GENERIC RESULTS OF THE SPACE PHYSICS COMMUNITY SURVEY

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13. ABSTRACT *(Maximum 200 words)*

This report summarizes the results of a survey of the members of the space physics research community conducted in 1990-1991 to ascertain demographic information on the respondents and information on their views on a number of facets of their space physics research. The survey was conducted by questionnaire and the information received was compiled in a database and analyzed statistically. The statistical results are presented for the respondent population as a whole and by four different respondent cross sections: individual disciplines of space physics, type of employers, age groups, and research techniques employed.

Data from a brief corresponding survey of the graduate students of respondents are also included.

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1. Introduction

The Space Physics Division (SPD) was established in September 1987 within NASA's then current Office of Space Science and Applications (OSSA). The SPD was created by combining the Space Plasma Physics branch of OSSA's Earth Science and Applications Division with two discipline areas—Solar and Heliospheric Physics and Particle Astrophysics—from the Astrophysics Division. The Space Physics Division comprises four science branches: Cosmic and Heliospheric Physics; Solar Physics; Magnetospheric Physics; and Ionospheric, Thermospheric and Mesospheric Physics.

The overall responsibility of the Space Physics Division is to support investigations of the origin, evolution, and interactions of particles and electromagnetic fields in space plasmas in a wide variety of astrophysical settings. The goals of the Division, endorsed by the Committee on Solar and Space Physics (CSSP) of the National Academy of Sciences, are to understand: (1) the Sun, both as a star and as the dominant source of energy, plasma, and energetic particles in the solar system; (2) the interactions between the solar wind and solar system bodies, including the ionospheres and magnetospheres of the Earth and other bodies in the solar system; (3) the nature of the heliosphere, in its steady state and dynamic configuration; and (4) the origin, acceleration, and propagation of the solar wind and of solar and galactic cosmic rays.

In 1990-1991, on the recommendation of the Space Physics Subcommittee (an advisory body to the Division), the Division conducted a survey of the space physics community to improve its knowledge of the community's resources, needs, and interests, and to assist both itself and the Space Physics Subcommittee in program planning. This report is the product of that survey.

The survey was conducted via questionnaire. Two types of data were gathered: demographic information on the respondents, and the respondent's priorities, opinions, and needs. The organization of this report is as follows: Section 2 describes the target population of the survey. Section 3 provides an overview of the methodology, data-entry procedures and analysis of the responses. (Responses of space physics graduate students are assessed separately.) Section 4 discusses the overall results. In Section 5, population data about the respondents from the research community are analyzed according to: (i) the four disciplines of the Space

Physics Division, (ii) five types of employers of respondents, (iii) eight age groups of respondents, and (iv) three research techniques used by respondents. Sections 6 through Section 11 analyze responses across the four sort groups (though here for the three age groups: 40 and under, 41 to 50, and above 50). The results of the space physics graduate students portion of the survey are provided in Section 12. The questionnaire used for conducting the survey is provided in Appendixes A and B.

Funding for this research was provided by the National Aeronautics and Space Administration under Contract NASW-4394.

The authors are indebted to Drs. Mary Mellott and Miriam Forman of the Space Physics Division, National Aeronautics and Space Administration, who served as technical monitors, and to the staff members of the Science Applications International Corporation who contributed to developing the survey instrument and to recording and analyzing the results. Special thanks are due to Theresa Jefferson, who developed the programs for analysis of the survey data, to Chris Thompson, who structured and edited the report, and to Deb Tripp, who produced it. And, of course, we wish to thank the many members of the Space Physics community whose participation in the survey made the results possible.

2. Survey Target Population

Three separate sources were used to generate the mailing list for the survey. The NASA Space Physics Division's mailing list (1210 entries), a list provided by the American Geophysical Union (AGU) (1475 entries), and a list provided by the American Astronomical Society (AAS) (755 entries). The SPD list included Principal Investigators (PI's) and Co-Investigators (Co-I's) in the NASA Space Physics program and others who have expressed interest in being informed of NASA Announcements of Opportunity and Research Announcements. The AGU list included members whose primary interests are in aeronomy, solar and heliospheric physics, and magnetospheric physics. The AAS list included members interested in solar and high-energy astrophysics. The three lists yielded a raw total of 3440 names. Redundant listings were eliminated, as were all non-U.S. listings, because the survey was intended to cover only the scientific community in the United States. The questionnaire was sent to the remaining 1770 names during the first week of January 1991.

While the principal portion of the questionnaire was intended for the post-graduate research community, one section targeted graduate students in space physics. Because no separate list of graduate students was known to exist, recipients of the questionnaire were asked to pass on the graduate student section to any graduate students in their program or employment.

In a letter that accompanied the questionnaire, recipients were encouraged to respond because the results of the survey could be beneficial to them. They also were assured that the confidentiality and anonymity of the responses would be protected and that the data would be used exclusively by the Space Physics Division and Space Physics Subcommittee, and only for the purposes mentioned in the Introduction (Section 1 above). Three weeks after the mailing, follow-up letters were sent to recipients reminding them to send back their completed questionnaires.

In addition to the 1770 community members on the mailing list, advertisements were placed in two widely circulated scientific publications, *EOS*, the weekly transactions of the AGU; and *Physics Today*, the monthly magazine of the American Physical Society of the American Institute of Physics. These advertisements notified readers of the survey and invited them to request questionnaires and participate. Subsequently, 10 questionnaires were sent out on request, giving a total of 1780.

3. Survey Responses

The two parts of the questionnaire, the primary part intended for the members of the space physics community, and the part intended for space physics graduate students, are contained in Appendix A and Appendix B, respectively. The total of 686 responses to the primary questionnaire received represent 38.5% of the 1780 questionnaires sent. This response rate is similar to those normally obtained in such surveys. In addition, 138 graduate student responses were received but it is not known how many graduate students were given questionnaires, so no response rate can be determined for that part of the survey.

When the completed questionnaires were received, address information was removed and used to update the Space Physics mailing list. The now anonymous response data were checked for completeness and consistency, and then entered into a relational database resident on a stand-alone microcomputer for analysis. After entry, the data were again verified to correct any data entry errors.

A primary variable employed in subsequent analyses of responses is the affiliation of the respondents. The four principal affiliations of the survey population are: universities, NASA, government agencies other than NASA, and industry. A fifth category—other organizations—gathered any affiliations not falling into the first four categories. Table 3-1 shows the distribution by affiliation of the presumed recipients of the questionnaire and of those who responded. Graduate students are not included here.

	Affiliation					
	Univ.	NASA	Other Gov't.	Industry	Other	Total
Recipients	841 (47.2%)	309 (17.4%)	316 (17.7%)	263 (14.8%)	51 (2.9%)	1780
Respondents	362 (53.3%)	101 (14.9%)	98 (14.4%)	78 (11.5%)	40 (5.9%)	679*
Rate of Response	43.0%	32.7%	31.0%	29.7%	78.4%	38.1%*

Table 3-1. Affiliation and Rates of Response to the Questionnaire

Note that response rates are higher for university-affiliated respondents than for government and industry respondents. The significance of the very high response rate for the "other" category of respondents is uncertain, though the smaller absolute numbers in that category may be a contributing factor.

* Seven (7) respondents did not indicate affiliation and are omitted from this table.

4. Overall Results of the Survey of Space Physics Community Members

Section 4 provides an overview of the survey responses from the Space Physics Community questionnaire (i.e., not including the graduate student questionnaire, which is addressed separately later in this report.) The data presented in Section 4 are raw. Later sections of the report will present the data in correlated form, e.g., responses as they vary with discipline, institution, age, or research technique. The heading of each subsection indicates which questions from the questionnaire are addressed in that subsection.

The primary questionnaire (Appendix A) contained 65 questions. Not all respondents answered all questions; the number of respondents for each question is shown in Table 4-1. The nine questions that asked the respondent to provide comments on a subject (i.e., Questions 49b, 51b, 52b, 53b, 55b, 62b, 63b, 64b, and 65) are not counted for the purpose of Table 1.

A number of the survey questions asked respondents to prioritize a number of policy options. For such questions, two measures of the responses are presented in this report. The first measure is the ranking of the options by the number of respondents who assigned that option highest priority. The second measure is a weighted overall ranking, where weights are assigned according to the level of priority assigned (highest weight for highest priority on a scale of 1 to n, where n is the number of options to be ranked).

Question number	Number of responses received	Question number	Number of responses received	Question number	Number of responses received	Question number	Number of responses received
1	665	*17*	662	*33*	227	*49a*	645
2	657	*18*	665	*34*	112	*50*	652
3	660	*19*	566	*35*	112	*51a*	616
4	655	*20*	339	*36*	641	*52a*	516
5	668	*21*	677	*37*	666	*53a*	420
6	616	*22*	280	*38*	624	*54*	522
7	670	*23*	313	*39*	596	*55a*	369
8	638	*24*	190	*40*	172	*56*	555
9	644	*25*	258	*41*	172	*57*	513
10	637	*26*	349	*42*	659	*58*	613
11	668	*27*	679	*43*	661	*59*	347
12	679	*28*	268	*44*	668	*60*	120
13	678	*29*	255	*45*	287	*61*	82
14	679	*30*	255	*46*	287	*62a*	643
15	663	*31*	679	*47*	334	*63a*	641
16	679	*32*	227	*48*	204	*64a*	638

Table 4-1. Number of Responses to Each Question (1–64)

4.1 Involvement of Respondents in NASA Programs (Questions 1–6)

Respondents were asked five questions to help ascertain their current involvement in NASA programs. Table 4-2 provides the results.

Degree of Involvement	Number	%
Ever used Space Physics flight data	533 of 665	80.2
Ever used other OSSA flight data	402 of 657	61.2
Ever received Space Physics funding	489 of 660	74.1
Ever received other NASA funding	375 of 655	57.3
Currently active in Space Physics research	621 of 668	93.0

Table 4-2. Overview of Respondents' Participation in NASA Programs (Questions 1–5)

Respondents were next asked the total number of years they have been involved in space physics research. Their responses are given in Table 4-3 below.

Years of Involvement	No.	%
0–5 Years	77	12.5
6–10 Years	125	20.3
11–15 Years	109	17.7
16–20 Years	104	16.9
21–25 Years	99	16.1
26–30 Years	66	10.7
>30 Years	36	5.8

Table 4-3. Current Respondents' Years of Involvement in Space Physics Research (Question 6) (616 Respondents)

The relatively flat distribution for the intervals from 6 to 25 years is shown graphically in Figure 4-1.

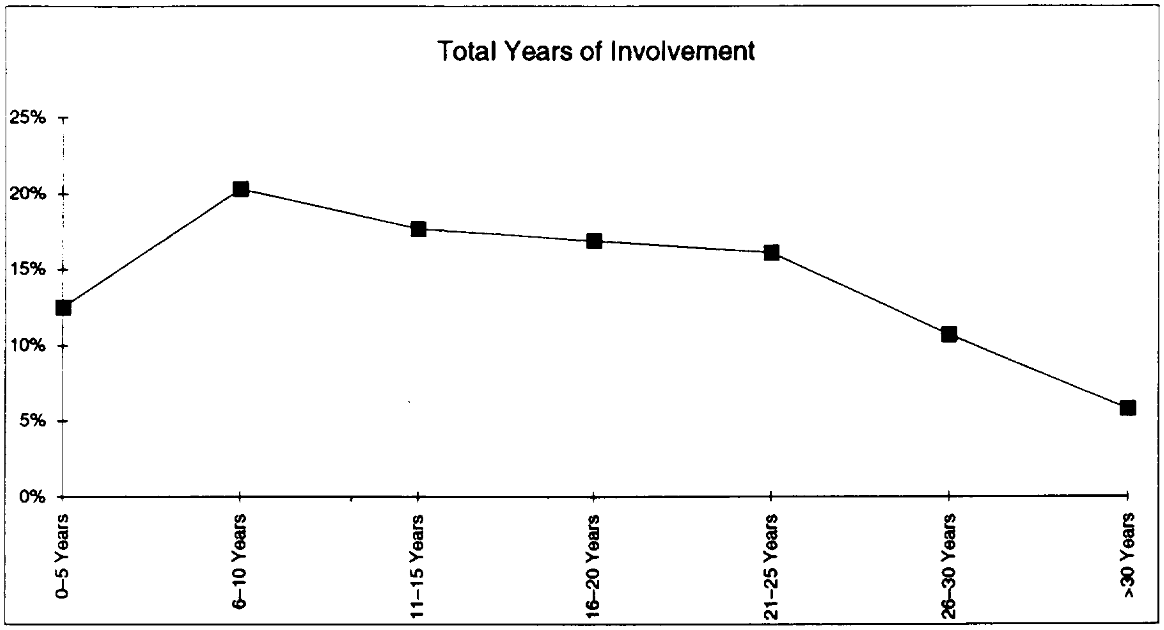

Figure 4-1. Total Years of Involvement in Space Physics Research of the Survey Respondents.

4.2 Academic and Employment Background (Questions 7–8, 10–13)

The breakdown of the 670 respondents who listed the level of the highest degree earned is shown in Table 4-4.

Type of Degree	No.	%
B.S.	9	1.3
M.S.	26	3.9
Ph.D.	635	94.8

Table 4-4. Highest Degree Earned by Respondents (670 Respondents)

The country of origin of the highest degree attained was overwhelmingly the United States, 556 (87.3%) of the 637 who answered the question. The age at which respondents received their highest degree is shown in Figure 4-2. Over 80 percent received their highest degrees when in the age range 25–32 years.

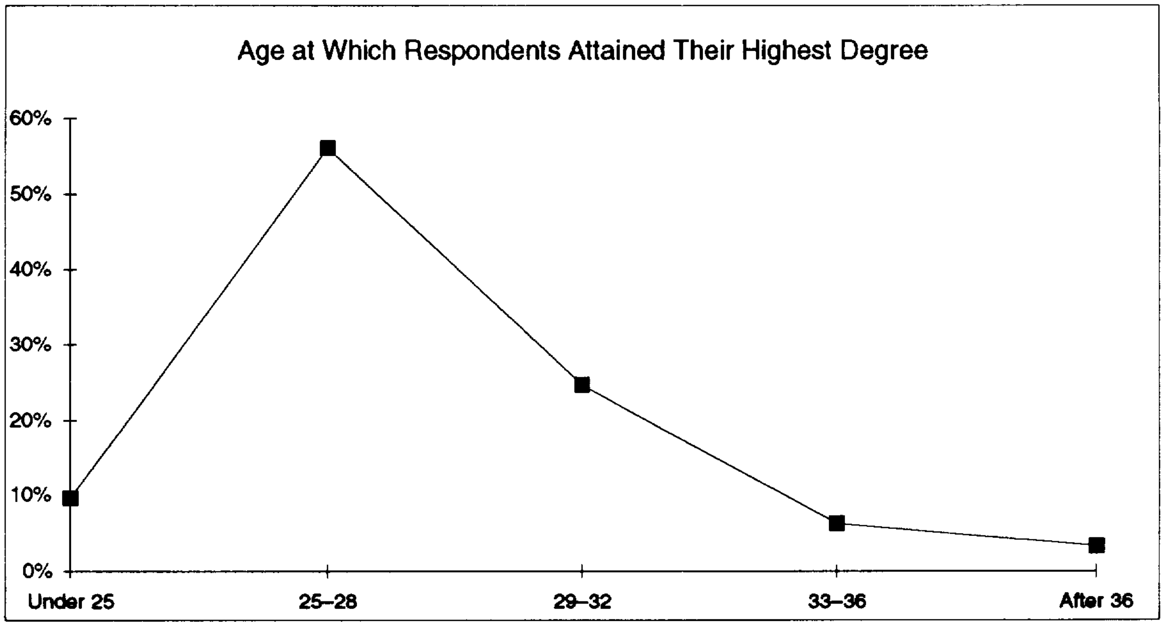

Figure 4-2. Age at Which Respondents Attained Their Highest Degree.

Survey respondents were asked to indicate the discipline in which their highest degree was earned. Of the 668 respondents, 396 (59.3%) earned degrees in the traditional subdisciplines of Space Physics (magnetospheric, ITM, C&H, and solar physics) or the closely related plasma physics. Responses in the "Other" category included solar-terrestrial physics, planetary science, fusion, engineering, chemistry, computer science, mathematics, chemical physics, and nuclear physics. Responses are shown in Table 4-5.

Degree Research Area	No.	%
Magnetospheric Physics	96	14.4
ITM Physics	86	12.9
C&H Physics	71	10.6
Solar Physics	70	10.5
Plasma Physics	72	10.8
Astrophysics	104	15.6
Other	169	25.3

Table 4-5. Discipline in Which Respondents Earned Their Highest Degree (668 Respondents)

The distribution of type of institution of first employment of the 679 respondents who gave this information is shown in Table 4-6. A majority (58.3%) was employed first by a university.

Type of Institution	No.	%
University	396	58.3
Other Government Agencies	117	17.2
Industry	72	10.6
NASA	52	7.7
Other	42	6.2

Table 4-6. Institution of Respondents' First Employment After Earning Highest Degree (679 Respondents)

The distribution of respondents who indicated the type of position held in their first employment after receipt of their highest degree is shown in Table 4-7.

