics	5
Astronomy & astrophysics	7
Chemistry	6
Earth science	8
Engineering	*
Other	25

^{*} is used where there are less than 5 respondents

Table B6: Field of Doctorate: Other Respondents

Fifty four of the other respondents have master's degrees, and twenty-four do not have master's degrees.

Field of Master's Degree	Number
Physics	6
Geology & geophysics	10
Astronomy & astrophysics	5
Planetary science	*
Earth science	*
Engineering	*
Other	25

^{*} is used where there are less than 5 respondents

Table B7: Field of Master's Degree: Other Respondents

Field of Bachelor's Degree	Number
Physics	11
Geology & geophysics	16
Chemistry	10
Astronomy & astrophysics	11
Engineering	*
Earth science	*
Biology	8
Planetary science	*
Math	*
Other	25

^{*} is used where there are less than 5 respondents

Table B8: Field of Bachelor's Degree: Other Respondents

	Not				Very
Area	covered	Weak	Fair	Good	good
Subject matter knowledge	*	*	*	23	50
Sophisticated problem solving	*	*	5	22	50
Advanced quantitative skills	*	*	12	25	35
Oral communication skills	*	*	14	27	34
Collaboration / team skills	*	5	21	32	17
Programming skills	7	10	18	18	24
Research integrity / ethics	5	*	7	21	36
Teaching skills	*	10	23	29	11
Establish contacts in planetary science	16	9	11	21	19
Proposal writing skills	15	15	14	21	11
Managing projects	13	13	20	22	9
Lab equipment skills	10	7	15	16	28
Managing people	17	25	15	13	7
Non-academic career information	20	27	20	8	*
Public outreach	16	15	16	17	13
NASA mission	26	8	14	18	11

^{*} is used where there are less than 5 respondents

Table B9: How Well Areas Were Covered in Doctoral Program: Other Respondents

Area	Primary	Secondary
Subject matter knowledge	*	*
Sophisticated problem solving	*	*
Advanced quantitative skills	*	*
Oral communication skills	*	*
Collaboration / team skills	10	7
Programming skills	6	5
Research integrity / ethics		
Teaching skills	5	7
Establish contacts in planetary science	5	*
Proposal writing skills	20	9
Managing projects	9	7
Lab equipment skills		*
Managing people	*	10
Non-academic career information	*	*
Public outreach		
NASA mission	*	5

^{*} is used where there are less than 5 respondents

Table B10: Primary and Secondary Wishes for More Coverage in PhD Program: Other Respondents

Overall, 6 of the other respondents were dissatisfied with their doctoral program, 37 were satisfied, and 34 were very satisfied.

When	First Submission	First Success
Not yet authored	15	
Not yet successful		10
After doctorate & any post-docs	28	30
During post-doc	17	8
During doctoral studies	16	10

Table B11: First Grant Proposal Submission and First Successful Grant Proposal Submission: Other Respondents

The median number of years after the doctorate and any post-docs for the first submission is two; it is also two for the first success.

Panel	Number
NASA review panel	37
NSF review panel	21
Other review panel	8
Not served on a review panel	30

Table B12: Service on Review Panels: Other Respondents

The next series of questions was about research funding. We first asked about the respondent's involvement in research. Sixty-three respondents were involved in research, and fifteen were not. When we asked the sixty-three researchers about external funding, forty-five reported receiving external funding. Of these, 37 received funding from NASA, and 12 received funding from NSF. Table B13 (below) shows the percent of research funding the respondents received from these two agencies.

Agency	25 th Percentile	Median	75 th Percentile
NASA	26	75	100
NSF	5	38	50

Note: Respondents were asked to indicate what percent of their research funding was provided by the agency; these figures are percents, not dollar amounts.

Table B13: Percentage of Research Funding Support from NASA and NSF Received:
Other Respondents

Over the last ten years, I have (Select all that apply)	Number
Served as NASA PI	*
Served as NASA Co-I	*
Served as NASA instrument PI	*
Served on NASA PSP	*
Been funded, but not named	12
Participated in some other way	13
Not been involved in a NASA mission	52

^{*} is used where there are less than 5 respondents

Table B14: Worked on NASA Flight Mission during the Last Ten Years: Other Respondents

Over the last ten years, I have (Select all that apply)	Number	Number with Multiple Proposals
Proposed a NASA flight mission as PI	*	*
Proposed a NASA flight mission as Co-I	*	*
Participated in preparing a proposal for a mission, but not been named	6	6
Not proposed a NASA flight mission	67	

^{*} is used where there are less than 5 respondents

Table B15: Proposed a NASA Flight Mission during the Last Ten Years: Other Respondents

Over the last ten years, I have (Select all that apply)	Number	Number with Multiple Proposals
Proposed an instrument on a NASA flight mission as PI		
Proposed an instrument on a NASA flight mission as Co-I	*	*
Participated in preparing a proposal for an instrument, but not been named	*	*
Not proposed an instrument for a NASA flight mission	72	

^{*} is used where there are less than 5 respondents

Table B16: Proposed an Instrument for a NASA Flight Mission during the Last Ten Years:
Other Respondents

During the last ten years, I have (Select all that apply)	Number
Served on the SMD-wide advisory group (previously called the SSAC)	
Served on the Planetary Science subcommittee (or its predecessors)	
Served on an SDT	*
Served on another working group or subcommittee	7
Not served on any of these but have participated in open meetings	12
of assessment groups for my discipline (OPAG, SBAG, MEPAG, etc.)	12
Not served in any of these capacities	58

^{*} is used where there are less than 5 respondents

Table B17: Service on NASA Committees: Other Respondents

Fifty-four of the other respondents were married or in a similar partnered relationship, and twenty-three were not. Of the fifty-four, seven had relocated because their spouse or partner had relocated, and fewer than five had turned down a job offer because their spouse or partner could not find work in the area. Tables B18 and B19 provide details on the spouse or partner's academic training and job status.

My spouse or partner	Number
Has a degree in planetary science	6
Has a PhD in another science	10
Has a PhD in a non-science field	*
Has a bachelor's degree in science, math, or engineering	11
Does not have a PhD or is not trained in science, math, or engineering	25

^{*} is used where there are less than 5 respondents

Table B18: Spouse or Partner's Academic Training: Other Respondents

My spouse or partner	Number
Works in planetary science	7
Works in another science, math, or engineering	16
Works in a non-science field	21
Does not work	10

Table B19: Spouse or Partner's Job Status: Other Respondents

Forty-seven of the other respondents have children; thirty-nine do not. Of those with children, eight did not have any children living with them at home in the last ten years. Table B20 provides data on the number of children.

Number of Children	Number
None	39
One	9
Two	16
Three or more	12

Table B20: Number of Children: Other Respondents

Twenty-seven of the other respondents were female, and forty-nine were male. Tables B21 and B22 provide other demographic information.

Race or Ethnicity (May check more than one)	Number Selecting
Asian or Asian American	*
Black or African American	*
Hispanic or Latino	*
White	63
Other	*

^{*} is used where there are less than 5 respondents

Table B21: Race or Ethnicity: Other Respondents

Age	Number
Under 30	5
30 to 39	18
40 to 49	19
50 to 59	20
60 and older	14

Table B22: Age Profile: Other Respondents

Over half of these respondents were employed in a non-science job, and are the only respondents who reported being employed outside the enterprise of science and engineering. So, they differ in that aspect. In most other ways, these additional respondents are very similar to those in the larger group.