

# A brief history of space flight from 1961 to 2020: An analysis of missions and astronaut demographics

## Supplemental Material

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### 1. Supplemental results tables

#### 1.1. Quasi-separation of data

Table S1 Cross-tabulation between gender and education, showing quasi-separation of data. Data shown are the number of astronauts of each gender in each education category. Education data were missing for n=5 astronauts.

Education	Female	Male	Total
No college	0	5	5
BS	6	90	96
MS	19	238	257
PhD/MD	39	160	199
<b>Total</b>	64	493	557

Table S2 Cross-tabulation between agency and education, showing quasi-separation of data. Data shown are the number of astronauts from each agency in each education category. Education data were missing for n=5 astronauts.

Education	Agency						Total
	NASA	Roscosmos	ESA	CNSA	CSA	JAXA	
No college	1	2	1	1	0	0	5
BS	53	26	7	7	1	2	96
MS	171	68	12	1	2	3	257
PhD/MD	124	47	16	0	6	6	199
<b>Total</b>	349	143	36	9	9	11	557

## 1.2. Gender: Mission-level

Due to missing data, 20 spaceflights (1.7%) could not be included in regression analysis of astronaut gender. A total of 1150 spaceflights therefore contributed to the analysis. At the level of individual missions, there were significant effects on gender by military background, children and age at launch (Table S3). Similarly to the individual-level analysis, astronauts were significantly less likely to be female with increasing age and with increasing numbers of children, and if they had a military background. The point estimates for the likelihood of an astronaut being a female have increased over time, but this was not statistically significant.

Table S3 Mission-level effects on gender. Statistically significant Type III effects highlighted with bold typeface. Odds ratios (OR) for being female are shown for each level of categorical variables, and for each one unit increase of continuous variables.

Covariate	F	Type III test			Odds ratios		
		df1	df2	p-value	Level	OR	95% CI
Education	1.0	2	1131	0.359	No college	-	-
					B	Reference level	
					M	1.17	0.24; 5.80
					PhD/MD	2.44	0.49; 12.21
Marital status	1.1	2	1131	0.324	Unmarried	Reference level	
					Married	0.74	0.16; 3.44
					Divorced	3.31	0.33; 33.30
Total missions	0.7	1	1131	0.406	OR/mission	0.86	0.61; 1.22
<b>Children</b>	<b>18.2</b>	<b>1</b>	<b>1131</b>	<b>&lt;0.001</b>	OR/child	0.37	0.24; 0.59
Decade	1.4	4	1131	0.221	1960s	Reference level	
					1970s	-	-
					1980s	1.45	0.08; 26.38
					1990s	3.38	0.20; 57.91
					2000s	6.43	0.34; 121.28
					2010s	9.70	0.38; 244.67
Agency	2.1	5	1131	0.063	NASA	Reference level	
					ROSCOSMOS	0.10	0.02; 0.50
					ESA	0.21	0.02; 1.87
					CNSA	1.16	0.04; 33.19
					CSA	1.71	0.12; 23.66
					JAXA	0.19	0.02; 2.19
<b>Military background</b>	<b>5.5</b>	<b>1</b>	<b>1131</b>	<b>0.019</b>	No	Reference level	
					Yes	0.27	0.09; 0.80
<b>Age at launch</b>	<b>12.2</b>	<b>1</b>	<b>1131</b>	<b>0.001</b>	OR/year	0.86	0.80; 0.94
Mission duration	0.0	1	1131	0.926	OR/day	1.00	0.99; 1.01

df: degrees of freedom; CI: confidence interval

## 1.3. Military background: Mission-level

Due to missing data, 23 spaceflights (1.8%) could not be included in regression analysis of military background. A total of 1231 spaceflights therefore contributed to the analysis. Results of the mission-level analysis of military background are given in Table S4. As with the individual-level analysis, there were significant effects of education, launch decade and gender on the likelihood of the astronaut having a military background. Men were more than four times as likely to have a military background than women.

Post-hoc tests for education are given in Table S16. Astronauts with a PhD/MD education were significantly less likely to have a military background than astronauts with a Bachelor's-level (OR=0.023)

or Master's level (OR=0.025) education. Other education levels were not significantly different from each other.

Post-hoc tests for launch decade are given in Table S17. Astronauts in the 1960's and 1970's were significantly more likely to have a military background than astronauts in the 1980's, 1990's, 2000's and 2010's. The likelihood of an astronaut having a military background at the mission-level was not significantly different between any other launch decades.