Type of Position	No.	%
Postdoctoral Fellow	344	50.7
Research Scientist	254	37.5
Professor	49	7.2
Administrator/Manager	2	0.3
Others	29	4.3

Table 4-7. Position of Respondents' First Employment After Earning Highest Degree (678 Respondents)

4.3 Current Status of Respondents (Questions 9, 14–18)

This set of questions addressed current occupations, employers, disciplines, age, and research techniques of the survey population. Respondents were first asked to categorize their current employers and present positions. The 679 who listed the institution of current employment are distributed as shown in Table 4-8:

Type of Institution	No.	%
University	362	53.3
Other Government Agencies	98	14.4
Industry	78	11.5
NASA	101	14.9
Other	40	5.9

Table 4-8. Respondents' Current Employers (679 Respondents)

The present positions in which the respondents have their primary responsibility are shown in Table 4-9. The category of "Research Scientist" includes research group leader, and that of "Professor" includes both tenured and non-tenured professors. The "Other" category includes engineers.

Type of Position	No.	%
Research Scientist	379	55.8
Professor	192	28.3
Administrator and Manager	55	8.1
Postdoctoral Fellow	28	4.1
Other	25	3.7

Table 4-9. Respondents' Present Positions (679 Respondents)

Table 4-10 shows the ages of the 644 respondents who responded to that question.

Age Group	No.	%
Under 31	17	2.6
31–35	81	12.6
36–40	112	17.4
41–45	105	16.3
46–50	137	21.3
51–55	81	12.6
56–60	56	8.7
Over 60	55	8.5

Table 4-10. Age of Respondents (644 Respondents)

The age distribution of the respondents is shown in Figure 4-3. Nearly 30% are over 50 years in age, and therefore might be expected to retire in the next 10 to 15 years.

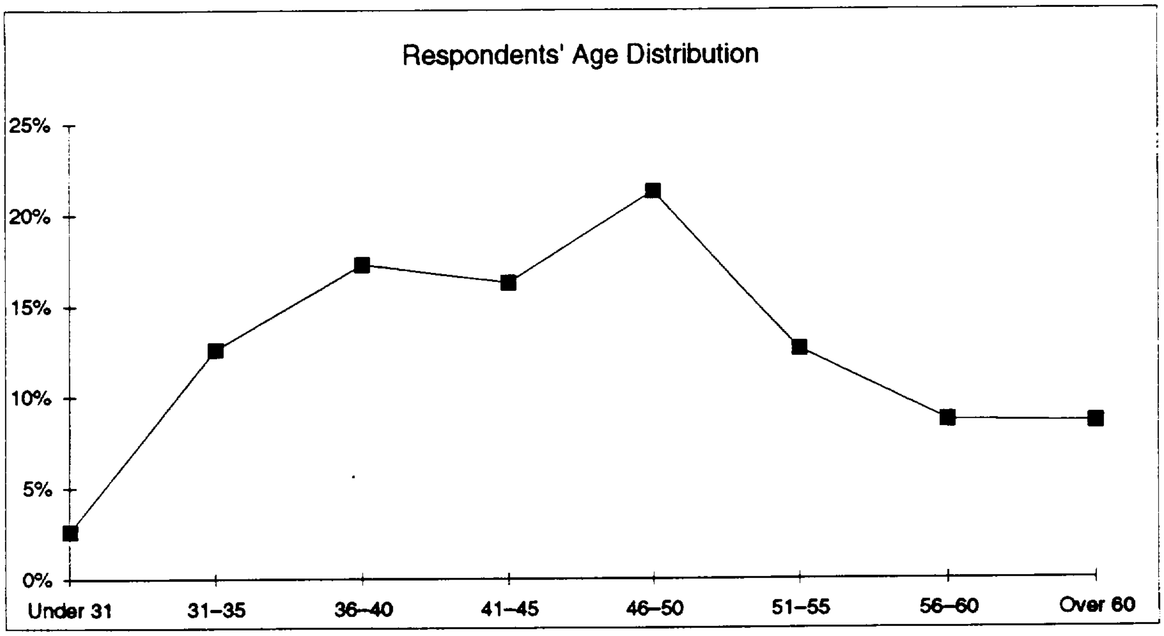

Figure 4-3. Respondents' Age Distribution (Question 9) (644 Respondents).

Respondents were asked to indicate their current primary and secondary discipline areas. Of the 662 respondents to this question, 450 are working in the traditional subdisciplines of space physics (magnetospheric, ITM, C&H, and solar physics). Responses in the "Other" category included solar-terrestrial physics, planetary science, fusion, engineering, chemistry, computer science, mathematics, chemical physics, and nuclear physics. Responses are shown in Table 4-11.

Current Research Area	**No.**	**%**
Magnetospheric Physics	144	21.7
ITM Physics	114	17.2
C&H Physics	73	11.0
Solar Physics	119	18.0
Plasma Physics	39	5.9
Astrophysics	68	10.3
Other	105	15.9

Table 4-11. Respondents' Current Disciplines (662 Respondents)

The distribution of primary research technique identified by the 665 respondents who listed that information is given in Table 4-12.

Primary Research Technique	**No.**	**%**
Theory, Simulation, and Modeling	232	34.9
Instrument Measurements	211	31.7
Data Interpretation	210	31.6
Other	12	1.8

Table 4-12. Respondents' Primary Research Techniques (665 Respondents)

An analysis of the areas of the highest degree attained versus current research areas provides a measure of the extent that respondents were willing to change field. Table 4-13 shows, for those respondents who answered both questions, the current primary fields of research (across the top row) for respondents receiving their highest degree in the fields listed in the left column. For simplicity, only the four conventional subdisciplines of space physics are shown individually across the top (for current research area) while all the listed highest degrees are shown on the left. As might be expected, there is a high correspondence between degree field and current research field. In addition, there appears to be some correlation of astrophysicists in solar physics and a marked tendency for C&H, ITM, and plasma physicists to move into magnetospheric physics. It is also evident that, of the 450 respondents who currently work in the four subdisciplines of space physics, nearly one-third (143) received their highest degree in a different research area.

Current Areas → Field of Degree ↓	C&H Physics	Solar Physics	Magneto-spheric Physics	ITM Physics	Other Areas
C&H Physics	50	6	10	4	1
Solar Physics	0	61	2	2	5
Magnetospheric Physics	0	2	85	3	6
ITM Physics	3	0	11	68	4
Solar-terrestrial Physics	1	4	2	4	10
Planetary Physics	2	2	2	1	9
Fusion	1	1	3	0	6
Astrophysics	3	31	4	3	63
Plasma Physics	4	6	14	7	41
Engineering	1	0	2	5	3
Chemistry	1	0	1	4	3
Mathematics	1	1	1	0	3
Other	6	5	7	13	58
Totals	73	119	144	114	212

(light shading)	No transition from degree field to current work area
(dark shading)	Significant transitions from degree field to current work area

Table 4-13. Respondents' Current Primary Area of Research vs. Area of Highest Degree (Data Having Particular Significance Have Been Shaded)

4.4 Sources of Support for Annual Salary (Questions 19 and 20)

Respondents were asked to indicate the source(s) of their annual salary, indicating the percentage from each source if there is more than one. Respondents were asked to choose among the following sources:

- Universities
- The Space Physics Division

- Other NASA Divisions
- Other Government Agencies
- Industry
- Other Organizations.

Responses from NASA employees were not included in the results, which are shown in Table 4-14 as an overall distribution.

Source of Annual Salary Support	%
University	26.7
NASA Space Physics Division	24.5
NASA Other Divisions	8.8
Other Government	32.9
Industry	3.4
Other	3.7
Total	100.0

Table 4-14. Distribution of Sources of Overall Respondent Salaries, by Source Institution (566 Respondents, Excluding NASA Respondents)

NASA provides 1/3 of the support for the overall respondent salaries, 24.5% of which comes from the Space Physics Division and the remaining 8.8% from other divisions of OSSA (mainly the Astrophysics Division). Other government agencies provide almost as much support (32.9%). The support received from industry and other organizations combined is approximately 7.0%. The "Other" category also includes respondents who are either self-employed or have employment with two or more types of institutions.

Respondents who received funding from the Space Physics Division were asked to indicate the percentage of funding they receive from the different program elements of the Division. Responses from the NASA employees are not included in the results. By far, the largest single support element reported is the SR&T program, providing 31.7% of the support. The overall results are shown in Table 4-15.

Space Physics Program Element	%
Supporting Research and Technology	31.7
Space Physics Theory Program	13.3
Flight Programs	17.4
Mission Operations and Data Analysis	18.5
Guest Investigator Program	9.0
Suborbital Program	6.1
Other	4.0

Table 4-15. Distribution of Sources of SPD-Funded Respondents' Salary, by SPD Program Elements (Question 20) (339 Respondents)

4.5 Size and Sources of Support for PI's and Their Research Groups (Questions 21–26)

Respondents self-identified as NASA PI's or Co-I's for NASA SR&T or flight programs were asked to provide information on the size of their research group and its sources of funding. Of the 677 respondents to question 21 asking respondents their PI/Co-I status, 392 (57.9%) identified themselves as PI's or Co-I's. Of these, 288 reported having scientific and/or technical staff. The totals of full-time equivalent (FTE) positions are shown below in Table 4-16. Because the intent of this section was to profile the second-tier funded population, the responding PI's and Co-I's were asked not to include themselves in their tallies.

Type of Staff	Total FTE's	Average FTE's per research group
Research scientists	667.7	2.3
Graduate students	428.2	1.5
Engineers	333.0	1.2
Technicians	277.1	1.0
Programmers	259.0	1.0
Postdoctoral fellows	250.2	0.9
Undergraduates	192.0	0.7
Others	129.6	0.5
Professors	82.3	0.3
Average Group Size		9.4

Table 4-16. Full-Time Equivalent (FTE) Scientific and Technical Staff in Research Groups of NASA's PI's and Co-I's (Question 22)

Respondents were next asked to report the percentage of their group's research funding from the various funding sources. At a combined 91.5%, the Government was the largest source of reported funding. The largest single source reported was the SPD, at 38.7%. The results are shown in Table 4-17.

Sources of Funding	%
University	5.2
NASA Space Physics Division	38.7
NASA Other Divisions	23.5
Other Government	29.3
Industry	1.6
Other	1.7
Total	100.0

Table 4-17. Distribution of Sources of Research Group Funding Among Source Institutions

PI's and Co-I's who reported receiving funding from the SPD for their research groups were asked to indicate the number of full-time equivalent scientists supported by SPD "soft money" positions for their group. The 190 respondents reported 282.3 FTE's so supported. The respondents were next asked to indicate the percentage of funding provided by the different program elements of the SPD for their research group. By far, the largest single support element reported is the SR&T program, at 42.2% more than twice the percentage of any other program element. Responses from NASA employees are not included in the results, which are shown in Table 4-18.

Space Physics Program Element	%
Supporting Research and Technology	42.2
Space Physics Theory Program	8.6
Flight Programs	19.3
Mission Operations and Data Analysis	12.8
Guest Investigator Program	7.1
Suborbital Program	8.9
Other	1.1

Table 4-18. Distribution of Sources of Research Group Funding Among SPD Program Elements (Question 25) (258 Respondents)

Responses in the "Other" category included funding received from the Graduate Student Research Program and other sources.

Respondents self-identified as NASA PI's or Co-I's were next asked to indicate the amount of funding received from the SPD during the 4-year period 1987-1990. The results are shown in Table 4-19.

Amount of Funding	No.	%
Less than $100,000	132	37.8
$100,000–500,000	155	44.4
$500,000–1,000,000	0	0
$1,000,000–5,000,000	54	15.5
Over $5,000,000	8	2.3

Table 4-19. Distribution of SPD Grants, by Amount

4.6 Data on Graduate Student Supervision by the Respondents (Questions 27–35, 52, 53)

This section of the questionnaire inquired about the graduate student populations supervised by the respondents. Questions addressed directly to graduate student respondents are treated in Section 12 of this report.

4.6.1 Supervision History

Of the 679 respondents to the filter question (#27) for this section, only 272 (40.0%) had ever supervised graduate students. These 272 respondents went on to report that they supervised a total of 1,611 graduate students, 868 of whom (53.9%) worked on Ph.D.'s in Space Physics. The average number of Ph.D.'s supervised (but not necessarily in Space Physics) per respondent is 5.9; the average number of supervised Ph.D.'s in Space Physics per respondent is 3.2. The institutions of first employment for the graduated students is shown in Table 4-20.

Type of Institution	No.	%
University	338	40.2%
Industry	174	20.7%
Other Government Agencies	158	18.8%
NASA	112	13.3%
Other	59	7.0%

Table 4-20. Institution of First Employment of Supervised Space Physics Ph.D.'s (Question 30) (258 Respondents, 841 "Supervisees")

4.6.2 Current Graduate Student Supervision by Respondents (Questions 31–35, 52, 53)

Of the 679 respondents to the filter question (#31) for this section, only 227 (33.4%) were supervising graduate students at the time of the survey. These 227 respondents reported that they were supervising a total of 509 graduate students, 342 (67.2%) of whom were working on Ph.D.'s in Space Physics. The average number of Space Physics Ph.D.'s being supervised per respondent was 1.5.

Only 112 of the 227 potential respondents answered Question 34, which asked how many of their Ph.D. students in Space Physics were currently supported by SPD research funds. These 112 respondents reported a total of 166 Space Physics Ph.D. students (48.5% of the total 342) so supported. A total of 238 of the 342 Space Physics Ph.D. students supervised by respondents were reported to be U.S. citizens (69.6%).

4.6.3 Graduate Student Availability and Research Group Size

Questions 52 (a & b) and 53 (a & b), from the opinion portion of the Survey, are germane to the subject of the graduate student population. In these questions, respondents were asked to provide data and opinions on graduate student availability and research group size. In response to Question 52, the average optimum graduate student research group size, taken from a total of 516 responses, is

2.7 students per year per respondent. This yields a demand for about 1408 students per year.

When asked (in Question 53) how many *additional* graduate students a respondent could effectively attract, supervise and place in a career, given funding availability, the average response among 420 respondents was 2.1 additional students per respondent, for a total of 870 additional students. Added to the 509 current students supervised (in all responding disciplines), this yields a total desired graduate student population of 1379 students, close to the optimum population of 1408 based on individual group size indicated in responses to Question 52.

In Part (b) of Questions 52 and 53, the respondents were given space for comments. A representative sample of the comments follows.

> "Why encourage students to go into space physics theory when there are so few jobs?"

> "I feel apprehensive about producing new Ph.D.'s now. The future seems dark and hard to predict, and I am not confident that most of the Ph.D.'s we are producing right now will ever have secure and permanent jobs."

> "The problem is to find a productive scientific job for the graduate student once he or she has become a productive scientist."

> "Not much interest in space physics viewed as dead-end [sic], since NASA support comes and goes (mostly goes). NASA viewed as not committed to science only to engineering and hardware."

> "Any number of excellent foreign students can be found but they are expensive to support. The pool of U.S. candidates is small."

> "Most NASA missions take more than 10 years to launch which is not suited for the graduate students. Need more small programs suitable for students."

4.6.4 Perceptions of Increased Difficulty in Getting Good Graduate Students (Questions 54 and 55)

Respondents were asked in Question 54 if they were experiencing difficulty in getting good graduate students. Of the 522 respondents to this question, 353 (67.6%) responded affirmatively. In Question 55, those who responded affirmatively to Question 54 were asked to rank, based on their perceptions, different factors responsible for the increased difficulty in getting good graduate students. The various factors to be ranked were: limited number of graduate students, limited research funds, more interesting work in other fields of research, and lack of job potential. The distribution of responses is shown in Table 4-21.

Reason for Difficulty	No.	%
Limited Research Funds	150	40.7
Limited Number of Graduate Students	121	32.8
Lack of Job Potential	70	19.0
More Interesting Work in Other Fields	28	7.5

Table 4-21. Reasons Given for Difficulty in Finding Good Graduate Students (Question 55a) (369 Respondents)

When a more detailed evaluation of these factors was conducted, in which all responses were evaluated with weights assigned in accordance with priority, and the percentages of scores for each factor were calculated, the result yielded the same ranking as above.

In part (b) of Question 55, the respondents were asked to comment on the issue of getting good graduate students to carry out research in their groups. A representative sample of the comments is given below:

> "It is difficult to support graduate students for the required five years time on grants lasting three years or less."

"The problem is not really funding, but attracting physics and astronomy students into doing space physics."

"I think there is sufficient (some more than needed) support for graduate students in the system counting all agencies (i.e., National Science Foundation, Office of Naval Research, and Air Force Office of Scientific and Industrial Research, etc)."

"With the way things are now, present graduate students and postdoctoral [fellows] will soon be changing careers."

"Attracting new space physics students (U.S. citizens) is difficult. Placing them in careers is also difficult, especially the foreign students (no problem attracting them)."

"Limited research funds least important only in the sense that there are currently enough funds on the short term for research. Longer term funds are to be allocated for the graduate students to do research."

"The problem for us is institutional; the solar and astrophysics groups have little visibility to attract potential students to the university."

"The lack of job potential means that there are few (perceived) job opportunities in the private sector, outside academia."

"In our department, "space physics" and "astronomy" compete for new graduate students. Space physics has always faced a disadvantage in this competition because it is less "visible" or "exciting" than astronomy. This problem has perhaps been exacerbated lately by the advent of the great observatories."

"If the possibility of a job is not there after many years of hard work, why get into the field?"

"Students are horrified to see productive researchers on soft money and tenured faculty who do little significant work. The conclusion is that good work is arbitrarily rewarded."

"This is really more a national problem referring to the current values of the nation, and to some extent to lack of visibility of space physics in university campuses in general."

