Historical trends of participation of women scientists in robotic spacecraft missions

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Introduction

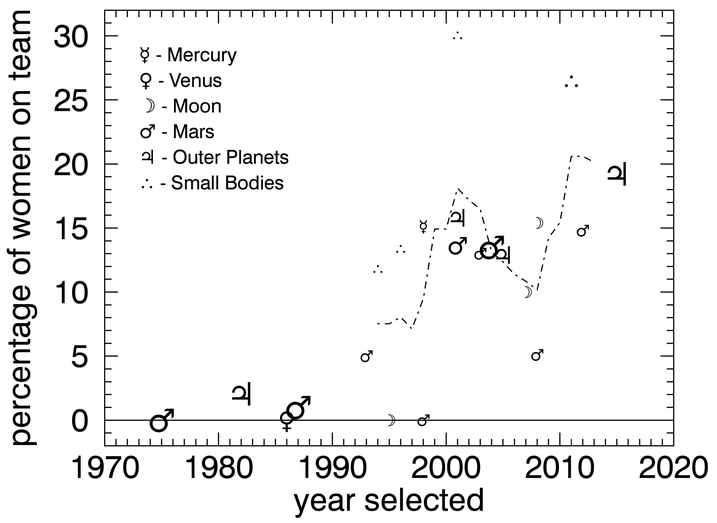
For many planetary scientists, being involved in a spacecraft mission is the highlight of a career. Many young scientists hope to one day be involved in such a mission. "We have counted members of science teams of 22 NASA planetary science missions over a period of 41 years and determined the percentage of women on each team. We have compared that to the percentage of women in the field during the missions' selection year.

Methods

For each team, we searched team web pages, the internet archive, and published articles and fact sheets. Our goal was to consider only original team scientists (not engineers or members of project management nor students or postdocs) from US institutions (since investigators from foreign institutions are generally not funded by NASA). We also determined the year each team was selected, which was more difficult for the pre-1995 missions. Once we found a list of team members, we noted their institution (at that time) and gender presentation. For the more recent missions, generally at least one of us knew the investigator personally and it was easy to make the determination. In other cases, we relied on web searches for images of the investigator. Limiting to US institutions enabled our US-centric team to better determine gender from first name when personal knowledge or photographs were not available.

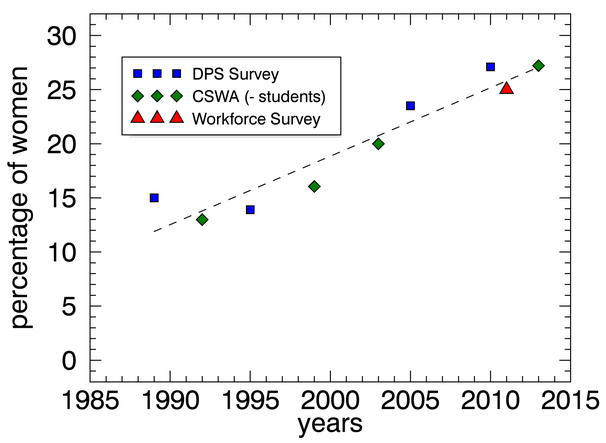
The most difficult part of determining science team membership was that it often changes as new members are added. We wanted to find the original team members from the year the team was selected so we could compare it to the composition of the field at that time. We were not always successful, so we likely overestimate some missions' complement of female scientists. The Cassini mission was one of the most difficult to determine original members, since several scientists have been added since its 1997 launch.