Table S4 Mission-level effects on military background. Statistically significant Type III effects highlighted with bold typeface. Odds ratios (OR) for having a military background are shown for each level of categorical variables, and for each one unit increase of continuous variables.

Covariate	Type III test				Odds ratios		
	F	df1	df2	p-value	Level	OR	95% CI
<b>Education</b>	<b>44.0</b>	<b>3</b>	<b>1211</b>	<b>&lt;0.001</b>	No college	Reference level	
					B	2.13	0.04; 101.80
					M	2.24	0.05; 102.76
					PhD/MD	0.05	0.00; 2.44
Marital status	0.8	2	1211	0.459	Unmarried	Reference level	
					Married	1.36	0.30; 6.11
					Divorced	0.46	0.05; 4.26
Total missions	0.1	1	1211	0.779	OR/mission	1.03	0.82; 1.31
Children	0.3	1	1211	0.607	OR/child	0.93	0.71; 1.22
<b>Decade</b>	<b>3.3</b>	<b>5</b>	<b>1211</b>	<b>0.006</b>	1960s	Reference level	
					1970s	0.52	0.11; 2.47
					1980s	0.11	0.02; 0.54
					1990s	0.09	0.02; 0.42
					2000s	0.06	0.01; 0.33
					2010s	0.11	0.02; 0.74
Agency	1.7	4	1211	0.140	NASA	Reference level	
					ROSCOSMOS	0.51	0.22; 1.17
					ESA	0.89	0.25; 3.23
					CNSA	-	-
					CSA	0.35	0.03; 3.59
					JAXA	0.07	0.01; 0.81
<b>Gender</b>	<b>8.1</b>	<b>1</b>	<b>1211</b>	<b>0.004</b>	Female	Reference level	
					Male	4.50	1.60; 12.67
Age at launch	0.1	1	1211	0.733	OR/year	1.01	0.96; 1.06
Duration	1.6	1	1211	0.210	OR/day	1.00	0.99; 1.00

df: degrees of freedom; CI: confidence interval

## 1.4. Post-hoc test results

Table S5 Pairwise comparisons for effect of agency on astronaut gender (individual-level analysis).

Agency (A)	Agency (B)	Mean difference (A-B)	SE	p-value
JAXA	CSA	-0.19	0.164	0.245
	CNSA	-0.06	0.093	0.548
	ESA	0	0.031	0.957
	Roscosmos	0.02	0.025	0.529
	NASA	-0.07	0.041	0.067
CSA	JAXA	0.19	0.164	0.245
	CNSA	0.14	0.188	0.471
	ESA	0.19	0.164	0.239
	Roscosmos	0.21	0.165	0.211
	NASA	0.12	0.159	0.464
CNSA	JAXA	0.06	0.093	0.548
	CSA	-0.14	0.188	0.471
	ESA	0.06	0.093	0.538
	Roscosmos	0.07	0.092	0.438
	NASA	-0.02	0.095	0.840
ESA	JAXA	0	0.031	0.957
	CSA	-0.19	0.164	0.239
	CNSA	-0.06	0.093	0.538
	Roscosmos	0.01	0.023	0.523
	NASA	-0.08	0.040	0.057
Roscosmos	JAXA	-0.02	0.025	0.529
	CSA	-0.21	0.165	0.211
	CNSA	-0.07	0.092	0.438
	ESA	-0.01	0.023	0.523
	<b>NASA</b>	<b>-0.09</b>	<b>0.040</b>	<b>0.023</b>
NASA	JAXA	0.07	0.041	0.067
	CSA	-0.12	0.159	0.464
	CNSA	0.02	0.095	0.840
	ESA	0.08	0.040	0.057
	<b>Roscosmos</b>	<b>0.09</b>	<b>0.040</b>	<b>0.023</b>

Table S6 Pairwise comparisons for effect of education on military background (individual-level analysis).

Education (A)	Education (B)	Mean difference (A-B)	SE	p-value
PhD/MD	<b>M</b>	<b>-0.55</b>	<b>0.067</b>	<b>&lt;0.0001</b>
	<b>B</b>	<b>-0.51</b>	<b>0.087</b>	<b>&lt;0.0001</b>
	No college	-0.39	0.329	0.239
M	<b>PhD/MD</b>	<b>0.55</b>	<b>0.067</b>	<b>&lt;0.0001</b>
	B	0.04	0.08	0.627
	No college	0.17	0.325	0.611
B	<b>PhD/MD</b>	<b>0.51</b>	<b>0.087</b>	<b>&lt;0.0001</b>
	M	-0.04	0.08	0.627
	No college	0.13	0.329	0.701
No college	PhD/MD	0.39	0.329	0.239
	M	-0.17	0.325	0.611
	B	-0.13	0.329	0.701

Table S7 Pairwise comparisons for effect of decade of first spaceflight on military background (individual-level analysis).