"Limited research funds inhibits search for qualified U.S. students. The U.S. students see little acclaim and economic benefit for rigorous field of study involving 'hard' science."

4.6.5 Institutional Capabilities for Providing Training and Financial Support (Questions 56 and 57)

In Question 56, the respondents were asked to indicate the opportunities provided by their institution for the training of graduate students. Respondents were asked to check as many opportunities as were applicable from a checklist provided. The results are shown in Table 4-22.

Type of Training	No.	%
Data Analysis	507	91.4
Modeling	454	81.8
Theory	452	81.4
Simulation	397	71.5
Laboratory Research	365	65.8
Instrument Calibration	343	61.8
Flight Hardware Design and Fabrication	303	54.6
Academic Preparation	297	53.5
Flight Operations	190	34.2
Program or Project Management	153	27.6
Other	28	5.0

Table 4-22. Institutional Training Opportunities for Graduate Students (Question 56) (555 Respondents)

In Question 57, respondents were asked to indicate what sort of graduate student assistantships and postgraduate employment were available in their university departments. Of the 513 responses, 436 (85%) offered research assistantships, 292 (56.9%) offered teaching assistantships, and 383 (74.7%) offered postgraduate employment.

4.6.6 Graduate Student Research Program (Questions 58–61)

Questions 58–61 measured the respondents' awareness of, and activity in, NASA's Graduate Student Research Program. Of 613 respondents, 353 (57.6%) were aware of the program. Of these, 120 (34%) reported having submitted proposals to the program in the last three years before the survey; the total number of proposals reported submitted was 259. Respondents reported that 139 proposals received funding awards in those three years.

4.7 Computer Resources (Questions 36–48)

In this section, the respondents were asked to state whether or not their access to space physics computer resources and mission data and other relevant databases is adequate to support their research. In response to Question 36, 544 from a total of 641 responses (84.9%) indicated that their access is adequate to support their research.

4.7.1 Networks and Electronic Mail Facilities (Questions 37–41)

The respondents were asked to answer a variety of questions regarding the use of networks and electronic mail facilities. For Question 37, 624 from a total of 666 respondents (about 93.7%) indicated they use networks and electronic mail facilities at present. Question 38 yielded the pattern of use of various networks and electronic mail facilities. The results are shown in Table 4-23 (respondents were asked to check as many networks and electronic mail facilities as applied to them).

Type of Network	No.	%
Space Physics Analysis Network	482	74.2
INTERNET	336	53.8
BITNET	306	49.0
TELENET	161	25.8
NSF Network	64	10.3
Other	33	5.3
NASA Science Internet	30	4.8

Table 4-23. Electronic Network Use Reported (624 Respondents)

Question 39 yielded the frequency of use of networks and electronic mail facilities for sending electronic mail, processing data remotely, transferring data files, and accessing databases. The results are shown in Table 4-24.

(a) Frequency of Electronic Mail Use (596 Respondents)

Frequency of Use	No.	%
Daily	445	74.7
Weekly	81	13.6
Monthly	15	2.5
Occasionally	41	6.9
Never	14	2.3

(b) Frequency of Remote Data Processing (531 Respondents)

Frequency of Use	No.	%
Daily	65	12.2
Weekly	80	15.1
Monthly	48	9.0
Occasionally	184	34.7
Never	154	29.0

(c) Frequency of Data File Transfer (569 Respondents)

Frequency of Use	No.	%
Daily	104	18.3
Weekly	163	28.6
Monthly	86	15.1
Occasionally	182	32.0
Never	34	6.0

(d) Frequency of Database Access (537 Respondents)

Frequency of Use	No.	%
Daily	45	8.4
Weekly	76	14.2
Monthly	57	10.6
Occasionally	248	46.2
Never	111	20.6

Table 4-24 (a–d). Frequency of Types of Use of Electronic Networks

In response to Questions 40 and 41, 164 respondents indicated a need for additional access to networks or electronic mail facilities (about 26.3% of the 624 current users). Eight others indicated a need for new access.

4.7.2 Computer Use (Questions 42 and 43)

Question 42 yielded the distribution of respondent computer use, by type of computer. The results are shown in Table 4-25 (respondents were asked to check as many types of computers as were used in their research).

Type of Computer	No.	%
Microcomputer	553	83.9
Workstation	463	70.3
Mainframe	400	60.7
Minicomputer	353	53.6
Supercomputer	347	52.7
Mini supercomputer	145	22.0
Others	16	2.4

Table 4-25. Types of Computers Used by Respondents (659 Respondents)

From a total of 661 responses to Question 43, 523 (about 79.1%) of the respondents think that their institutions provide adequate computer resources to support their research.

4.7.3 Requirements for Use of Supercomputer (Questions 44–48)

In questions 44–48, respondents were asked to provide information about their current and anticipated use of supercomputers in their research. A total of 334 respondents reported the type of institution where they use supercomputers. Of these, 124 (37.1%) use supercomputers at non-NASA federal laboratories, while 102 (30.5%) use them at NASA's field centers. Another 108 (32.4%) reported using supercomputers at other installations. The number of respondents who expected to use supercomputers in CY 1991 was 47 fewer (14.1%) than those reporting use at the time of the survey. The distribution of anticipated CY 1991 supercomputer time for these respondents is shown in Table 4-26.

CPU Hours	No.	%
Will need 100 hours or less in CY 1991	164	57.1
Will need 100-1000 hours in CY 1991	118	41.1
Will need more than 1000 hours in CY 1991	5	1.7
Total predicted need	48,155 hrs	
Average need per respondent	168 hrs	

Table 4-26. Requirements for Supercomputer Use in CY 1991 (287 respondents)

The distribution of total CPU time for different purposes projected for calender year 1991 is shown in Table 4-27.

Purpose	CPU hours	Percentage
Simulation and Modeling	39920.5	82.9
Data Visualization	4285.8	8.9
Data Analysis	3274.5	6.8
Instrument Design	385.3	0.8
Other	192.6	0.4
Multivariate Statistics	96.3	0.2

Table 4-27. Projected Distribution of Types of CPU Use in CY 1991

4.8 Opinions and Perceptions of Respondents (Questions 49–51, and 64)

The respondents were asked to prioritize in various ways (i) the program elements of the SPD, (ii) techniques used for research, and (iii) options for the structure of the grants program.

4.8.1 Priorities for Increased Funding per Program Element (Question 49)

In Part (a) of Question 49, respondents were asked to prioritize Space Physics Program elements according to need for increased funding, given the assumption that increased funding would be available. They were also asked to assume that the goal of the funding increase would be to maintain or enhance the health of Space Physics in general. Respondents prioritized each of the seven existing program elements, plus an "other" element they could choose to enter in a space provided. Prioritization was indicated by assigning to each program element a priority figure from 1 (highest) to 8 (lowest). Table 4-28 lists the percentage of #1 (highest priority) scores each program element received.

Space Physics Program Element	No.	%
Supporting Research and Technology	193	29.9
Small Missions	171	26.5
Space Physics Theory Program	93	14.4
Mission Operations and Data Analysis	74	11.5
Suborbital Program	49	7.6
Guest Investigator Program	41	6.4
Large Missions	19	2.9
Other*	5	0.8

* "Other" entries given #1 priority included the Graduate Student Research Program, laboratory research, and educational programs.

Table 4-28. Percentage of #1 Rankings for Increased Funding of Program Elements (645 respondents)

An overall ranking of each program element, based on weighted averages, is shown in Table 4-29. Because the "other" category has not been considered in this computation, only 7 program elements are included, and the weight scale is 1 to 7, with 7 for the highest ranked program.

Space Physics Program Element	**Score (Scale of 7)**
Supporting Research and Technology	5.24
Small Missions	5.23
Mission Operations and Data Analysis	4.47
Space Physics Theory Program	4.09
Guest Investigator Program	3.89
Suborbital Program	3.33
Large Missions	2.74

Table 4-29. Weighted Average Scores for Increased Funding of Program Elements

In Part (b) of Question 49, the respondents were given space for comments. A representative sample of the comments follows.

"[The] Suborbital and Supporting Research and Technology Programs develop the scientific infrastructure/basis that NASA badly needs now."

"[There is at present] far too little funding for Small Flight Programs, which I believe yield [the] greatest scientific return for money spent."

"We are finding small flight programs (sounding rockets) to be much more manageable and productive than large programs."

"If [the] Space Physics Division had its own class of Big Explorer/Small Explorer types of missions, then the Mission Operations and Data Analysis would solve many of the existing SR&T/MO&DA shortfalls."

"Small programs [flight and suborbital] and SR&T need increased funding and stability of funding to (i) enhance NASA science output and (ii) provide training for the next generation of scientists."

"There should be a possibility for a graduate student to be with the experimental program from start to finish. This aspect appears to be de-emphasized by NASA."

"It is important that NASA does whatever is possible to support the infrastructure of the space physics community. Small and medium scale efforts will do this best."

"The training of the hardware oriented graduate students is critical for the health of the discipline."

"The balloon program, a part of the Suborbital Program, generates the most science in the shortest time and yet it is underfunded by a factor of three to four of what it should be."

"Strongly encourage Code R to invest more in research on particles and fields system [sic], instrumentation and sensors. SR&T plus flight programs serve common goals of enhanced understanding of solar-terrestrial relations. A balance is needed and I feel that SR&T continues to be comparatively neglected."

"It is my belief that advances in space plasma physics are achieved depending on the technological capability of our spacecraft and instrumentation. Small flight programs with research funds for instrument development allow to develop new capabilities that can be established, such that whenever large flight programs which require established instrument capabilities, then these missions will have the greatest capability for scientific achievement with minimal risk."

4.8.2 Priorities for Space Physics Research Techniques (Question 50)

Respondents were asked to prioritize Space Physics research techniques according to need for funding increase, assuming an increase would be available. Respondents prioritized each of the four existing techniques, plus an "other" technique they could choose to enter in a space provided. Prioritization was indicated by assigning to each technique a priority figure from 1 (highest) to 5 (lowest). Table 4-30 lists the percentage of #1 (highest priority) scores each technique received.

Research Technique	No.	%
Data Interpretation	233	35.7
Instrument Measurements	232	35.6
Theory	86	13.2
Simulation/Modeling	84	12.9
Other*	17	2.6

* "Other" entries given #1 priority included laboratory measurements and ground-based measurements.

Table 4-30. Percentage of #1 Rankings for Increased Funding of Research Techniques (652 Respondents)

An overall ranking of each program element is shown below, based on weighted averages. The "other" category has not been considered in this computation, leading to a weight scale of 1 to 4, with 4 for the highest ranked program.

Research Technique	Score (Scale of 4)
Data Interpretation	2.98
Instrument Measurements	2.68
Theory	2.25
Simulation/Modeling	2.24

Table 4-31. Weighted Average Scores for Increased Funding of Research Techniques

Although comments were not solicited for this question, some were provided by the respondents. A representative sample of the comments follows.

"There has never been enough money available to support data analysis of data that has already been collected and archived."

"Space physics needs have matured from "gee-whiz" observations to input data for theoretical and numerical models; thus we need improved utility of archived data, access of current mission data, multi-satellite and multi-regional measurements and new images of plasma processes: all at the affordable prices."

"Computer modeling of the space physics should be more strongly supported as it will aid in interpreting data and knowing the best places to orbit satellites to get vital informations."

"Progress in simulation is limited by the lack of resources not by computer capacity or techniques."

4.8.3 Priorities for the Structure of the Grants Program (Question 51)

A diversity of opinions exists at present about the structure of the grants program for the SPD. The respondents were asked to rank, in order of priority, various options for the structure of the grants program, assuming no increase in total funding. The options were as follows:

Option 1: Increase the average grant award and duration in order to decrease the amount of time spent in writing proposals. Do this even though the number of grants and the amount of money available for annual competition would decrease.

Option 2: Establish several "Centers of Excellence" both to concentrate scientific and interdisciplinary expertise and to focus on major space physics research problems. Do this even though the number of grants to individuals would decrease significantly.

Option 3: Divert some of the grant funding to support young members preferentially in order to provide more tenured faculty positions.

Option 4: Pursue a distribution that ensures a significant number of new opportunities with funding at lower levels. This funding might include new Ph.D. researchers, young faculty, and researchers from other fields. Do this even though the number of grants to established researchers would decrease.

Option 5: Pursue a distribution that favors established researchers with good productivity and grant awards that can cover research scientists on "soft money." Do this even though there would be fewer grants and little turnover in investigators.

Option 6: Leave the system as it is.

More respondents (35.2% of the 616 respondents) listed Option 1 (increase average award and duration) as having highest priority than any other option. The number and percentage of #1 rankings for each option are shown in Table 4-32.

Option	No. Ranking Option as #1	%
Option 1	217	35.2
Option 4	143	23.2
Option 6	136	22.1
Option 5	55	8.9
Option 3	43	7.0
Option 2	22	3.6

Table 4-32. Percentage of #1 Rankings for Changes to the Structure of the Grants Program (616 Respondents)

The overall ranking (weighted averages) of the perceptions of respondents for options for the structure of the grants program is shown in Table 4-33.

Option	Score (Scale of 6)
Option 1: Increase avg. award and duration	4.54
Option 4: New opportunities, at lower $ levels	4.25
Option 6: Leave the system as is	3.89
Option 3: Support more tenured positions	3.44
Option 5: Favor established, productive rschrs.	3.39
Option 2: Establish "Centers of Excellence"	2.35

Table 4-33. Weighted Average Scores for Structure of the Grants Program (616 Respondents)

The respondents provided comments about the structure of the grants program. A representative sample follows:

"Excellence of research and applicability to NASA's missions should be primary criteria by which grants are awarded, regardless of seniority or institutional affiliation."

"Young people are leaving the soft money space physics program due to the lack of security and opportunity."

"To say that there is no emphasis on seniority or affiliation is all right. But there is a tendency in the current system to discourage new and innovative research. The reason is that it is easier to give a good review of something known than something new and unspecific."

"I am strongly opposed to "centers of excellence" in an era of tight money and dividing the funding pie into too many small pieces that a research career becomes writing, reviewing, and managing grants."

"In principle, excellence should be the only criteria for awarding grants regardless of age, experience, etc. The scarcity of faculty positions is the most discouraging aspect of space science. Soft money does not provide for security or peace of mind and as a young scientist one is often tempted to leave academia for industry, even though the interest and talent may not lie there."

"People are spending far too much time in writing and reviewing proposals. It has gotten to the point of being counterproductive. We could better use the time to do research."

"Preference for a mixed system, where a fraction is set aside for long term grants and the rest for the short term grants. There should be open competition for short term grants with the exclusion of those who have long term grants."

"Try to respond to quality, whatever direction it seems to be leading in. As soon as a policy is enunciated, there are immediately expectations. Be skeptical about specifying detailed policies and then trying to stick to them."

"I feel that any distribution that uses any criteria other than scientific excellence would be detrimental to the program in the long run. In the short run (a) increase the efficiency of grant usage, (b) preserve the existing scientific base, and (c) try to expand the scientific base."

"With all of its faults, the present system does a pretty good job of equitably distributing the available funds. The real problem is the lack of adequate funding for the missions to which the agency is already committed."

"Young investigators should be brought into the program through programs like NSF's Presidential Young Investigator Awards and DOE's Outstanding Young Investigator Awards. These should have a separate funding base. The standard funding base should be used to maintain groups with demonstrated capability to generate science. Groups that have not done this should be excised to make room for young and productive investigators."

"It would be nice to have, available to the space physics community, example of outstanding research proposals that were submitted to and funded by the NASA's Space Physics Division programs, at least one example for each program."

"It seems that there is a general feeling in the community of being overburdened by proposal writing and reviewing, grant management, and community service activities at the expense of quality research time. Yet, the pressure to attempt to cover oneself by writing an ever greater number of proposals is undeniable."

4.8.4 Preferences for Large Versus Small Flight Missions (Question 64)

There were a total of 638 responses to question 64, which asked respondents' preferences for the balance of small, more frequent flight opportunities (such as Explorers, sounding rockets, and balloons) versus large, less frequent ones, though the number of space physics large missions may decrease. An overwhelming majority 91.4% (583 of the total 638 responses) opted for more, smaller missions. Only 8.6% (55 of the total responses) opted for more, larger missions.

Respondents were asked for their comments on this issue. A representative sample is included below.

"I consider this question to be most important issue facing the future development of U.S. scientists and the re-filling of the pipeline from the pool of the pre-college to postgraduate workers."

"Smaller missions are often more innovative and less often hampered and even primarily influenced through considerations."

"More scientists, graduate students, and engineers could participate and learn from smaller missions. More effective way of training real people for the future."

"The larger missions can actually inhibit the advancement of space science, which progresses largely through the smaller missions."

"I recommend that the baseline program should be thought of in terms of a base and [a] vigorous SR&T, MO&DA, and small mission complement which always has number one priority. On top of that can be added supplemented MO&DA, small, intermediate, and perhaps, large mission (number 2 priority). If a mission, especially a large one, overruns by some agreed mixed percentage (e.g., 20%) then automatic and significant , re-assessment should be made; above a larger percent overrun (e.g., 40%) then automatic cancellation should apply (otherwise the number one priority baseline could be threatened). Under no conditions should a large new start with overrun be allowed to cut resources out of the reasonable base-level SR&T resources because that threatens central NASA goals (enhancing our understanding of the solar-terrestrial system or the Earth system etc.) even more (at least in many cases) than the impact of cancellation. In some cases , major scaling down or cancellation may enable new, important, and previously unanticipated possibilities."