selection year	Launch year	Mission Name	# women	total #	% women	Target	Size
1975	1975	Viking	0	78	0	mars	large
1982	1989	Galileo	2	97	2.06	outer planets	large
1986	1989	Magellan	0	35	0	venus	medium
1987	1992	Mars Observer	1	73	1.4	mars	large
1994	1996	NEAR	2	17	11.8	small bodies	small
1995	1998	Lunar Prospector	0	6	0	moon	small
1996	1998	Deep-Space 1	2	15	13.3	small bodies	small
1998	2004	MESSENGER	5	33	15.1	mercury	small
1998	2003	MER	0	22	0	mars	small
2001	2006	New Horizons	3	19	15.8	outer planets	medium
2001	2007	Dawn	6	20	30	small bodies	small
2001	2005	MRO	6	44	13.6	mars	medium
2005	2011	Juno	4	31	12.9	outer planets	medium
2006	2011	Curiosity	5	37	13.5	mars	large
2007	2011	GRAIL	1	10	10	moon	small
2008	2013	MAVEN	2	39	5.1	mars	small
2008	2013	LADEE	2	13	15.4	moon	small
2011	2016	Osiris-rex	14	53	26.4	small bodies	medium
2012	2016	Insight	4	27	14.8	mars	small
2015	2022	Europa	15	78	19.2	outer planets	large



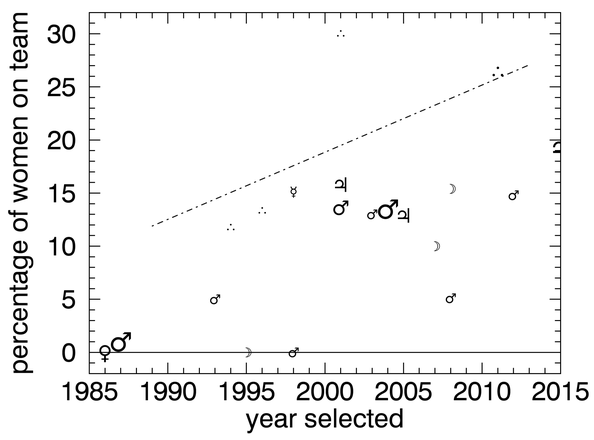
Percentage of women on science mission teams

- Dotted line shows a running average (6-year window)
- No mission since 1998 (MER & LP) has had no women on it
- Small bodies missions have a higher percentage of women
- While representation increased dramatically by 2000, the average has remained remarkably constant since then.
- 1987-2015 average: 12% (14% if we don't include MER & LP)



Percentage of women in the field

The only measurement we could find specifically for all planetary science is from the 2011 planetary workforce survey (red triangle)[1]. The blue squares show results from DPS surveys (although not all planetary scientists are member of DPS)[2,3]. The most detailed survey of women in astronomy was completed by the Committee on the Status of Women in Astronomy (CSWA). The green triangles show the percentage of women non-students[4]. The line shows a linear fit to all the data and predict that the field will read parity in 2049.



Comparison

The mission data on this graph is the same as that shown on the first graph, above. The line is the fit to the percentage of women in the field, at left.

While the percentage of women planetary scientists has continued to increase, the percentage of women on science mission teams has remained essentially constant, at 14.7% (see above).

An earlier study (using fewer missions) found 14.5% of science team members were women[5]. They further found that this is 4 standard deviations away from the mean.

Future Work

- Determine the percentage of women on other science mission teams, including Cassini.
- Refine current numbers. **Please contact me if you have first-hand knowledge**, particularly of older missions.
- Determine the percentage of women involved in science mission teams (i.e. as participating scientist, postdocs, or graduate students) and how it changes with time for each mission. Hurley[5] suggested that participating scientist programs have a higher percentage of women and that including such a program is expected to increase the participation of women in missions.

References: [1]http://lasp.colorado.edu/home/mop/resources/related-links/planetary-science-workforce-survey/, [2]http://dps.aas.org/files/dps/publications/OldSurvey1989.pdf, [3]http://dps.aas.org/files/dps/publications/survey_2010/SurveyResultsBusinessMeeting.pdf, [4]http://www.aas.org/cswa/Jan14/CSWAtownhall.pdf, [5]Hurley, D.M. Women Count, *Eos*, Vol. 95, No. 44, 4 November 2014 .