Decade (A)	Decade (B)	Mean difference (A-B)	SE	p-value
11-20	01-10	0.20	0.119	0.091
	91-00	0.12	0.122	0.318
	81-90	0.07	0.125	0.568
	71-80	-0.20	0.149	0.187
	<b>61-70</b>	<b>-0.39</b>	<b>0.143</b>	<b>0.007</b>
01-10	11-20	-0.20	0.119	0.091
	91-00	-0.08	0.066	0.225
	81-90	-0.13	0.077	0.089
	<b>71-80</b>	<b>-0.40</b>	<b>0.119</b>	<b>0.001</b>
	<b>61-70</b>	<b>-0.59</b>	<b>0.103</b>	<b>&lt;0.001</b>
91-00	11-20	-0.12	0.122	0.318
	01-10	0.08	0.066	0.225
	81-90	-0.05	0.071	0.476
	<b>71-80</b>	<b>-0.32</b>	<b>0.114</b>	<b>0.005</b>
	<b>61-70</b>	<b>-0.51</b>	<b>0.101</b>	<b>&lt;0.001</b>
81-90	11-20	-0.07	0.125	0.568
	01-10	0.13	0.077	0.089
	91-00	0.05	0.071	0.476
	<b>71-80</b>	<b>-0.27</b>	<b>0.112</b>	<b>0.017</b>
	<b>61-70</b>	<b>-0.46</b>	<b>0.107</b>	<b>&lt;0.001</b>
71-80	11-20	0.20	0.149	0.187
	<b>01-10</b>	<b>0.40</b>	<b>0.119</b>	<b>0.001</b>
	<b>91-00</b>	<b>0.32</b>	<b>0.114</b>	<b>0.005</b>
	<b>81-90</b>	<b>0.27</b>	<b>0.112</b>	<b>0.017</b>
	61-70	-0.19	0.126	0.133
61-70	<b>11-20</b>	<b>0.39</b>	<b>0.143</b>	<b>0.007</b>
	<b>01-10</b>	<b>0.59</b>	<b>0.103</b>	<b>&lt;0.001</b>
	<b>91-00</b>	<b>0.51</b>	<b>0.101</b>	<b>&lt;0.001</b>
	<b>81-90</b>	<b>0.46</b>	<b>0.107</b>	<b>&lt;0.001</b>
	71-80	0.19	0.126	0.133

Table S8 Pairwise comparisons for effect of agency on military background (individual-level analysis).

Agency (A)	Agency (B)	Mean difference (A-B)	SE	p-value
JAXA	CSA	-0.17	0.253	0.505
	<b>ESA</b>	<b>-0.44</b>	<b>0.174</b>	<b>0.012</b>
	<b>Roscosmos</b>	<b>-0.32</b>	<b>0.155</b>	<b>0.040</b>
	<b>NASA</b>	<b>-0.48</b>	<b>0.146</b>	<b>0.001</b>
CSA	JAXA	0.17	0.253	0.505
	ESA	-0.27	0.232	0.249
	Roscosmos	-0.15	0.222	0.501
	NASA	-0.31	0.212	0.142
ESA	<b>JAXA</b>	<b>0.44</b>	<b>0.174</b>	<b>0.012</b>
	CSA	0.27	0.232	0.249
	Roscosmos	0.12	0.125	0.340
	NASA	-0.04	0.11	0.691
Roscosmos	<b>JAXA</b>	<b>0.32</b>	<b>0.155</b>	<b>0.040</b>
	CSA	0.15	0.222	0.501
	ESA	-0.12	0.125	0.340
	<b>NASA</b>	<b>-0.16</b>	<b>0.074</b>	<b>0.029</b>
NASA	<b>JAXA</b>	<b>0.48</b>	<b>0.146</b>	<b>0.001</b>
	CSA	0.31	0.212	0.142
	ESA	0.04	0.11	0.691
	<b>Roscosmos</b>	<b>0.16</b>	<b>0.074</b>	<b>0.029</b>

Table S9 Pairwise comparisons for effect of decade of first spaceflight on astronaut age (individual-level analysis).