"The larger missions are those which can return the first rate science. Without them, tenure slots and perceptions by other scientists in other fields will suffer. But the smaller missions are necessary testbeds."

"A balance between major and smaller missions must be maintained. The problem in the past has been the financial accountability of the major missions. Whenever they encounter problems, they are invariably bailed out at the expense of NASA's smaller programs. This practice must be controlled more effectively or terminated."

"Missions can only be formed based upon improved physical understanding: not because they are small (versus large). The same holds true for larger missions. However, there must remain some type of balance, so that all aspects of the [Space Physics] Division continue to make progress."

"The large missions should take the lowest priority. They generate the least science per dollar spent and provide the poorest opportunity for training the next generation of space scientists. When they fail, the consequences are disastrous."

"NASA should recognize that the vitality of the space physics community; e.g., core science, [and] development of young scientists for future missions, is critically dependent to develop instruments and make frequent observations. This can only be done effectively supporting rockets, balloons and small frequent missions like the Explorers."

"The emphasis on costly, technologically risky large missions is killing space physics and astrophysics."

4.9 Space Physics Data Accessibility and Availability

The respondents were asked to comment on the quality of the services of the National Space Science Data Center (NSSDC) and their perception of the future architecture of the Space Physics Data System of the Space Physics Division.

4.9.1 Quality of the Services of the National Space Science Data Center (Question 62)

There were a total of 643 responses to this question, which asked respondents to rank the services of the NSSDC as Adequate or Inadequate to their research needs.

Of the 643 respondents, 312 (48.5%) reported that they do not use the NSSDC. The non-users were not filtered out from the raters by the survey instrument, but the number of raters equaled the number of users (331). A total of 286 respondents (86.4% of the users) indicated the NSSDC was adequate for their research needs. A total of 45 (13.6% of the users) rated the NSSDC as inadequate for their research needs.

In Part (b) of Question 62, the respondents were given space for comments. A representative sample of the comments follows.

> "[I am] extremely pleased with the service I have received. Not too pleased with some of the data made available by the PI's."

> "The NSSDC needs a vibrant visiting scientist program to enlighten the staff. A data center is a natural home for numerical modelers in search of lots of data."

> "The NSSDC's talents are great but the capabilities in areas other than data archiving and access are strictly limited by the availability of funds."

> "The NSSDC is doing a good job with limited support from the NASA headquarters."

> "Little effort has been spent on archiving data bases with adequate documentation and transportable software. Without these the data are of little value."

> "Some of the older data sets need to be recopied onto new media. Data sets that are not available due to media decay can sometimes be reacquired from their original sources."

> "The NSSDC does a good job of delivering data. The main problems have to do with data quality and documentation. Also they lack the scientific expertise to help scientists in all fields with data-related problems."

"Significant increased sums of money need to be placed in the data management area to make the data more accessible and perceive its integrity in the long term."

4.9.2 Architecture of the Space Physics Data System (Question 63)

In Question 63, respondents were asked to choose between two types of facilities for the future NASA Space Physics Data System (which is in the planning stage at the present time). A choice of two types of facilities was given. The first choice was a distributed facility and the second a centralized facility. From a total of 641 responses, 269 (42.0%) of the respondents had no preference, 224 (34.9%) preferred the distributed facility and 148 (23.1%) the centralized facility.

In part (b) of Question 63 respondents were given space for comments. A representative sample follows.

"A centralized facility currently exists. A distributed facility results in duplication in design, equipment, etc. A distributed facility for new data will relegate NSSDC to archiving old, unwanted, dead data, thereby making NSSDC a dead source of data. Our interests would be better served by rejuvenating NSSDC with a large and vibrant Guest Investigator Program."

"It is far more effective to have access to other institutions data products and tools, than to reinvent them all at a centralized facility. The other choice is to lower expectations, use only a small fraction of available resources and centralized it."

"Strongly support distributed facility. The NSSDC is a good example of an inflexible, slow-moving monstrosity. If a centralized facility is chosen, it should be contracted to private industry or a non-profit, non-civil service organization."

"Distributed facility would be better if universal (standard) protocols, formats, etc. can be established."

"Follow CODMAC recommendations, it is okay to have some control group at NSSDC, but 90% of most productive work will come out of groups with large data holdings and modern data analysis."

"A distributed facility would probably provide access to more data sets than a centralized one, because a centralized requires first submission to the center. It is also easier to maintain and update data bases when the data are where the investigators are."

"Electronic transfer of large volumes of data across the country is still slow and often unreliable. A data system which has elements distributed around the country would provide better data transferability and accessibility."

"With good network access, a centralized facility is more efficient; with poor network access, a distributed facility is preferable."

"Management of data by the experts who generated the data is usually most efficient; thus, I believe distributed data centers with network access as the best plan. Of course, a common user interface is recommended at all of the distributed data centers."

"We already have a centralized system in NSSDC. If the system were distributed to locations where the data are being processed and analyzed, a user would be more likely to get good advice in using and interpreting the data."

"Distributed facility for data sets still being manipulated. When a data set becomes static, it should migrate to a centralized location."

"The PI and his or her institute should be encouraged to develop the capability to provide easy and remote access to most Space Physics Division data sets as well as others of space physics relevance."

5. Cross-Distributions of Respondent Ages, Disciplines, Employers, and Research Techniques (Questions 14–19)

5.1 Disciplines of Respondents

There were 450 respondents who reported they are presently working in the four disciplines of space physics (65.6% of total 686 responses received). Of these 450, a total of 73 (16.2%) reported working in cosmic and heliospheric physics, 119 (26.4%) in solar physics, 144 (32.0%) in magnetospheric physics, and 114 (25.4%) in ITM physics. (In addition to these 450, a total of 31 respondents reported working in solar-terrestrial physics.)

5.1.1 Age Distribution, by Disciplines

Of the 450 respondents to the survey working in the four disciplines of space physics, 423 provided their age, as shown in Table 5-1.

Space Physics Discipline	Number Giving Age
Cosmic and Heliospheric Physics	69
Solar Physics	112
Magnetospheric Physics	134
ITM Physics	108
Total	423

Table 5-1. Number of Respondents Giving Their Age, by Discipline

The age distribution of these respondents is shown in Figure 5-1.

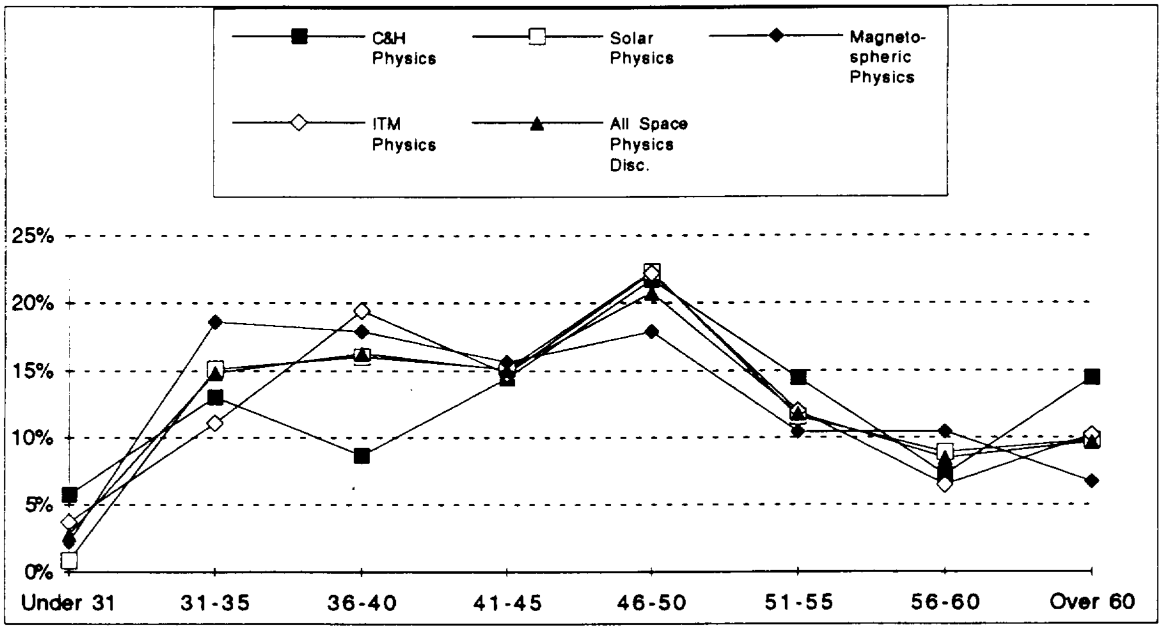

Figure 5-1. Respondents' Age Distribution, by Space Physics Disciplines.

There is little difference in age distribution among the disciplines. Only that for cosmic and heliospheric physics deviates more than a few percent from the full set, and this may be an artifact of the smaller numbers of respondents in that discipline.

5.1.2 Distribution of Research Techniques, by Disciplines

Of the 450 respondents working in the four space physics disciplines, 444 indicated the primary research techniques they used. The distribution of research techniques by space physics research disciplines is provided in Table 5-2.

Research Technique	C&H PHYSICS		SOLAR PHYSICS		MAGNETO. PHYSICS		ITM PHYSICS		TOTAL
	Number	Percent	Number	Percent	Number	Percent	Number	Percent	
Data Interpretation	26	36.1%	52	44.4%	54	38.3%	31	27.2%	163
Theory, Sim., & Model.	20	27.8%	34	29.1%	51	36.2%	28	24.6%	133
Inst. Measurements	26	36.1%	29	24.8%	36	25.5%	53	46.5%	144
Other	0	0.0%	2	1.7%	0	0.0%	2	1.7%	4
All Techniques	72	100.0%	117	100.0%	141	100.0%	114	100.0%	444

Table 5-2. Distribution of Respondents' Research Techniques, by Space Physics Disciplines

5.1.3 Distribution of Employers, by Disciplines

A total of 448 respondents working in the four space physics disciplines identified their current employers. The distribution of these employers by the space physics disciplines is provided in Table 5-3.

Employer	C&H PHYSICS		SOLAR PHYSICS		MAGNETO. PHYSICS		ITM PHYSICS		TOTAL
	Number	Percent	Number	Percent	Number	Percent	Number	Percent	
University	44	60.3%	44	37.0%	78	54.9%	65	57.0%	231
NASA	12	16.4%	27	22.7%	18	12.7%	11	9.7%	68
Other Gov't	11	15.1%	21	17.6%	12	8.5%	14	12.3%	58
Industry	3	4.1%	17	14.3%	23	16.2%	16	14.0%	59
Other	3	4.1%	10	8.4%	11	7.7%	8	7.0%	32
All Employers	73	100.0%	119	100.0%	142	100.0%	114	100.0%	448

Table 5-3. Distribution of Respondents' Current Employer, by Discipline

The distributions are not markedly different, except that there seems to be some concentration of solar physicists in NASA and other government agencies compared to the other disciplines, with a correspondingly smaller percentage in universities.

5.2 Employers of Respondents

Of the total of 686 individuals responding to the survey, 679 identified their employers. The majority of respondents (53.3%) at the time of the survey were employed by universities. The breakdown is shown in Table 5-4 and in Section 4.3.

Type of Institution	Responses	
	Number	%
University	362	53.3
NASA	101	14.9
Other Government Agencies	98	14.4
Industry	78	11.5
Other	40	5.9

Table 5-4. Respondents' Current Employers (679 Respondents)

5.2.1 Age Distribution, by Current Employers

The age distribution of the 640 respondents employed by universities, NASA, other government agencies, and industry who indicated their age is given in Figure 5-2. The age distribution of the university respondents is similar to the age distribution of the total population (see Figure 5-2). NASA respondents seem to be older on the average, with a peak in the 51–55 years-old age group. Industry respondents are younger.

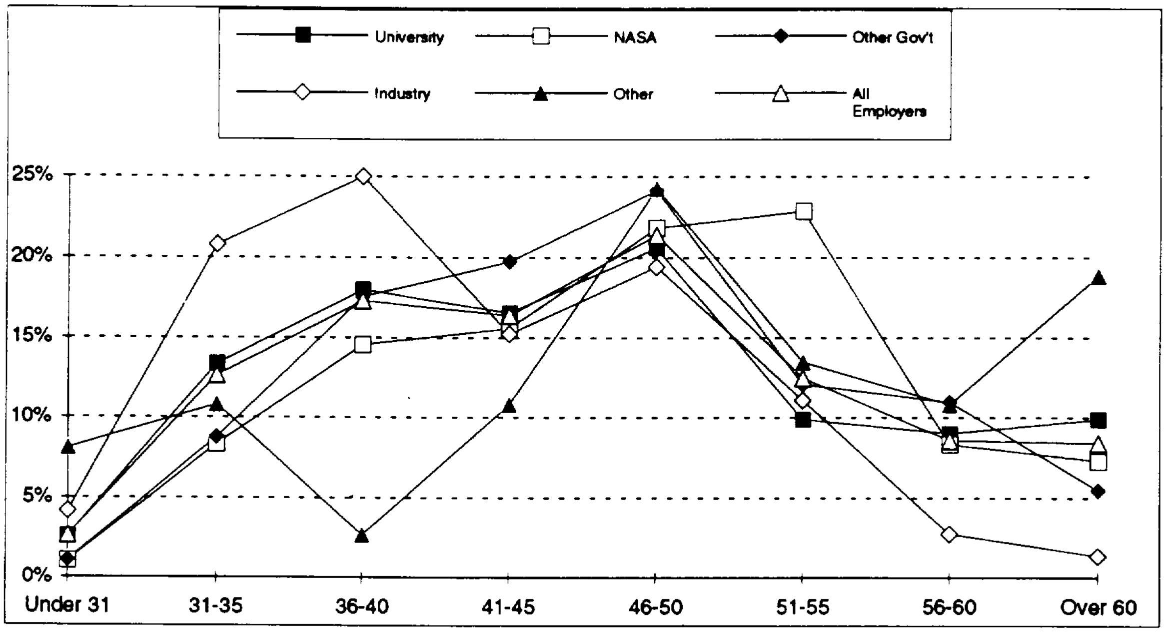

Figure 5-2. Respondents' Age Distribution, by Current Employers.

5.2.2 Distribution of Research Techniques, by Current Employer

Of the total of 679 respondents who identified their employer, 665 also listed the principal research technique they use. The distribution of respondents' research techniques by employer is given in Table 5-5.

Research Technique	UNIVERSITY		NASA		OTHER GOV'T		INDUSTRY		OTHER		TOT-ALS
	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	
Data Interpre-tation	97	27.0%	40	42.6%	36	37.1%	22	29.0%	15	38.5%	210
Theory, Sim., & Model.	145	40.4%	25	26.6%	32	33.0%	21	27.6%	9	23.1%	232
Inst. Measure-ments	113	31.5%	25	26.6%	28	28.9%	31	40.8%	14	35.9%	211
Other	4	1.1%	4	4.2%	1	1.0%	2	2.6%	1	2.5%	12
All Tech-niques	359	100.0%	94	100.0%	97	100.0%	76	100.0%	39	100.0%	665

Table 5-5. Distribution of Respondents' Research Techniques, by Current Employer

5.3 Research Techniques of Total Survey Population

Out of a total of 686 responses to this survey, 665 respondents (96.9%) answered Question 18 regarding their primary research technique. For the following analysis, the respondents are divided into four groups. The first group consists of those respondents who use data interpretation. The second group consists of those respondents who use theory, simulation, and modeling; the third group consists of those who use instrument measurements; and a fourth group is those few who indicated some other technique The results are shown in Table 5-6.

Research Technique	No.	%
Data Interpretation	210	31.6
Theory, Simulation/Modeling	232	34.9
Instrument Measurements	211	31.7
Other	12	1.8

Table 5-6. Primary Research Techniques of Total Survey Population (665 Responses)

5.3.1 Age Distribution, by Research Techniques

A total of 624 of the survey respondents provided both their age and their primary research technique. Distribution of age for each of the research techniques is shown in Figure 5-3. As in the other age distributions, the distributions for each technique differ little from that of the entire survey population, except for the category "Other," where the differences are believed to be an artifact of the small numbers involved.

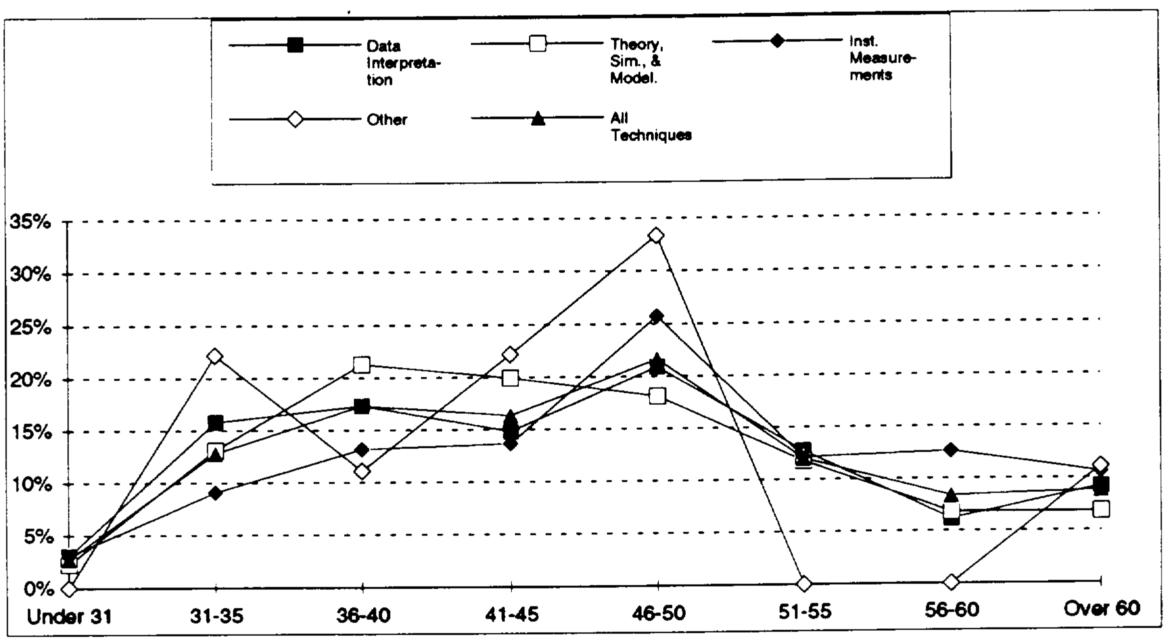

Figure 5-3. Respondents' Age Distribution, by Research Techniques.

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6. Sources of Support for Annual Salary (Question 20)

6.1 Institutional Sources of Respondents' Annual Salaries

6.1.1 Distribution of Institutional Sources of Salary Support, by Respondent Disciplines

The reported institutional sources of salary support for respondents (excluding NASA's respondents), in terms of average percentage, are shown distributed by discipline in Table 6-1. The 372 responses in this category indicate that cosmic and heliospheric physics respondents receive the highest percentage of support from universities; solar and magnetospheric physics respondents receive the highest percentage from NASA (SPD and other divisions); and ITM physics respondents receive the highest support from other government agencies.

	Discipline			
Source of Annual Salary Support	**Cosmic and Heliospheric Physics (57 respondents)**	**Solar Physics (89 respondents)**	**Magneto-spheric Physics (126 respondents)**	**ITM Physics (100 respondents)**
University	34.9%	17.0%	18.9%	20.0%
NASA Space Physics Division	24.5%	33.3%	36.7%	20.9%
NASA Other Division	4.0%	6.6%	8.0%	8.3%
Other Government	29.9%	34.3%	27.0%	44.0%
Industry	2.0%	3.4%	4.5%	2.5%
Other	4.7%	5.4%	4.9%	4.3%

Table 6-1. Institutional Sources of Support for Respondents' Annual Salary, by Discipline (Excluding NASA Respondents)

6.1.2 Distribution of Institutional Sources of Salary Support, by Respondent Employers

The average percentage of respondents' salary support (excluding NASA respondents) from various institutions is shown distributed by employer in Table 6-2. The 574 responses here indicate that respondents employed by universities, other government agencies, and "other" organizations, are primarily supported by their employing institutions. Support for industry respondents is more evenly distributed across sources. More than one third of the support of respondents employed by universities, industry, and other organizations comes from the SPD and other divisions of OSSA.

	Employer			
Source of Annual Salary Support	**University (361 respondents)**	**Other Government (97 respondents)**	**Industry (78 respondents)**	**Other (38 respondents)**
University	41.8%	0.1%	0.0%	0.5%
NASA Space Physics Division	25.9%	12.6%	31.0%	22.6%
NASA Other Division	9.8%	6.2%	13.6%	19.6%
Other Government	20.4%	80.7%	31.4%	23.3%
Industry	0.4%	0.0%	21.8%	1.5%
Other	1.7%	0.4%	2.2%	32.5%

Table 6-2. Institutional Sources of Support for Respondents' Annual Salary, by Employer (Excluding NASA Respondents)

6.1.3 Distribution of Institutional Sources of Salary Support, by Respondent Age Groups

The average percentage of respondents' institutional sources of salary support (excluding NASA respondents) is shown distributed by age group (age equal or less than 40, greater than 40 up to 50, and greater than 50) in Table 6-3. The 539 responses indicate that the youngest age group is supported primarily by the SPD, while the second age group is supported more by other government agencies. The respondents in the third age group receive the greatest support from universities.

	Age Group		
Source of Annual Salary Support	**Age ≤40 (179 respondents)**	**40 < Age ≤50 (212 respondents)**	**Age >50 (148 respondents)**
University	14.7%	26.9%	39.5%
NASA Space Physics Division	39.7%	21.1%	11.6%
NASA Other Divisions	10.2%	12.0%	9.2%
Other Government	30.3%	34.8%	28.1%
Industry	3.1%	2.2%	5.2%
Other	2.0%	3.0%	6.4%

Table 6-3. Institutional Sources of Support for Respondents' Annual Salary, by Age Group (Excluding NASA Respondents)

6.1.4 Distribution of Institutional Sources of Support, by Respondent Research Techniques

The average percentage of respondents' institutional sources of salary support (excluding NASA respondents) is shown distributed by research technique in Table 6-4. Respondents doing data interpretation and instrument measurement receive the greatest percentage of support from NASA. Other government agencies provided about one third of the support for respondents doing theory, simulation, and modeling. A total of 560 responses are included here.

	Research Technique		
Source of Salary Annual Support	**Data Interpretation (165 respondents)**	**Theory, Simulation and Modeling (204 respondents)**	**Instrument Measurements (191 respondents)**
University	21.3%	28.2%	29.0%
NASA Space Physics Division	27.2%	25.8%	20.0%
NASA Other Divisions	9.8%	6.8%	13.4%
Other Government	36.3%	33.1%	28.2%
Industry	3.4%	2.1%	4.4%
Other	2.0%	4.0%	5.0%

Table 6-4. Institutional Sources of Support for Respondents' Annual Salary, by Research Technique (Excluding NASA Respondents)

6.2 SPD Programs' Support of Respondents' Annual Salaries

6.2.1 Distribution of SPD Program Salary Support, by Respondent Discipline

The average percentage of SPD program element support of respondents' salaries (excluding NASA respondents) is shown distributed by discipline in Table 6-5. The 250 relevant responses indicate that SR&T support is most significant in cosmic and heliospheric physics, solar physics, and magnetospheric physics. Respondents in ITM physics receive their greatest support from the Suborbital Program. The MO&DA program is the second most significant program element source of salaries reported by respondents in cosmic and heliospheric physics, magnetospheric physics, and ITM physics; while for the solar physics respondents the second most important source is Flight Programs.

	Discipline			
Space Physics Program Element	**Cosmic and Heliospheric Physics (40 respondents)**	**Solar Physics (60 respondents)**	**Magnetospheric Physics (94 respondents)**	**ITM Physics (56 respondents)**
Supporting Research and Technology	49.6%	34.9%	29.0%	14.0%
Space Physics Theory	7.7%	10.5%	14.3%	15.4%
Flight Program	11.0%	24.0%	20.7%	17.6%
Mission Operations and Data Analysis	19.7%	12.8%	23.2%	18.4%
Guest Investigator Program	10.0%	7.7%	8.0%	13.6%
Suborbital	0.0%	4.8%	1.2%	19.6%
Other	2.0%	5.3%	3.6%	1.4%

Table 6-5. Space Physics Division Program Element Sources of Support for Respondents' Annual Salary, by Discipline (Excluding NASA Respondents)

6.2.2 Distribution of SPD Program Salary Support, by Respondent Employer

The average percentage of SPD program element support of respondents' salaries is shown distributed by employer in Table 6-6. The SR&T Program supports the highest percentage of respondents in universities and other government agencies. Industry respondents receive more support from the MO&DA Program, while those employed by other organizations receive more support from the Flight Program. There were 339 responses applicable to this distribution.

	Employer			
Space Physics Program Element	**University (226 respondents)**	**Other Government (39 respondents)**	**Industry (47 respondents)**	**Other (27 respondents)**
Supporting Research and Technology	37.9%	30.0%	15.2%	12.8%
Space Physics Theory	14.2%	15.5%	11.0%	5.9%
Flight Program	14.0%	20.6%	24.1%	27.2%
Mission Operations and Data Analysis	15.8%	18.6%	29.8%	20.4%
Guest Investigator Program	7.8%	9.9%	10.5%	14.8%
Suborbital	7.4%	1.5%	4.7%	6.3%
Other	2.9%	3.9%	4.7%	12.6%

Table 6-6. Space Physics Division Program Element Sources of Support for Respondents' Annual Salary, by Employer (Excluding NASA Respondents)

6.2.3 Distribution of SPD Program Salary Support, by Respondent Age Group

The average percentage of SPD program element support of respondents' salaries (excluding NASA respondents) is shown distributed by age group in Table 6-7. The 321 relevant responses indicate that the SR&T Program provides the highest percentage of support in each age group. Younger respondents receive more support from the Space Physics Theory Program, MO&DA Program, Guest Investigator Program, and the Suborbital Program, than do respondents in the middle and older age group.

	Age Group		
Space Physics Program Element	**Age ≤40 (128 respondents)**	**40 < Age ≤50 (124 respondents)**	**Age >50 (69 respondents)**
Supporting Research and Technology	28.5%	30.7%	38.5%
Space Physics Theory	16.3%	11.6%	11.4%
Flight Program	14.3%	19.4%	18.2%
Mission Operations and Data Analysis	19.5%	17.3%	18.5%
Guest Investigator Program	10.7%	10.0%	5.7%
Suborbital	7.4%	6.4%	3.9%
Other	3.3%	4.6%	3.8%

Table 6-7. Space Physics Division Program Element Sources of Support for Respondents' Annual Salary, by Age Group (Excluding NASA Respondents)

6.2.4 Distribution of SPD Program Salary Support, by Respondent Research Techniques

The average percentage of SPD program element support of respondents' salares (excluding NASA respondents) is shown distributed by research technique in Table 6-8. The 333 responses indicate that, as might be expected, the SR&T Program provided the highest percentage of support for respondents doing theory, simulation, and modeling; the MO&DA Program provided the highest percentage of support to respondents doing data interpretation; and the Flight and Suborbital Programs provided greatest support to respondents doing instrument measurements.

	Research Technique		
Space Physics Program Element	**Data Interpretation (102 respondents)**	**Theory, Simulation and Modeling (123 respondents)**	**Instrument Measurements (108 respondents)**
Supporting Research and Technology	22.6%	41.0%	28.7%
Space Physics Theory	3.2%	31.8%	2.4%
Flight Program	16.6%	8.8%	27.6%
Mission Operations and Data Analysis	31.2%	5.5%	21.1%
Guest Investigator Program	15.9%	9.2%	2.5%
Suborbital	5.6%	0.5%	13.4%
Other	4.9%	3.2%	4.3%

Table 6-8. Space Physics Division Program Element Sources of Support for Respondents' Annual Salary, by Research Technique (Excluding NASA Respondents)

7. Characteristics of NASA PI's And Co-I's and Their Research Groups (Questions 21–26)

7.1 Percentages of Respondents Who Are NASA PI's and Co-I's

Of the 677 respondents who answered Question 21 regarding their status as NASA PI's or Co-I's, a total of 392 (57.9%) responded that they are either PI's or Co-I's. The following subsections analyze this group according to disciplines, ages, employers, and research techniques. The number of respondents in each subsection will vary within the total of 392, according to the number of responses to the question yielding the distribution.

7.1.1 Distribution of Respondents Who Are NASA PI's and Co-I's, by Respondent Discipline

Of the 447 respondents in the four space physics disciplines who responded to this question, 271 (60.6%) stated that they are either NASA PI's or Co-I's. Table 7-1 shows their distribution across disciplines:

Space Physics Discipline	Respondents	NASA PI's/Co-I's	
Cosmic and Heliospheric Physics	73	53	(72.6% of total)
Solar Physics	116	69	(59.5% of total)
Magnetospheric Physics	144	85	(59.0% of total)
ITM Physics	115	64	(55.7% of total)
Total Space Physics Disciplines	448*	271	(60.5% of total)

Table 7-1. Distribution of NASA PI's and Co-I's, by Space Physics Disciplines (271 Responses)

* One respondent listed two primary disciplines

7.1.2 Distribution of Respondents Who Are NASA PI's and Co-I's, by Respondent Employer

Table 7-2 indicates the percentage of respondents who are NASA PI's and Co-I's, per employer category.

Employer	Respondents	Respondents Who Are NASA PI's/Co-I's	
University	360	212	(58.9%)
NASA	100	71	(71.0%)
Other Government Agencies	96	47	(49.0%)
Industry	78	36	(46.2%)
Other organizations	39	23	(59.0%)
Total	673	389	(57.8%)

Table 7-2. Distribution of NASA PI's and Co-I's, by Employer Categories (389 Responses)

7.1.3 Distribution of Respondents Who Are NASA PI's and Co-I's, by Respondent Age Group

Table 7-3 indicates the percentage of respondents who are NASA PI's and Co-I's in each age group.

Age Group	Respondents	Respondents Who Are NASA PI's/Co-'s	
40 or Younger	208	101	(48.6%)
40–50	240	154	(64.2%)
Over 50	192	117	(60.9%)
Total	640	372	(58.1%)

Table 7-3. Distribution of NASA PI's and Co-I's, by Age Group (372 Responses)

7.1.4 Distribution of Respondents Who Are NASA PI's and Co-I's, by Respondent Research Techniques

Table 7-4 indicates the percentage of respondents who are NASA PI's and Co-I's using each research technique.

Research Technique	Respondents	Respondents Who Are NASA PI's/Co-'s	
Data Interpretation	206	118	(57.3%)
Theory, Simulation, and Modeling	231	123	(53.2%)
Instrument Measurements	209	139	(66.5%)
Total	646	380	(58.8%)

Table 7-4. Distribution of NASA PI's and Co-I's, by Research Technique (380 Responses)

7.2 Full-Time Equivalents (FTE's) in Research Groups Reported by NASA PI's and Co-I's

7.2.1 Distribution of Full-Time Equivalents (FTE's) in Research Groups, by Respondent Discipline

The 392 respondents identified as NASA PI's and Co-I's in Question 21 were asked to report on the number of full-time equivalent positions, in each of ten job categories, included in their research groups. The following subsections analyze the responses according to the disciplines and employers of the respondents.

Table 7-5 provides the distribution of full-time equivalent scientific and technical staff in research groups of NASA PI's and Co-I's by discipline. Solar physics research groups support the largest number of research scientists, while magnetospheric physics research groups support the largest number of postdoctoral fellows. The largest single number of graduate students is supported by research groups of ITM physics respondents.

	FTE's per Discipline			
Type of Positions	Cosmic and Heliospheric Physics	Solar Physics	Magnetospheric Physics	ITM Physics
Professors	10.3	22.4	24.7	2.5
Research Scientists	100.0	185.9	95.4	97.4
Postdoctoral Fellows	56.6	24.6	89.4	17.3
Graduate Students	52.6	55.7	85.2	99.5
Undergraduates	35.0	18.5	35.9	47.3
Engineers	50.7	59.5	54.7	78.5
Programmers	22.5	47.4	47.7	50.5
Technicians	42.4	68.0	48.1	47.7
Others	7.8	19.3	18.0	3.5
Total FTE's	377.9	501.3	499.1	444.2

Table 7-5. Numbers of Full-Time Equivalent Scientific and Technical Staff in NASA PI and Co-I Research Groups, by SPD Discipline

7.2.2 Distribution of Full-Time Equivalents (FTE's) in Research Groups, by Respondent Employer

The numbers of full-time equivalent scientific staff in research groups of NASA PI's and Co-I's by employer are provided in Table 7-6. University research groups employ more scientific and technical staff (except postdoctoral fellows) than any other single employer class. NASA employs more postdoctoral fellows than employed by universities.

Type of Position	FTE's per Employer University	NASA	Other Government Agencies	Industry	Other
Professors	64.4	2.7	15.3	0.0	0.0
Research Scientists	248.5	151.7	96.8	59.4	102.4
Postdoctoral Fellows	99.1	114.8	23.8	6.3	7.3
Graduate Students	362.5	50.0	11.5	6.0	0.2
Undergrad-uates	137.2	39.1	10.5	4.3	3.0
Engineers	145.2	60.2	50.5	34.0	38.5
Programmers	98.2	62.3	51.6	25.1	23.9
Technicians	94.3	62.6	51.8	22.3	41.5
Others	53.8	18.3	26.8	8.6	18.1
Total	1303.2	561.7	338.6	166	234.9

Table 7-6. Numbers of Full-Time Equivalent Scientific and Technical Staff in Research Groups, by Employer of NASA PI's and Co-I's

7.3 Full-Time Equivalents (FTE's) Supported by SPD "Soft" Money in SPD PI and Co-I Research Groups

The 392 respondents identified as NASA PI's and Co-I's in Question 21 were asked to report on the number of full-time equivalent positions in their research groups supported by "soft" money from the Space Physics Division. The following subsections analyze the responses according to the disciplines and employers of the respondents.

7.3.1 Distribution of Soft-Money FTE's, by Respondent PI and Co-I Disciplines

The number of full-time equivalent scientists supported through soft money received by SPD PI's and Co-I's is shown distributed by disciplines and employers in Table 7-7.