Decade (A)	Decade (B)	Mean difference (A-B)	SE	p-value
61-70	<b>71-80</b>	<b>-3.81</b>	<b>0.901</b>	<b>&lt;0.001</b>
	<b>81-90</b>	<b>-5.39</b>	<b>0.780</b>	<b>&lt;0.001</b>
	<b>91-00</b>	<b>-5.09</b>	<b>0.811</b>	<b>&lt;0.001</b>
	<b>01-10</b>	<b>-8.69</b>	<b>0.825</b>	<b>&lt;0.001</b>
	<b>11-20</b>	<b>-7.47</b>	<b>1.007</b>	<b>&lt;0.001</b>
71-80	<b>61-70</b>	<b>3.81</b>	<b>0.901</b>	<b>&lt;0.001</b>
	<b>81-90</b>	<b>-1.58</b>	<b>0.761</b>	<b>0.038</b>
	91-00	-1.28	0.786	0.104
	<b>01-10</b>	<b>-4.89</b>	<b>0.795</b>	<b>&lt;0.001</b>
81-90	<b>11-20</b>	<b>-3.66</b>	<b>0.985</b>	<b>&lt;0.001</b>
	<b>61-70</b>	<b>5.39</b>	<b>0.780</b>	<b>&lt;0.001</b>
	<b>71-80</b>	<b>1.58</b>	<b>0.761</b>	<b>0.038</b>
	91-00	0.30	0.537	0.578
	<b>01-10</b>	<b>-3.31</b>	<b>0.578</b>	<b>&lt;0.001</b>
91-00	<b>11-20</b>	<b>-2.08</b>	<b>0.854</b>	<b>0.015</b>
	<b>61-70</b>	<b>5.09</b>	<b>0.811</b>	<b>&lt;0.001</b>
	71-80	1.28	0.786	0.104
	81-90	-0.30	0.537	0.578
	<b>01-10</b>	<b>-3.61</b>	<b>0.574</b>	<b>&lt;0.001</b>
01-10	<b>11-20</b>	<b>-2.38</b>	<b>0.848</b>	<b>0.005</b>
	<b>61-70</b>	<b>8.69</b>	<b>0.825</b>	<b>&lt;0.001</b>
	<b>71-80</b>	<b>4.89</b>	<b>0.795</b>	<b>&lt;0.001</b>
	<b>81-90</b>	<b>3.31</b>	<b>0.578</b>	<b>&lt;0.001</b>
	<b>91-00</b>	<b>3.61</b>	<b>0.574</b>	<b>&lt;0.001</b>
11-20	11-20	1.22	0.843	0.146
	<b>61-70</b>	<b>7.47</b>	<b>1.007</b>	<b>&lt;0.001</b>
	<b>71-80</b>	<b>3.66</b>	<b>0.985</b>	<b>&lt;0.001</b>
	<b>81-90</b>	<b>2.08</b>	<b>0.854</b>	<b>0.015</b>
	<b>91-00</b>	<b>2.38</b>	<b>0.848</b>	<b>0.005</b>
	01-10	-1.22	0.843	0.146

Table S10 Pairwise comparisons for effect of agency on astronaut age at first spaceflight (individual-level analysis).

Agency (A)	Agency (B)	Mean difference (A-B)	SE	p-value
NASA	<b>Roscosmos</b>	<b>2.22</b>	<b>0.496</b>	<b>&lt;0.001</b>
	ESA	1.32	0.828	0.111
	<b>CNSA</b>	<b>4.70</b>	<b>1.804</b>	<b>0.009</b>
	CSA	-0.74	1.525	0.629
Roscosmos	<b>NASA</b>	<b>-2.22</b>	<b>0.496</b>	<b>&lt;0.001</b>
	ESA	-0.90	0.909	0.320
	CNSA	2.48	1.817	0.172
	CSA	-2.96	1.578	0.061
ESA	<b>JAXA</b>	<b>-1.38</b>	<b>1.429</b>	<b>0.334</b>
	NASA	-1.32	0.828	0.111
	Roscosmos	0.90	0.909	0.320
	CNSA	3.39	1.935	0.080
CNSA	CSA	-2.06	1.668	0.218
	<b>JAXA</b>	<b>-0.48</b>	<b>1.558</b>	<b>0.759</b>
	<b>NASA</b>	<b>-4.70</b>	<b>1.804</b>	<b>0.009</b>
	Roscosmos	-2.48	1.817	0.172
CSA	ESA	-3.39	1.935	0.080
	<b>CSA</b>	<b>-5.44</b>	<b>2.350</b>	<b>0.021</b>
	JAXA	-3.86	2.215	0.081
	NASA	0.74	1.525	0.629
JAXA	Roscosmos	2.96	1.578	0.061
	ESA	2.06	1.668	0.218
	<b>CNSA</b>	<b>5.44</b>	<b>2.350</b>	<b>0.021</b>
	JAXA	1.58	2.014	0.433
NASA	NASA	-0.84	1.400	0.548
	Roscosmos	1.38	1.429	0.334
	ESA	0.48	1.558	0.759
	CNSA	3.86	2.215	0.081
CSA	CSA	-1.58	2.014	0.433



Table S11 Pairwise comparisons for effect of agency on age at launch (mission-level analysis). P-values are adjusted for multiple hypothesis testing (Holm step-down procedure).