Employer	Soft-Money FTE's per Discipline			
	Cosmic and Heliospheric Physics	Solar Physics	Magnetospheric Physics	ITM Physics
University	24.5	33.1	17.2	16.0
NASA	7.2	15.4	20.0	3.8
Other Government	7.3	15.6	5.2	2.7
Industry	3.1	11.5	13.7	0
Other	0	0.5	3.8	8.5
Total	42.1	76.1	59.9	31.0

Table 7-7. Number of FTE Scientists Supported by SPD Soft Money, by Discipline and Employer

7.4 SPD Program Element Funding to NASA PI's and Co-I's, Across Respondent PI and Co-I Disciplines and Employers

The 392 respondents identified as NASA PI's and Co-I's in Question 21 were asked to report, for that portion of their annual salary received from the NASA Space Physics Division, the percentage received from each of the program elements within the Space Physics Division. The following subsections analyze the responses according to the disciplines and employers of the respondents.

7.4.1 Distribution of SPD Program Element Funding to NASA PI's and Co-I's, by Respondent PI and Co-I Disciplines

The distribution of SPD program element funding of PI's and Co-I's within each space physics discipline is shown in Table 7-8. The SR&T program is the biggest single source of funding for cosmic and heliospheric, solar, and magnetospheric physics. The Suborbital Program provides the highest percentage of funding support for ITM physics.

	Discipline			
Space Physics Program Element	**Cosmic and Heliospheric Physics**	**Solar Physics**	**Magneto-spheric Physics**	**ITM Physics**
SR&T	68.3%	48.9%	37.5%	14.6%
Space Physics Theory	4.4%	4.4%	12.4%	11.6%
Flight Program	11.2%	30.2%	19.3%	20.6%
MO&DA	10.9%	5.8%	18.6%	15.8%
Guest Investigator Program	3.2%	5.6%	9.2%	7.7%
Suborbital Program	0.4%	4.2%	3.0%	28.4%
Other	1.6%	0.9%	0.0%	1.3%

Table 7-8. SPD Program Element Sources of Support for Overall Salary Funding of PI's and Co-I's, by Discipline

7.4.2 Distribution of SPD Program Element Funding to NASA PI's and Co-I's, by Respondent PI and Co-I Employers

The distribution of SPD program element funding of PI/Co-I salary within each employer category is shown in Table 7-9. The PI's and Co-I's employed by universities, NASA, other government agencies, and industry receive the highest percentage of funding from the SR&T Program; while the PI's and Co-I's employed at other organizations receive the highest percentage of funding from Flight Programs. The MO&DA and Flight Programs provide roughly the same percentage of funding to the industry respondents as provided by the SR&T Program.

	Employer				
Space Physics Program Element	**University**	**NASA**	**Other Government Agencies**	**Industry**	**Other**
Supporting Research and Technology Program	45.6%	42.0%	40.4%	30.9%	22.7%
Space Physics Theory Program	9.1%	6.4%	14.6%	0.5%	12.1%
Flight Program	14.4%	23.4%	21.9%	28.8%	34.7%
Mission Operations and Data Analysis	10.3%	15.1%	10.4%	29.4%	14.7%
Guest Investigator Program	7.8%	5.8%	5.2%	6.7%	6.8%
Suborbital Program	11.7%	7.3%	1.7%	3.7%	6.1%
Other	1.1%	0.0%	5.8%	0.0%	2.9%

Table 7-9. SPD Program Element Sources of Support for Overall Salary Funding of PI's and Co-I's, by PI/Co-I Employer Category

8. Expressed Priorities for Increased Funding of SPD Program Elements (Question 49)

There were a total of 645 responses to Question 49, which asked respondents to prioritize increased funding of the SPD program elements. Of these 645 respondents, 432 also provided sufficient information to be analyzed according to discipline, employer, age group, and research techniques in the following subsections.

8.1 Distribution of Expressed Priorities for Increased Funding of SPD Program Elements, by Respondent Disciplines

The distribution of SPD program element accorded the highest priority for increased funding by the respondents, listed by the respondent's discipline, is shown in Table 8-1.

	Respondent's Discipline							
Space Physics Program Element	Cosmic and Heliospheric Physics (68 respondents)		Solar Physics (111 respondents)		Magneto-spheric Physics (142 respondents)		ITM Physics (111 respondents)	
Supporting Research and Technology	30	(44.1%)	44	(39.6%)	37	(26.1%)	22	(19.8%)
Space Physics Theory	5	(7.4%)	10	(9.0%)	20	(14.1%)	8	(7.2%)
Large Flight Program	2	(2.9%)	6	(5.4%)	5	(3.5%)	2	(1.8%)
Small Flight Program	16	(23.5%)	25	(22.6%)	41	(28.9%)	43	(38.7%)
Mission Operations and Data Analysis	11	(16.2%)	9	(8.1%)	22	(15.5%)	11	(9.9%)
Guest Investigator Program	0	(0.0%)	7	(6.3%)	11	(7.7%)	7	(6.4%)
Suborbital Program	4	(5.9%)	9	(8.1%)	5	(3.5%)	17	(15.3%)
Other	0	(0.0%)	1	(0.9%)	1	(0.7%)	1	(0.9%)

Table 8-1. Space Physics Program Element Selected by Respondents as Having the Highest Priority for Increased Funding, by Respondent Discipline

Table 8-2 shows the weighted average scores for priority for increased funding, by discipline of respondents, of all the ranked program elements. The weighting scale is from 1 to 7, with the highest ranked element given a weight of 7, the lowest 1, and the others ordered appropriately between. The highest ranked program element for each discipline is shaded.

	Respondent's Discipline			
Space Physics Program Element	**Cosmic and Heliospheric Physics**	**Solar Physics**	**Magneto-spheric Physics**	**ITM Physics**
Supporting Research and Technology	5.91	5.72	4.94	4.37
Space Physics Theory	3.51	3.64	4.20	3.84
Large Flight Program	3.27	2.86	2.67	2.26
Small Flight Program	5.40	5.14	5.27	5.67
Mission Operations and Data Analysis	4.46	4.36	4.70	4.35
Guest Investigator Program	3.14	3.79	4.13	3.97
Suborbital Program	3.42	3.53	2.99	4.14

Table 8-2. Weighted Average Scores of Priority for Increased Funding of Space Physics Program Elements, by Respondent Discipline (Scale of 7)

8.2 Distribution of Expressed Priorities for Increased Funding of SPD Program Elements, by Respondent Employers

The distribution of SPD program element accorded the highest priority for increased funding by the respondents, listed by the respondent's employer, is shown in Table 8-3.

	Respondent's Employer									
Space Physics Program Element	**University (341 respondents)**		**NASA (94 respondents)**		**Other Government (95 respondents)**		**Industry (77 respondents)**		**Other (35 respondents)**	
Supporting Research and Technology	112	(32.9%)	32	(34.0%)	26	(27.4%)	17	(22.1%)	6	(17.1%)
Space Physics Theory	56	(16.4%)	9	(9.6%)	14	(14.7%)	7	(9.1%)	7	(20.0%)
Large Flight Program	12	(3.5%)	1	(1.1%)	1	(1.1%)	5	(6.5%)	0	(0.0%)
Small Flight Program	71	(20.8%)	29	(30.8%)	31	(32.6%)	28	(36.3%)	10	(28.6%)
Mission Operations and Data Analysis	24	(7.0%)	13	(13.8%)	16	(16.8%)	12	(15.6%)	9	(25.7%)
Guest Investigator Program	26	(7.6%)	3	(3.2%)	4	(4.2%)	7	(9.1%)	1	(2.9%)
Suborbital Program	36	(10.6%)	6	(6.4%)	3	(3.2%)	1	(1.3%)	2	(5.7%)
Other	4	(1.2%)	1	(1.1%)	0	(0.0%)	0	(0.0%)	0	(0.0%)

Table 8-3. Space Physics Program Element Selected by Respondents as Having the Highest Priority for Increased Funding, by Respondent Employer

Table 8-4 shows the weighted average scores for priority for increased funding, by the current employer of respondents, of all the ranked program elements. The weighting scale is from 1 to 7, with the highest ranked element given a weight of 7, the lowest 1, and the others ordered appropriately between. The highest ranked program element for each employer is shaded.

	Respondent's Employer				
Space Physics Program Element	**University**	**NASA**	**Other Government**	**Industry**	**Other**
Supporting Research and Technology	**5.30**	**5.56**	4.89	5.19	4.88
Space Physics Theory	4.25	3.57	4.22	3.63	4.06
Large Flight Program	2.73	2.97	2.68	2.62	2.79
Small Flight Program	5.07	5.34	**5.17**	**5.61**	**5.55**
Mission Operations and Data Analysis	4.22	4.66	4.66	4.82	5.03
Guest Investigator Program	3.96	3.33	3.85	3.95	3.85
Suborbital Program	3.42	3.27	3.19	2.82	2.76

Table 8-4. Weighted Average Scores of Priority for Increased Funding of Space Physics Division Program Elements, by Respondent Employer (Scale of 7)

8.3 Distribution of Expressed Priorities for Increased Funding of SPD Program Elements, by Respondent Age Groups

The distribution of SPD program element accorded the highest priority for increased funding by the respondents, listed by the respondent's age groups, is shown in Table 8-5.

	Age of Respondents					
Space Physics Program Element	**Age ≤40 (199 respondents)**		**40 < Age ≤50 (227 respondents)**		**Age >50 (181 respondents)**	
Supporting Research and Technology	50	(25.1%)	69	(30.4%)	65	(35.9%)
Space Physics Theory	36	(18.1%)	32	(14.1%)	23	(12.7%)
Large Flight Program	6	(3.0%	9	(4.0%)	3	(1.7%)
Small Flight Program	49	(24.7%)	65	(28.6%)	45	(24.9%)
Mission Operations and Data Analysis	27	(13.6%)	25	(11.0%)	20	(11.0%)
Guest Investigator Program	16	(8.0%)	11	(4.8%)	6	(3.3%)
Suborbital Program	14	(7.0%)	16	(7.1%)	17	(9.4%)
Other	1	(0.5%)	0	(0.0%)	2	(1.1%)

Table 8-5. Space Physics Program Element Selected by Respondents as Having the Highest Priority for Increased Funding, by Respondent Age Group

Table 8-6 shows the weighted average ranking of priority for increased funding, by age groups, of all the ranked program elements. The weighting scale is from 1 to 7, with the highest ranked element given a weight of 7, the lowest 1, and the others ordered appropriately between. The highest ranked program element for each age group is shaded.

	Age of Respondent		
Space Physics Program Element	**Age ≤40**	**40 < Age ≤50**	**Age >50**
Supporting Research and Technology	4.98	**5.27**	**5.57**
Space Physics Theory Program	4.18	4.24	3.78
Large Flight Program	2.71	2.68	2.65
Small Flight Program	**5.10**	5.20	5.31
Mission Operations and Data Analysis	4.64	4.38	4.53
Guest Investigator Program	4.00	3.83	3.86
Suborbital Program	3.02	3.36	3.58

Table 8-6. Weighted Average Scores of Priority for Increased Funding of Space Physics Program Elements, by Respondent Age Group (Scale of 7)

8.4 Distribution of Expressed Priorities for Increased Funding of SPD Program Elements, by Respondent Research Techniques

The distribution of SPD program element accorded the highest priority for increased funding by the respondents, listed by the respondent's research techniques, is shown in Table 8-7.

	Respondent's Primary Research Technique					
Space Physics Program Element	**Data Interpretation (200 respondents)**		**Theory, Simulation and Modeling (217 respondents)**		**Instrument Measurements (199 respondents)**	
Supporting Research and Technology	57	(28.5%)	63	(29.0%)	60	(30.2%)
Space Physics Theory Program	4	(2.0%)	84	(38.7%)	4	(2.0%)
Large Flight Program	6	(3.0%)	4	(1.8%)	9	(4.5%)
Small Flight Program	61	(30.5%)	35	(16.1%)	68	(34.2%)
Mission Operations and Data Analysis	38	(19.0%)	16	(7.4%)	14	(7.0%)
Guest Investigator Program	22	(11.0%)	8	(3.7%)	10	(5.0%)
Suborbital Program	12	(6.0%)	3	(1.4%)	33	(16.6%)
Other	0	(0.0%)	4	(1.9%)	1	(0.5%)

Table 8-7. Space Physics Program Element Selected by Respondents as Having the Highest Priority for Increased Funding, by Respondent Research Techniques

Table 8-8 shows the weighted average ranking of priority for increased funding, by research techniques, of all the ranked program elements. The weighting scale is from 1 to 7, with the highest ranked element given a weight of 7, the lowest 1, and the others ordered appropriately between. The highest ranked program element for each research technique is shaded.

	Respondent's Primary Research Technique		
Space Physics Program Element	**Data Interpretation**	**Theory, Simulation and Modeling**	**Instrument Measurements**
Supporting Research and Technology	5.10	5.27	5.28
Space Physics Theory Program	3.34	**5.41**	3.24
Large Flight Program	2.86	2.50	2.90
Small Flight Program	**5.30**	4.72	**5.65**
Mission Operations and Data Analysis	4.91	4.09	4.37
Guest Investigator Program	4.23	4.05	3.44
Suborbital Program	3.12	2.80	4.08

Table 8-8. Weighted Average Scores of Priority for Increased Funding of Space Physics Program Elements, by Respondent Research Technique (Scale of 7)

9. Expressed Priorities for Changes to the SPD Grants Program (Question 51)

There were a total of 616 responses to Question 51, which asked respondents to prioritize options for changes to the SPD grants program. The options and responses are summarized in Section 4.8.3 above. The options are repeated here for convenience:

Option 1: Increase the average grant award and duration in order to decrease the amount of time spent in writing proposals. Do this even though the number of grants and the amount of money available for annual competition would decrease.

Option 2: Establish several "Centers of Excellence" both to concentrate scientific and interdisciplinary expertise and to focus on major space physics research problems. Do this even though the number of grants to individuals would decrease significantly.

Option 3: Divert some of the grant funding to support young members preferentially in order to provide more tenured faculty positions.

Option 4: Pursue a distribution that ensures a significant number of new opportunities with funding at lower levels. This funding might include new Ph.D. researchers, young faculty, and researchers from other fields. Do this even though the number of grants to established researchers would decrease.

Option 5: Pursue a distribution that favors established researchers with good productivity and grant awards that can cover research scientists on "soft money." Do this even though there would be fewer grants and little turnover in investigators.

Option 6: Leave the system as it is.

In every distribution set reported in the following subsections, Option 1 was the overall preferred option. The analysis in each subsection below is reported in the form of weighted average on a scale of 6.

9.1 Distribution of Expressed Priorities for Changes to the SPD Grants Program, by Respondent Disciplines

The overall rankings (weighted averages) of expressed priorities for changes to the SPD grants program are shown by respondent disciplines in Table 9-1. The overall preferred option was Option 1, although respondents in the ITM physics discipline preferred Options 4 and 6 by a small difference (by .27 and .24, respectively, on a scale of 6). Option 4 offered to establish more grants at lower funding levels, and Option 6 offered to leave the system as is. The highest ranked option for each discipline is shaded.

	Respondent Discipline			
Option	**Cosmic and Heliospheric Physics**	**Solar Physics**	**Magnetospheric Physics**	**ITM Physics**
First Option	4.66	4.24	4.66	4.19
Second Option	2.19	2.33	2.59	2.08
Third Option	3.74	3.61	3.19	3.05
Fourth Option	4.27	2.86	3.92	4.46
Fifth Option	3.45	3.41	3.52	2.52
Sixth Option	3.61	4.19	3.81	4.43

Table 9-1. Weighted Average Scores for Options for the Structure of the Grants Program, by Respondent Discipline (Scale of 6)

9.2 Distribution of Expressed Priorities for Changes to the SPD Grants Program, by Respondent Employers

The overall rankings (weighted averages) of expressed priorities for changes to the SPD grants program are shown by respondent employers in Table 9-2. The overall preferred option was again Option 1. Option 4 was a close second in all cases (a .04 difference among NASA respondents) except in the Other employer category, where Option 1 was favored by significant margins over Options 6 (.97 margin) and 4 (1.14 margin). The highest ranked option for each employer is shaded.

Option	University	NASA	Other Government	Industry	Other
First Option	4.52	4.49	4.45	4.56	4.93
Second Option	2.15	2.60	2.85	2.54	2.17
Third Option	3.54	3.25	3.53	3.06	3.03
Fourth Option	4.21	4.45	4.22	4.36	3.79
Fifth Option	3.51	3.23	3.24	3.25	3.59
Sixth Option	3.88	3.90	3.71	4.10	3.96

Table 9-2. Weighted Average Scores for Options for the Structure of the Grants Program, by Respondent Employer (Scale of 6)

9.3 Distribution of Expressed Priorities for Changes to the SPD Grants Program, by Respondent Age Groups

The overall rankings (weighted averages) of expressed priorities for changes to the SPD grants program are shown by respondent age groups in Table 9-3. The overall preferred option was again Option 1, although for respondents aged 40 years or younger, Option 4 was preferred by a margin of .15. Option 4 was the second preference in the two older age groups. Option 6 was the third preference in all three age groups. The highest ranked option for each age group is shaded.

Option	Age ≤40	40 < Age ≤50	Age >50
First Option	4.35	4.60	4.64
Second Option	2.40	2.32	2.38
Third Option	3.55	3.20	3.41
Fourth Option	4.50	4.08	4.06
Fifth Option	3.03	3.75	3.49
Sixth Option	3.71	3.97	3.99

Table 9-3. Weighted Average Scores for Options for the Structure of the Grants Program, by Respondent Age Group (Scale of 6)

9.4 Distribution of Expressed Priorities for Changes to the SPD Grants Program, by Respondent Research Techniques

The overall rankings (weighted averages) of expressed priorities for changes to the SPD grants program are shown by respondent research techniques in Table 9-4. In order of ranking, Options 1, 4, and 6 were preferred. The highest ranked option for each research technique is shaded.

Option	Data Interpretation	Theory, Simulation and Modeling	Instrument Measurements
First Option	4.51	4.54	4.59
Second Option	2.27	2.53	2.30
Third Option	3.34	3.47	3.34
Fourth Option	4.29	4.24	4.16
Fifth Option	3.47	3.32	3.49
Sixth Option	3.80	3.79	4.09

Table 9-4. Weighted Average Scores for Options for the Structure of the Grants Program by Respondents' Research Techniques (Scale of 6)

10. Reasons Given for Difficulty in Finding Good Graduate Students (Question 55)

There were a total of 369 responses to Question 55, which asked respondents to choose among four possible reasons for their difficulty in getting good graduate students. (Question 54, which asked if respondents had experienced this difficulty, filtered the respondents from 522 to 353 for Question 55. An additional 16 respondents, presumably from the group who indicated that they did not have difficulty in finding good graduate students, also answered Question 55.) The reasons and responses are summarized in Section 4.6.3 above.

In every distribution set reported in the following subsections, Reasons 1 (limited number of graduate students) and 2 (limited research finds) were ranked highest overall, and in that order. They were followed by Reason 4 (limited job opportunities) and Reason 3 (more interesting work in other fields). The analysis in each subsection below is reported in the form of weighted average on a scale of 4.

10.1 Distribution of Reasons Given for Difficulty in Finding Good Graduate Students, by Respondent Disciplines

The overall rankings (weighted averages) of reasons given for difficulty in finding good graduate students are shown by respondent disciplines in Table 10-1. Cosmic and heliospheric physics respondents gave Reason 3 (more interesting work in other fields) a significantly higher ranking than did the other disciplines. They were also at variance from the other disciplines in giving Reason 4 (lack of job potential) their highest ranking. The highest ranked reason for each discipline is shaded.

	Respondent's Discipline			
Reason for Difficulty	**Cosmic and Heliospheric Physics**	**Solar Physics**	**Magneto-spheric Physics**	**ITM Physics**
Limited Number of Graduate Students	2.92	3.00	2.61	2.85
Limited Research Funds	2.53	**3.03**	**3.06**	**3.20**
More Interesting Work in Other Fields	2.62	1.81	2.04	1.85
Lack of Job Potential	**2.94**	2.63	2.63	2.45

Table 10-1. Weighted Average Scores for Reasons Given for Difficulty in Finding Good Graduate Students, by Respondent Discipline (Scale of 4)

10.2 Distribution of Reasons Given for Difficulty in Finding Good Graduate Students, by Respondent Age Groups

The overall rankings (weighted averages) of reasons given for difficulty in finding good graduate students are shown by respondent age groups in Table 10-2. There is little significant variation across age groups, although the over-50 age group put a greater emphasis on Reason 2 (limited research funds) over Reason 1 (limited number of graduate students) than did the other age groups. The highest ranked reason for each age group is shaded.

	Respondent's Age Group		
Reason for Difficulty	**Age ≤ 40**	**$40 <$ Age ≤ 50**	**Age >50**
Limited Number of Graduate Students	**2.99**	2.84	2.63
Limited Research Funds	2.90	**3.01**	**3.22**
More Interesting Work in Other Fields	1.86	1.94	2.19
Lack of Job Potential	2.63	2.61	2.65

Table 10-2. Weighted Average Scores for Reasons Given for Difficulty in Finding Good Graduate Students, by Respondent Age Group (Scale of 4)

10.3 Distribution of Reasons Given for Difficulty in Finding Good Graduate Students, by Respondent Research Techniques

The overall rankings (weighted averages) of reasons given for difficulty in finding good graduate students are shown by respondent research techniques in Table 10-3. There is little significant variation across research techniques, although the Theory, Simulation, and Modeling group put a greater emphasis on Reason 2 (limited research funds) over Reason 1 (limited number of graduate students) than did the other groups. The highest ranked reason for each research technique is shaded.

	Respondent's Primary Research Technique		
Reason for Difficulty	**Date Interpretation**	**Theory, Simulation and Modeling**	**Instrument Measurements**
Limited Number of Graduate Students	2.94	2.68	2.91
Limited Research Funds	3.00	3.16	2.92
More Interesting Work in Other Fields	1.94	2.09	1.95
Lack of Job Potential	2.75	2.50	2.64

Table 10-3. Weighted Average Scores for Reasons Given for Difficulty of Finding Good Graduate Students, by Respondent Research Techniques (Scale of 4)

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11. Predicted Requirements for Supercomputer Use (Question 45)

There were a total of 287 responses to Question 45, which asked respondents to indicate how many hours of supercomputer time they expected to need for their research in calendar year 1991. (Respondents for this question had been filtered by Question 44, which eliminated those who did not anticipate any need for supercomputers in their research in 1991.)

11.1 Predicted Requirements for Supercomputer Use, by Respondent Disciplines

The respondents' predicted average amounts of supercomputer CPU hours for CY 1991 are shown, per discipline, in Table 11-1.

Space Physics Discipline	Hours
Cosmic and Heliospheric Physics	126
Solar Physics	120
Magnetospheric Physics	237
ITM Physics	88

Table 11-1. Average Individual Use of Supercomputers in CY 1991, per Respondent Discipline

11.2 Predicted Requirements for Supercomputer Use, by Respondent Employers

The respondents' predicted average amounts of supercomputer CPU hours for CY 1991 are shown, per employer category, in Table 11-2.

Employer	Hours
University	184
NASA	113
Other Government Agencies	153
Industry	197
Other Organizations	103

Table 11-2. Average Individual Use of Supercomputers in CY 1991, Per Respondent Employer

11.3 Predicted Requirements for Supercomputer Use, by Respondent Age Groups

The respondents' predicted average amounts of supercomputer CPU hours for CY 1991 are shown, per respondent age group, in Table 11-3.

Age Group	Hours
40 or Younger	123
41-50	194
Over 50	123

Table 11-3. Average Individual Use of Supercomputers in CY 1991, per Respondent Age Group

11.4 Predicted Requirements for Supercomputer Use, by Respondent Research Techniques

The respondents' predicted average amounts of supercomputer CPU hours for CY 1991 are shown, per respondent research technique, in Table 11-4.

Research Technique	Hours
Data Interpretation	63
Theory, Simulation, and Modeling	229
Instrument Measurements	83

Table 11-4. Average Individual Use of Supercomputers in CY 1991, per Respondent Research Technique

12. Overall Results of the Survey of Space Physics Graduate Students

Space Physics graduate students were surveyed by a separate questionnaire, distributed to them by those recipients of the primary questionnaire who supervised graduate students. The graduate students' questionnaire is included as Appendix B to this report.

There were a total of 138 graduate student respondents to the questionnaire. Not all respondents answered each of the 19 questions in the questionnaire. Table 12-1 below indicates the number of responses to each question.

Question number	Number of responses received	Question number	Number of responses received
1	137	11	30
2	137	12	137
3	138	13	138
4	137	14	133
5	136	15	129
6	134	16	129
7	136	17	119
8	71	18	137
9	138	19	30
10	76		

Table 12-1. Numbers of Responses Received for Each Question in the Space Physics Graduate Students Portion of the Survey

12.1 Disciplines, Research Techniques, and Expected Degrees of Space Physics Graduate Students (Questions 1, 2, and 4)

There were a total of 137 responses to Questions 1 and 2, which asked the graduate student respondents to indicate their primary research discipline, primary research techniques, and level of degree expected from present enrollment. Tables 12-2, 12-3, and 12-4 show the responses.

Discipline of Degree	No.	%
Magnetospheric Physics	39	28
ITM Physics	31	23
Solar Physics	25	18
Cosmic and Heliospheric Physics	13	10
Solar-Terrestrial Physics	7	5
Others	22	16

Table 12-2. Primary Disciplines of Respondent Graduate Students (137 Responses)

Research Technique	No.	%
Theory, Simulation, and Modeling	56	41
Data Interpretation	49	36
Instrument Measurements	32	23

Table 12-3. Primary Research Techniques of Respondent Graduate Students (137 Responses)

Type of Degree	No.	%
Ph.D.	121	88
M.S.	14	10
Other	2	2

Table 12-4. Level of Degree Expected from Present Enrollment (137 Responses)

Table 12-5 shows the distribution of the graduate students' research techniques, by discipline in which the responding students work.

	Respondent's Discipline					
Primary Research Technique	**Cosmic and Helio-spheric Physics (13 respon-dents)**	**Solar Physics (25 respon-dents)**	**Magneto-spheric Physics (39 respon-dents)**	**ITM Physics (31 respon-dents)**	**Solar Terrestrial Physics (7 respon-dents)**	**Other Areas (22 respon-dents)**
Data Interpretation	4 (31%)	8 (32%)	17 (43%)	10 (32%)	3 (43%)	7 (32%)
Theory, Simulation and Modeling	3 (23%)	13 (52%)	19 (49%)	11 (36%)	3 (43%)	7 (32%)
Instruments Measurement	6 (46%)	4 (16%)	3 (8%)	10 (32%)	1 (14%)	8 (36%)

Table 12-5. Primary Research Techniques Used by Space Physics Graduate Students, by Discipline

12.2 Sources and Types of Financial Support Reported by Space Physics Graduate Students (Questions 6, 7, 8)

Table 12-6 shows the responses to Question 6, which asked graduate students what type(s) of financial support they receive for their studies.

Type of Financial Support	No.	%
Research Assistantships	93	69
Fellowships	21	16
Teaching Assistantships	9	7
Other	11	8

Table 12-6. Types of Support for Respondents' Graduate Studies (134 Respondents)

Table 12-7 shows the types of support reported above, by respondents' reported disciplines, for the 134 respondents. Research assistantships are the greatest single source of support in each of the disciplines.

	Respondent's Discipline					
Type of Financial Support	Cosmic and Helio-spheric Physics (13 respon-dents)	Solar Physics (25 respon-dents)	Magneto-spheric Physics (37 respon-dents)	ITM Physics (31 respon-dents)	Solar Terrestrial Physics (6 respon-dents)	Other Areas (22 respon-dents)
Teaching Assistantship	0 (0%)	2 (8%)	3 (8%)	2 (6%)	0 (0%)	2 (9%)
Research Assistantship	9 (69%)	17 (68%)	26 (70%)	22 (71%)	6 (100%)	13 (59%)
Fellowship	3 (23%)	5 (20%)	3 (8%)	4 (13%)	0 (0%)	6 (27%)
Other	1 (8%)	1 (4%)	5 (14%)	3 (10%)	0 (0%)	1 (5%)

Table 12-7. Types of Financial Support Received by Space Physics Graduate Students, by Discipline

Table 12-8 shows the responses to Question 7, which asked graduate students to provide the institutional source(s) of financial support they receive for their studies.

Source of Financial Support	No.	%
NASA Space Physics Division	71	52
University	24	18
Other Government Agencies	22	16
Other NASA Divisions	14	10
Industry	0	0
Other	5	4

Table 12-8. Institutional Sources of Support for Graduate Studies (136 Respondents)

Table 12-9 shows the institutional support reported above, by the respondents' reported disciplines, of the 136 respondents. NASA's Space Physics Division is the single greatest institutional source of support in each of the named disciplines.

	Respondent Discipline					
Institutional Source of Financial Support	Cosmic and Heliospheric Physics (13 respondents)	Solar Physics (25 respondents)	Magnetospheric Physics (39 respondents)	ITM Physics (31 respondents)	Solar Terrestrial Physics (7 respondents)	Other Areas (21 respondents)
University	1 (8%)	2 (8%)	4 (10%)	9 (29%)	1 (14%)	7 (33%)
NASA Space Physics Division	7 (54%)	17 (68%)	24 (62%)	13 (42%)	4 (57%)	6 (29%)
NASA Other Division	3 (23%)	3 (12%)	0 (0%)	1 (3%)	2 (29%)	5 (24%)
Other Government	2 (15%)	3 (12%)	6 (15%)	8 (26%)	0 (0%)	3 (14%)
Other	0 (0%)	0 (0%)	5 (13%)	0 (0%)	0 (0%)	0 (0%)

Table 12-9. Institutional Sources of Support for Space Physics Graduate Students, by Discipline

Table 12-10 shows the NASA SPD support program element of the 71 graduate students who reported SPD support. Respondents were asked to indicate each source of their support, if they had more than one.

Space Physics Program Element	No.	%
Supporting Research and Technology	24	31
Mission Operations and Data Analysis	16	23
Graduate Student Researcher Program	14	20
Space Physics Theory Program	12	17
Suborbital Program	8	11
Flight Programs	3	4
Other	1	1

Table 12-10. SPD Program Element Sources of Support for Graduate Studies (Question 8) (71 Respondents)*

*Some respondents indicated more than one source. Total sources reported were 78.

12.3 Types of Training Available at Space Physics Graduate Students' Institutions (Question 12)

Table 12-11 shows the responses to Question 12, which asked the graduate students to indicate the types of research skill training available at their institutions.

Type of Research Training	No.	%
Theory	118	86
Data Analysis	116	85
Modeling	108	79
Teaching	88	64
Observations	87	64
Simulation	86	63
Instrument Measurements	76	56
Instrument Calibration	69	50
Laboratory Research	66	48
Proposal Writing	48	35
Flight Hardware and Fabrication	42	31
Flight Operation	21	15
Program or Project Management	19	14

Table 12-11. Types of Research Training Available At Graduate Students' Institutions (137 Respondents)

Most of the institutions provide opportunities in the areas of theory, data analysis, and modeling. Less than one third of the institutions provide opportunities to graduate students in flight hardware and fabrication, flight operations, and program or project management.

12.4 Graduate Students Research Program (Questions 9, 10, and 11)

Questions 9, 10, and 11 asked graduate students to provide data on their awareness of, and application to, the Space Physics Division's Graduate Students Research Program. The results are shown in Table 12-12.

Involvement in Program	No.	%
Aware of Program	67	49*
Submitted Proposal in the Last 3 years	33	43*
Received Grant	18	60*

Table 12-12. Awareness of, and Participation in the SPD's Graduate Student Research Program (Questions 9, 10, and 11) (138 Respondents)*

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*Each of these questions filtered the respondents for the next one. There were 138 respondents to Question 9; 76 respondents to Question 10; and 30 respondents to Question 11. Percentages are of respondent total for each question.

12.5 Expectations of Employment in Space Physics after Completion of Degree (Questions 5, 13–15)

In Question 5, graduate students were asked if they expected to continue in space physics after completion of their degree. The results are shown in Table 12-13.

Expectation	No.	%
Expect to Continue in Space Physics	101	74
Do Not Expect to Continue in Space Physics	1	1
Uncertain	34	25

Table 12-13. Expectation to Continue in Space Physics After Completion of Degree (136 Respondents)

In Question 13, graduate students were asked to rank five factors that they would consider important in their decision to continue working in space physics after completion of their graduate degree. The result is shown in Table 12-14 in the form of weighted average on a scale of 5 (highest ranked factor). There were a total of 138 responses, but not all respondents provided a prioritization for every factor. The average number of responses for each factor was 127.

Factor	Score (Scale of 5)
Excitement in Research	4.5
Ability to Obtain Research Funding	3.3
Salary	2.9
Job Security	2.4
Ability to Propose for Research Funding	2.0

Table 12-14. Weighted Average Scores for Priority of Factors Contributing to Graduate Students' Expectation to Continue Work in Space Physics (Question 13) (138 Respondents)*

*There were a total of 138 responses, but not all respondents provided a prioritization for every factor. The average number of responses for each factor was 127.

In Question 14, graduate students were asked to provide their expectation (High, Medium, or Low) of the satisfactory availability, after graduation, of the factors they ranked in Question 13. Respondents were asked to mark as many factors as applied to them. The results are shown in Table 12-15.

	Expected Availability (% of Respondents)		
Factor	High	Medium	Low
Salary	0	70	29
Job Security	6	62	30
Ability to Propose for Research Funding	29	59	9
Ability to Obtain Research Funding	6	53	41
Excitement in Research	66	32	8

Table 12-15. Graduate Students' Ranking of Factors Contributing to their Decision to Continue Work in Space Physics after Graduation (Question 14) (133 Respondents)

Taking into account the responses charted for Question 13, graduate student respondents have expressed a moderate expectation of the ability to satisfy the moderate-priority career-choice factors, but express a relatively low expectation of meeting the highest priority factor, "Excitement in Research."

Question 15 asked graduate students to indicate their perception of the overall availability of postgraduate employment in space physics, in the form of a yes or no answer. Of the 129 respondents, 74 (57%) responded Yes, and 55 (43%) responded No.

12.6 Graduate Student Evaluation of Computer Resources (Questions 16–19)

In Question 16, graduate students were asked to indicate if their access to space physics mission data and other relevant data bases was adequate to support their research. There were 129 responses, of which 104 (81%) responded Yes, and 25 (19%) responded No.

In response to Question 17, a total of 104 (87%) of the 119 graduate student respondents indicated that the computer resources provided by their institutions were adequate to support their research needs. A total of 15 (13%) reported that the institution's computer resources were inadequate.

In response to Question 18, a total of 33 of the 137 (24%) graduate student respondents indicated that they expect to need a supercomputer in their research. A total of 104 (76%) reported no such expectation. In response to Question 19, 30 of the 33 who indicated a need for supercomputer time provided the hour breakdown for FY 1991 shown in Table 12-16.