Agency (A)	Agency (B)	Contrast estimate (A-B)	SE	p-value
NASA	<b>Roscosmos</b>	<b>1.22</b>	<b>0.588</b>	<b>0.038</b>
	<b>ESA</b>	<b>2.25</b>	<b>0.985</b>	<b>0.022</b>
	<b>CNSA</b>	<b>7.96</b>	<b>2.231</b>	<b>&lt;0.001</b>
	CSA	-0.73	1.793	0.685
	JAXA	2.93	1.669	0.080
Roscosmos	<b>NASA</b>	<b>-1.22</b>	<b>0.588</b>	<b>0.038</b>
	ESA	1.03	1.075	0.336
	<b>CNSA</b>	<b>6.74</b>	<b>2.257</b>	<b>0.003</b>
	CSA	-1.95	1.852	0.293
	JAXA	1.71	1.706	0.317
ESA	<b>NASA</b>	<b>-2.25</b>	<b>0.985</b>	<b>0.022</b>
	Roscosmos	-1.03	1.075	0.336
	<b>CNSA</b>	<b>5.70</b>	<b>2.383</b>	<b>0.017</b>
	CSA	-2.98	1.985	0.134
	JAXA	0.68	1.868	0.718
CNSA	<b>NASA</b>	<b>-7.96</b>	<b>2.231</b>	<b>&lt;0.001</b>
	<b>Roscosmos</b>	<b>-6.74</b>	<b>2.257</b>	<b>0.003</b>
	<b>ESA</b>	<b>-5.70</b>	<b>2.383</b>	<b>0.017</b>
	<b>CSA</b>	<b>-8.68</b>	<b>2.839</b>	<b>0.002</b>
	JAXA	-5.03	2.724	0.065
CSA	NASA	0.73	1.793	0.685
	Roscosmos	1.95	1.852	0.293
	ESA	2.98	1.985	0.134
	<b>CNSA</b>	<b>8.68</b>	<b>2.839</b>	<b>0.002</b>
	JAXA	3.66	2.391	0.127
JAXA	NASA	-2.93	1.669	0.080
	Roscosmos	-1.71	1.706	0.317
	ESA	-0.68	1.868	0.718
	<b>CNSA</b>	<b>5.03</b>	<b>2.724</b>	<b>0.065</b>
	CSA	-3.66	2.391	0.127

Table S12 Pairwise comparisons for effect of launch decade on age at launch (mission-level analysis). P-values are adjusted for multiple hypothesis testing (Holm step-down procedure).

Decade (A)	Decade (B)	Contrast estimate (A-B)	SE	p-value
61-70	<b>71-80</b>	<b>-4.68</b>	<b>0.724</b>	<b>&lt;0.001</b>
	<b>81-90</b>	<b>-7.06</b>	<b>0.761</b>	<b>&lt;0.001</b>
	<b>91-00</b>	<b>-10.12</b>	<b>0.774</b>	<b>&lt;0.001</b>
	<b>01-10</b>	<b>-15.03</b>	<b>0.800</b>	<b>&lt;0.001</b>
	<b>11-20</b>	<b>-18.50</b>	<b>0.897</b>	<b>&lt;0.001</b>
71-80	<b>61-70</b>	<b>4.68</b>	<b>0.724</b>	<b>&lt;0.001</b>
	<b>81-90</b>	<b>-2.38</b>	<b>0.621</b>	<b>&lt;0.001</b>
	<b>91-00</b>	<b>-5.44</b>	<b>0.650</b>	<b>&lt;0.001</b>
	<b>01-10</b>	<b>-10.35</b>	<b>0.682</b>	<b>&lt;0.001</b>
	<b>11-20</b>	<b>-13.82</b>	<b>0.791</b>	<b>&lt;0.001</b>
81-90	<b>61-70</b>	<b>7.06</b>	<b>0.761</b>	<b>&lt;0.001</b>
	<b>71-80</b>	<b>2.38</b>	<b>0.621</b>	<b>&lt;0.001</b>
	<b>91-00</b>	<b>-3.06</b>	<b>0.361</b>	<b>&lt;0.001</b>
	<b>01-10</b>	<b>-7.97</b>	<b>0.441</b>	<b>&lt;0.001</b>
	<b>11-20</b>	<b>-11.44</b>	<b>0.605</b>	<b>&lt;0.001</b>
91-00	<b>61-70</b>	<b>10.12</b>	<b>0.774</b>	<b>&lt;0.001</b>
	<b>71-80</b>	<b>5.44</b>	<b>0.650</b>	<b>&lt;0.001</b>
	<b>81-90</b>	<b>3.06</b>	<b>0.361</b>	<b>&lt;0.001</b>
	<b>01-10</b>	<b>-4.91</b>	<b>0.333</b>	<b>&lt;0.001</b>
	<b>11-20</b>	<b>-8.38</b>	<b>0.541</b>	<b>&lt;0.001</b>
01-10	<b>61-70</b>	<b>15.03</b>	<b>0.800</b>	<b>&lt;0.001</b>
	<b>71-80</b>	<b>10.35</b>	<b>0.682</b>	<b>&lt;0.001</b>
	<b>81-90</b>	<b>7.97</b>	<b>0.441</b>	<b>&lt;0.001</b>
	<b>91-00</b>	<b>4.91</b>	<b>0.333</b>	<b>&lt;0.001</b>
	<b>11-20</b>	<b>-3.48</b>	<b>0.478</b>	<b>&lt;0.001</b>
11-20	<b>61-70</b>	<b>18.50</b>	<b>0.897</b>	<b>&lt;0.001</b>
	<b>71-80</b>	<b>13.82</b>	<b>0.791</b>	<b>&lt;0.001</b>
	<b>81-90</b>	<b>11.44</b>	<b>0.605</b>	<b>&lt;0.001</b>
	<b>91-00</b>	<b>8.38</b>	<b>0.541</b>	<b>&lt;0.001</b>
	<b>01-10</b>	<b>3.48</b>	<b>0.478</b>	<b>&lt;0.001</b>

Table S13 Pairwise comparisons for effect of education on mission duration (mission-level analysis). P-values are adjusted for multiple hypothesis testing (Holm step-down procedure).

Education (A)	Education (B)	Contrast estimate (A-B)	SE	p-value
No college	<b>B</b>	<b>-8.27</b>	<b>3.013</b>	<b>0.006</b>
	<b>M</b>	<b>-9.96</b>	<b>3.102</b>	<b>0.001</b>
	<b>PhD/MD</b>	<b>-6.97</b>	<b>2.895</b>	<b>0.016</b>
B	<b>No college</b>	<b>8.27</b>	<b>3.013</b>	<b>0.006</b>
	M	-1.70	1.422	0.233
	PhD/MD	1.30	1.468	0.377
M	<b>No college</b>	<b>9.96</b>	<b>3.102</b>	<b>0.001</b>
	B	1.70	1.422	0.233
	<b>PhD/MD</b>	<b>2.99</b>	<b>1.347</b>	<b>0.027</b>
PhD/MD	<b>No college</b>	<b>6.97</b>	<b>2.895</b>	<b>0.016</b>
	B	-1.30	1.468	0.377
	<b>M</b>	<b>-2.99</b>	<b>1.347</b>	<b>0.027</b>

Table S14 Pairwise comparisons for effect of agency on mission duration (mission-level analysis). P-values are adjusted for multiple hypothesis testing (Holm step-down procedure).

Agency (A)	Agency (B)	Contrast estimate (A-B)	SE	p-value
NASA	<b>Roscosmos</b>	<b>-28.93</b>	<b>5.563</b>	<b>&lt;0.001</b>
	ESA	-4.11	2.097	0.050
	<b>CNSA</b>	<b>7.32</b>	<b>1.399</b>	<b>&lt;0.001</b>
	CSA	-1.57	2.971	0.598
	JAXA	-5.47	3.922	0.163
Roscosmos	<b>NASA</b>	<b>28.93</b>	<b>5.563</b>	<b>&lt;0.001</b>
	<b>ESA</b>	<b>24.81</b>	<b>5.466</b>	<b>&lt;0.001</b>
	<b>CNSA</b>	<b>36.25</b>	<b>6.582</b>	<b>&lt;0.001</b>
	<b>CSA</b>	<b>27.36</b>	<b>6.123</b>	<b>&lt;0.001</b>
	<b>JAXA</b>	<b>23.46</b>	<b>6.075</b>	<b>&lt;0.001</b>
ESA	NASA	4.11	2.097	0.050
	<b>Roscosmos</b>	<b>-24.81</b>	<b>5.466</b>	<b>&lt;0.001</b>
	<b>CNSA</b>	<b>11.44</b>	<b>2.699</b>	<b>&lt;0.001</b>
	CSA	2.55	3.509	0.468
	JAXA	-1.36	4.237	0.749
CNSA	<b>NASA</b>	<b>-7.32</b>	<b>1.399</b>	<b>&lt;0.001</b>
	<b>Roscosmos</b>	<b>-36.25</b>	<b>6.582</b>	<b>&lt;0.001</b>
	<b>ESA</b>	<b>-11.44</b>	<b>2.699</b>	<b>&lt;0.001</b>
	<b>CSA</b>	<b>-8.89</b>	<b>3.331</b>	<b>0.008</b>
	<b>JAXA</b>	<b>-12.79</b>	<b>4.352</b>	<b>0.003</b>
CSA	NASA	1.57	2.971	0.598
	<b>Roscosmos</b>	<b>-27.36</b>	<b>6.123</b>	<b>&lt;0.001</b>
	ESA	-2.55	3.509	0.468
	<b>CNSA</b>	<b>8.89</b>	<b>3.331</b>	<b>0.008</b>
	JAXA	-3.90	4.796	0.416
JAXA	NASA	5.47	3.922	0.163
	<b>Roscosmos</b>	<b>-23.46</b>	<b>6.075</b>	<b>&lt;0.001</b>
	ESA	1.36	4.237	0.749
	<b>CNSA</b>	<b>12.79</b>	<b>4.352</b>	<b>0.003</b>
	CSA	3.90	4.796	0.416

Table S15 Pairwise comparisons for effect of launch decade on mission duration (mission-level analysis). P-values are adjusted for multiple hypothesis testing (Holm step-down procedure).

Decade (A)	Decade (B)	Contrast estimate (A-B)	SE	p-value
61-70	<b>71-80</b>	<b>-4.80</b>	<b>1.271</b>	<b>&lt;0.001</b>
	<b>81-90</b>	<b>-3.95</b>	<b>0.909</b>	<b>&lt;0.001</b>
	<b>91-00</b>	<b>-7.28</b>	<b>1.43</b>	<b>&lt;0.001</b>
	<b>01-10</b>	<b>-15.43</b>	<b>2.983</b>	<b>&lt;0.001</b>
	<b>10-20</b>	<b>-51.58</b>	<b>10.552</b>	<b>&lt;0.001</b>
71-80	<b>61-70</b>	<b>4.80</b>	<b>1.271</b>	<b>&lt;0.001</b>
	81-90	0.85	0.965	0.378
	<b>91-00</b>	<b>-2.47</b>	<b>1.107</b>	<b>0.026</b>
	<b>01-10</b>	<b>-10.63</b>	<b>2.339</b>	<b>&lt;0.001</b>
	<b>10-20</b>	<b>-46.78</b>	<b>9.813</b>	<b>&lt;0.001</b>
81-90	<b>61-70</b>	<b>3.95</b>	<b>0.909</b>	<b>&lt;0.001</b>
	71-80	-0.85	0.965	0.378
	<b>91-00</b>	<b>-3.32</b>	<b>0.847</b>	<b>&lt;0.001</b>
	<b>01-10</b>	<b>-11.48</b>	<b>2.346</b>	<b>&lt;0.001</b>
	<b>10-20</b>	<b>-47.63</b>	<b>9.945</b>	<b>&lt;0.001</b>
91-00	<b>61-70</b>	<b>7.28</b>	<b>1.43</b>	<b>&lt;0.001</b>
	<b>71-80</b>	<b>2.47</b>	<b>1.107</b>	<b>0.026</b>
	<b>81-90</b>	<b>3.32</b>	<b>0.847</b>	<b>&lt;0.001</b>
	<b>01-10</b>	<b>-8.16</b>	<b>1.88</b>	<b>&lt;0.001</b>
	<b>10-20</b>	<b>-44.31</b>	<b>9.493</b>	<b>&lt;0.001</b>
01-10	<b>61-70</b>	<b>15.43</b>	<b>2.983</b>	<b>&lt;0.001</b>
	<b>71-80</b>	<b>10.63</b>	<b>2.339</b>	<b>&lt;0.001</b>
	<b>81-90</b>	<b>11.48</b>	<b>2.346</b>	<b>&lt;0.001</b>
	<b>91-00</b>	<b>8.16</b>	<b>1.88</b>	<b>&lt;0.001</b>
	<b>11-20</b>	<b>-36.15</b>	<b>8.254</b>	<b>&lt;0.001</b>
11-20	<b>61-70</b>	<b>51.58</b>	<b>10.552</b>	<b>&lt;0.001</b>
	<b>71-80</b>	<b>46.78</b>	<b>9.813</b>	<b>&lt;0.001</b>
	<b>81-90</b>	<b>47.63</b>	<b>9.945</b>	<b>&lt;0.001</b>
	<b>91-00</b>	<b>44.31</b>	<b>9.493</b>	<b>&lt;0.001</b>
	<b>01-10</b>	<b>36.15</b>	<b>8.254</b>	<b>&lt;0.001</b>

Table S16 Pairwise comparisons for effect of education on military background (mission-level analysis). P-values are adjusted for multiple hypothesis testing (Holm step-down procedure).

Education (A)	Education (B)	Contrast estimate (A-B)	SE	p-value
PhD/MD	<b>M</b>	<b>-0.686</b>	<b>0.086</b>	<b>&lt;0.001</b>
	<b>B</b>	<b>-0.676</b>	<b>0.103</b>	<b>&lt;0.001</b>
	No college	-0.509	0.485	0.295
M	<b>PhD/MD</b>	<b>0.686</b>	<b>0.086</b>	<b>&lt;0.001</b>
	B	0.01	0.087	0.909
	No college	0.177	0.476	0.710
B	<b>PhD/MD</b>	<b>0.676</b>	<b>0.103</b>	<b>&lt;0.001</b>
	M	-0.01	0.087	0.909
	No college	0.167	0.48	0.728
No college	PhD/MD	0.509	0.485	0.295
	M	-0.177	0.476	0.710
	B	-0.167	0.48	0.728

Table S17 Pairwise comparisons for effect of launch decade on military background (mission-level analysis). P-values are adjusted for multiple hypothesis testing (Holm step-down procedure).

Decade (A)	Decade (B)	Contrast estimate (A-B)	SE	p-value
61-70	71-80	0.109	0.132	0.410
	<b>81-90</b>	<b>0.466</b>	<b>0.138</b>	<b>0.001</b>
	<b>91-00</b>	<b>0.528</b>	<b>0.125</b>	<b>&lt;0.001</b>
	<b>01-10</b>	<b>0.595</b>	<b>0.123</b>	<b>&lt;0.001</b>
	<b>10-20</b>	<b>0.474</b>	<b>0.172</b>	<b>0.006</b>
71-80	61-70	-0.109	0.132	0.410
	<b>81-90</b>	<b>0.358</b>	<b>0.123</b>	<b>0.004</b>
	<b>91-00</b>	<b>0.419</b>	<b>0.12</b>	<b>0.001</b>
	<b>01-10</b>	<b>0.486</b>	<b>0.124</b>	<b>&lt;0.001</b>
	<b>10-20</b>	<b>0.366</b>	<b>0.163</b>	<b>0.025</b>
81-90	<b>61-70</b>	<b>-0.466</b>	<b>0.138</b>	<b>0.001</b>
	<b>71-80</b>	<b>-0.358</b>	<b>0.123</b>	<b>0.004</b>
	91-00	0.062	0.089	0.489
	01-10	0.129	0.102	0.206
	10-20	0.008	0.141	0.956
91-00	<b>61-70</b>	<b>-0.528</b>	<b>0.125</b>	<b>&lt;0.001</b>
	<b>71-80</b>	<b>-0.419</b>	<b>0.12</b>	<b>0.001</b>
	81-90	-0.062	0.089	0.489
	01-10	0.067	0.074	0.365
	10-20	-0.054	0.128	0.675
01-10	<b>61-70</b>	<b>-0.595</b>	<b>0.123</b>	<b>&lt;0.001</b>
	<b>71-80</b>	<b>-0.486</b>	<b>0.124</b>	<b>&lt;0.001</b>
	81-90	-0.129	0.102	0.206
	91-00	-0.067	0.074	0.365
	11-20	-0.121	0.117	0.300
11-20	<b>61-70</b>	<b>-0.474</b>	<b>0.172</b>	<b>0.006</b>
	<b>71-80</b>	<b>-0.366</b>	<b>0.163</b>	<b>0.025</b>
	81-90	-0.008	0.141	0.956
	91-00	0.054	0.128	0.675
	01-10	0.121	0.117	0.300