CPU Hours	No.	%
Less than 100 hours	15	50
100–1000 hours	12	40
More than 1000 hours	3	10

Table 12-16. Expected Need, in Hours, for Graduate Students' Supercomputer Use in FY 1991 (Question 19) (30 Respondents)

Appendix A. Survey of the NASA Space Physics Community—Members

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Enclosure 1

OMB No.: 2700-0072
Expiration Date: 11/30/93

Survey of the NASA Space Physics Community

The NASA Space Physics Division and Science Applications International Corporation assure you that all appropriate measures will be taken to protect the confidentiality and privacy of the statements you make herein. The data will be used exclusively by the NASA Space Physics Division and the Space Physics Subcommittee for the purposes stated in the cover letter.

NASA

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DEFINITIONS

BITNET	Name derived from the phrase "Because It's Time." BITNET is a worldwide network connecting over 1000 hosts by means of leased 9600-baud telephone lines.
Co-I	Co-Investigator for a flight program or a research project.
Flight Program in Development	A NASA spaceflight mission which includes definition and development through launch.
Guest Investigator Program	Program to provide funds for data analysis and interpretation of data sets from flight missions. This program is open to scientists worldwide through a NASA Research Announcement.
Industry	Private organizations both for-profit and not-for-profit. Examples are Lockheed Palo Alto Research Laboratory and Southwest Research Institute.
INTERNET	The fastest-growing of the United States science networks. At present supported by the Defense Advanced Research Project Agency, the National Science Foundation (NSF), NASA, the Department of Energy, and the United States Geological Service.
Large Flight Program	Flight program for which total cost in 1990s dollars is greater than 200M. Examples include International Solar-Terrestrial Physics and the Solar Maximum Mission.
Mission Operations & Data Analysis	The funding source that supports both mission operations, during the flight-mission lifetime, and data analysis and data archiving for PIs, Co-Is, and associated postdocs and students.
NASA Space Physics Division	Formed in September 1987 within the Office of Space Science and Applications. Covers cosmic and heliospheric, solar, magnetospheric, and ionospheric/thermospheric/mesospheric physics. Before September 1987, program elements of other divisions covered were space plasma physics, solar and heliospheric physics, and particle astrophysics.
NSSDC	National Space Science Data Center located at the GSFC provides access to and archiving of mission scientific data for the space physics, earth sciences, astronomy and astrophysics, and planetary science disciplines.

Other Government	Government departments or agencies other than NASA. Examples are the NSF, the High Altitude Observatory, the National Center for Atmospheric Research, the Naval Research Laboratory, and the Los Alamos National Laboratory.
PI	Principal Investigator for a flight program or a research project.
Post Doc	A position of limited duration, usually received within five years of a Ph.D. degree. Generally not renewed for more than three years.
Research Scientist	A university or industry or government scientist whose primary employment is in research.
Small Flight Program	Flight program for which total cost in 1990s dollars is less than 200M. Generally supports observations and experiments carried out by such means as Explorer class of spacecraft, aircraft, balloons, sounding-rockets, and Shuttle-launched Spartans. Examples are Dynamics Explorer and the Interplanetary Monitoring Platform.
Soft Money Position	Position supported through money received from one or more funding agencies for specific research projects, typically lasting for three years or less. If funding is terminated, the position may also be terminated.
Space Physics Theory Program	The program that aims to achieve quantitative understanding of the important processes occurring in all space physics disciplines. Formerly called the Solar-Terrestrial Theory Program.
Suborbital Program	The program that oversees sounding-rocket and balloon payload development, flight, and data analysis.
Supporting Research and Technology	A NASA program including the Research and Analysis and Advanced Technology Development programs. The Suborbital Program is treated as a separate category for the purpose of this questionnaire.
TELENET	A commercial network with a mail service run by General Telephone and Electric. The most active TELENET networks are TELEMAIL, MAIL, NASAMAIL, and GSFCMAIL.

1990 NASA Space Physics Community Questionnaire

If you are at present a Space Physics graduate student, answer the questions on pages 15 to 18 only. If you wish to remain anonymous in your response to this questionnaire, or if you wish to update your address for us without completing this questionnaire, detach this page and return it separately. Fold and staple this page so that the return address on the reverse side of this page appears for mailing. Otherwise, complete this page and return it with the completed questionnaire.

ADDRESS UPDATE

[AFFIX PRINTED LABEL HERE]

If the address shown on the label above is incorrect or incomplete, please provide the correct and complete information below.

Name ____
Title Last Name First Name Middle Name or Initial

Institution ____

Address ____
Street

____

____
City State Zip

Telephone (   ) ____________ Fax (   ) ____________

SPAN/E-MAIL UPDATE

We would like the opportunity to provide information rapidly to the Space Physics community by way of electronic mail. Please provide your electronic mail address:

SPAN (Space Physics Analysis Network)

Address: ____

Other Electronic Mail

Name of Network: ____

Address: ____

QUESTIONNAIRE RESULTS

Would you like to receive the results from this Questionnaire? Yes ☐ No ☐

MAILING LIST

Would you like to receive Space Physics Division Announcements of Opportunity and Research Announcements? Yes ☐ No ☐

Would you like to receive the quarterly *Space Physics Newsletter*? Yes ☐ No ☐

NASA's SPACE PHYSICS DIVISION

OFFICIAL MAILING LIST

UPDATE

NASA

National Aeronautics And
Space Administration

Washington, D.C.
20546

Official Business
Penalty For Private Use, $300

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PERMIT No. G27

Space Physics Division Questionnaire
Science Applications International Corp.
600 Maryland Avenue, SW, Suite 307W
Washington, DC 20024

NHQ FORM 159 JAN 86

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1990 NASA Space Physics Community Questionnaire

DEGREE OF INVOLVEMENT

1. Have you ever used spaceflight data, provided either by the NASA Space Physics Division or by a prior NASA Space Physics program element, in your research?

   Yes ☐ No ☐

2. Have you ever used spaceflight data provided by other NASA programs?

   Yes ☐ No ☐

3. Have you ever received funding from the NASA Space Physics Division, or from a prior NASA Space Physics program element?

   Yes ☐ No ☐

4. Have you ever received funding from other NASA programs?

   Yes ☐ No ☐

5. Are you active in Space Physics research at present?

   Yes ☐ No ☐

6. For how many years have you been active in Space Physics research? ☐☐

PERSONAL BACKGROUND

7. Please mark the highest degree that you have earned.

   ☐ Ph.D. or Equivalent ☐ M.S. or Equivalent ☐ B.S. or Equivalent

8. In what year did you earn your highest degree?

   19 ☐☐

9. What is your age? ☐☐

10. In what nation was your highest degree earned? ☐ U.S.A. ☐ Other

11. What is the research area of your highest degree? *(Mark one.)*

☐ Cosmic Ray ☐ Heliosphere ☐ Solar ☐ Magnetosphere ☐ Ionosphere ☐ Thermosphere/Mesosphere

☐ Upper Atmosphere ☐ Solar-Terrestrial ☐ Planetary ☐ Fusion ☐ Astrophysics ☐ Plasma

☐ Engineering ☐ Chemistry ☐ Computer Science ☐ Math ☐ Other

1990 NASA Space Physics Community Questionnaire

PERSONAL BACKGROUND (continued)

12. By what type of institution were you first employed after receiving your highest degree? *(Mark one.)*

- ☐ University
- ☐ NASA
- ☐ Other Government
- ☐ Industry
- ☐ Other

13. What type of position did you have after completing your highest degree? *(Mark one.)*

- ☐ Professor
- ☐ Research Scientist
- ☐ Post Doc
- ☐ Administrator/ Manager
- ☐ Other

PERSONAL CURRENT STATUS

14. At what type of institution are you employed at present? *(Mark one.)*

- ☐ University
- ☐ NASA
- ☐ Other Government
- ☐ Industry
- ☐ Other

15. How many years have you been employed with your current institution? ☐☐

16. What is your current position? *(Mark 1 for primary and 2 for secondary responsibility.)*

- ☐ Administrator/ Manager
- ☐ Professor/Tenured
- ☐ Professor/Non-Tenured
- ☐ Research Scientist
- ☐ Research Group Leader
- ☐ Post Doc
- ☐ Engineer
- ☐ Other (Specify) ____________

17. What is your research area at present, or what area do you support? *(Mark 1 for primary and 2 for secondary research area.)*

- ☐ Cosmic Ray
- ☐ Heliosphere
- ☐ Solar
- ☐ Magnetosphere
- ☐ Ionosphere
- ☐ Thermosphere/Mesosphere
- ☐ Upper Atmosphere
- ☐ Solar-Terrestrial
- ☐ Planetary
- ☐ Fusion
- ☐ Astrophysics
- ☐ Plasma
- ☐ Engineering
- ☐ Chemistry
- ☐ Computer Science
- ☐ Mathematics
- ☐ Other (Specify) ____________

18. What techniques do you use in your research at present? *(Mark 1 for primary and 2 for secondary research technique.)*

- ☐ Data Interpretation
- ☐ Theory
- ☐ Simulation/Modeling
- ☐ Instrument Measurements
- ☐ Other (Specify) ____________

1990 NASA Space Physics Community Questionnaire

PERSONAL CURRENT STATUS (continued)

19. Many scientists are aware that parts of their annual salaries are covered by funds originating from outside the institutions that issue their paychecks. For example, 75% of a university professor's annual salary may be covered by general university funds and 25% by funds that flow from NASA grants and contracts. In other cases, however, all salary is covered by funds generated outside the institution issuing the paychecks; for example by the NASA Space Physics program. Please indicate the sources of your annual salary by entering the percent covered by funds originating from the sources below. If you are a NASA civil servant, please indicate the source of your *research funds* and the percent derived from the indicated source. Your entries should sum to 100.

☐☐☐ University

☐☐☐ NASA Space Physics Program

☐☐☐ NASA Other Programs

☐☐☐ Other Goverment

☐☐☐ Industry

☐☐☐ Other

20. For that portion of your annual salary, or if you are a NASA civil servant, that portion of your *research funding*, covered by the NASA Space Physics program, please indicate the percent received from the funding categories given below. Your entries should sum to 100.

☐☐☐ Supporting Research and Technology

☐☐☐ Space Physics Theory Program

☐☐☐ Flight Program(s) in Development

☐☐☐ Mission Operations and Data Analysis

☐☐☐ Guest Investigator Program(s)

☐☐☐ Suborbital Program

☐☐☐ Other

21. Are you at present a NASA PI or Co-I for a flight program or supporting research and technology program?

Yes ☐ No ☐

If yes, please answer questions 22 through 26.
If no, go to question 27.

RESEARCH GROUP *(Answer if NASA PI or Co-I.)*

If you are a NASA PI or Co-I, please answer the following questions for all scientific and technical staff that report to you directly. If you don't have a staff, go to question 26.

22. Please enter the number of full-time equivalents on your staff at your institution who report to you at this time regardless of the source of their support for each category below. Do not count yourself in your response. *(Fractional full-time equivalents should be reported.)*

☐☐.☐☐ Professors

☐☐.☐☐ Research Scientists

☐☐.☐☐ Post Docs

☐☐.☐☐ Graduate Students

☐☐.☐☐ Undergraduates

☐☐.☐☐ Engineers

☐☐.☐☐ Programmers

☐☐.☐☐ Technicians

☐☐.☐☐ Other

RESEARCH GROUP *(Answer if NASA PI or Co-I.)* (continued)

23. Please indicate the sources of funding for your group's total research efforts by entering the percent of your total research funding from each of the categories given below. Your entries should sum to 100.

☐ University ☐ NASA Space Physics Program ☐ NASA Other Programs ☐ Other Government ☐ Industry ☐ Other

24. How many full-time equivalent scientists do you support and supervise using NASA Space Physics Division "soft money" positions? ☐☐.☐☐

25. For that portion of your research group's funding supported by the NASA Space Physics program, please indicate the percent received in each of the categories given below. Your entries should sum to 100.

☐ Supporting Research and Technology ☐ Space Physics Theory Program ☐ Flight Program(s) in Development ☐ Mission Operations and Data Analysis ☐ Guest Investigator Program(s) ☐ Suborbital Program ☐ Other

26. Please indicate the *total funding* you received from the NASA Space Physics Division during the four-year period 1987 through 1990.

☐ Less than \$0.1M
☐ Between \$0.1M and \$0.5M
☐ Between \$0.5M and \$1.0M
☐ Between \$1.0M and \$5.0M
☐ Greater than \$5.0M

SPACE PHYSICS GRADUATE STUDENTS

27. Have you ever supervised graduate students other than those you may be supervising at present? Yes ☐ No ☐ *If no, go to question 31.*

28. How many Ph.D. theses in total have you supervised? ☐☐

29. How many of those Ph.D. theses were in Space Physics ? ☐☐

30. Please indicate the number of your past Space Physics Ph.D.'s first employed by the following.

☐ University ☐ NASA ☐ Other Government ☐ Industry ☐ Other

31. Are you at present supervising graduate students? Yes ☐ No ☐ *If no, go to question 36.*

If yes, please give a copy of the questionnaire to each of your Space Physics graduate students (questions on pages 15 to 18) to complete and ask them to mail it to the address provided.

SPACE PHYSICS GRADUATE STUDENTS (Continued)

32. How many Ph.D. students do you direct at this time? ☐☐

33. How many of your Ph.D. students at present are in Space Physics? ☐☐

34. How many of your Ph.D. students at present are supported by funds for research from the NASA Space Physics Division? ☐☐

35. How many of your Space Physics Ph.D. students at present are citizens of the U.S.A.? ☐☐

COMPUTER RESOURCES

36. Is your access to Space Physics mission data and other relevant databases adequate to support your research? Yes ☐ No ☐

37. Do you and your group use networks or electronic mail facilities?

    Yes ☐ No ☐ *If no, go to question 40.*

38. What networks or electronic mail facilities do you and your group currently use? *(Mark all that apply.)*

    - ☐ Space Physics Analysis Network (SPAN)
    - ☐ NASA Science Network (NSN)
    - ☐ NSF Network
    - ☐ BITNET
    - ☐ TELENET, including TELEMAIL, NASAMail and GSFCMail
    - ☐ INTERNET
    - ☐ Other (Specify) ____________________

39. How often do you and your group use networks for Space Physics research? *(Mark all that apply.)*

	Daily	*Weekly*	*Monthly*	*Occasionally*	*Never*
Electronic Mail					
Remote Data Processing					
File Transfer					
Database Access					

COMPUTER RESOURCES (continued)

40. Do you and your group need access, or additional access to networks or electronic mail facilities? Yes ☐ No ☐ *If no, go to question 42.*

41. To what networks or electronic mail facilities do you and your group need access, or additional access? *(Mark all that apply.)*

- ☐ Space Physics Analysis Network (SPAN)
- ☐ NASA Science Network (NSN)
- ☐ NSF Network
- ☐ BITNET
- ☐ TELENET, including TELEMAIL, NASAMail and GSFCMail
- ☐ INTERNET
- ☐ Other (Specify) ______

If the answer to question 41 regarding SPAN and/or NSN is yes, contact Christine Falsetti at Ames Research Center on (415) 604-6935 (FTS 464-6935) for SPAN and/or NSN access information.

42. Which of the following computer systems are available to you and your group for use in Space Physics research? *(Mark all that apply.)*

- ☐ Supercomputer
- ☐ Mini Supercomputer
- ☐ Mainframe
- ☐ Minicomputer
- ☐ Microcomputer (IBM/Compatible, Macintosh)
- ☐ Workstation (Apollo, SUN, PS/2)
- ☐ Other (Specify) ______

43. Do you consider the computer resources available through your institution adequate to support your research? Yes ☐ No ☐

44. Do you see a need for the use of a supercomputer in your future research?
Yes ☐ No ☐ *If no, go to question 47.*

45. How many hours of supercomputer CPU time do you think you will need for your research in calendar year 1991? ☐☐☐☐

46. For what purposes will you and your group use supercomputers to support your Space Physics research during calendar years 1991-1993? Write the percentages of anticipated use for the following activities. Your entries should sum to 100.

☐☐☐ Data Visualization

☐☐☐ Simulation/Modeling

☐☐☐ Data Analysis

☐☐☐ Multivariate Statistics

☐☐☐ Instrument Design

☐☐☐ Other *(Specify)* ______

COMPUTER RESOURCES (continued)

47. At what NASA field centers, or Federal laboratories or facilities, have you and your group ever worked with a supercomputer? *(Mark all that apply.)*

- ❑ None
- ❑ NASA Field Center (Specify) ____________________
- ❑ Federal Laboratory (Specify) ____________________
- ❑ Other Facility
  (Specify) ____________________
  ____

48. How much did you and your group spend on CPU time for Space Physics research last year? *(Enter amount in thousands of dollars.)*

☐☐☐☐

COMMUNITY OPINIONS AND PERCEPTIONS

In this section, we ask you to comment on some of the issues facing the Space Physics community. We have provided four lines for each of your comments. If you need more space, please continue each comment on a separate piece of paper, title the comment according to its question number, and return it with the completed questionnaire.

Part I — Distribution of Resources Across Research Programs and Techniques

49a. Assume that the NASA Space Physics Division could increase funding to one or more of its programs. Given an overall goal of maintaining and/or enhancing the health of Space Physics in general, to which program elements would you give priority in distributing such funding? *(Mark 1 for the most important and 8 for the least important.)*

- ☐ Supporting Research and Technology
- ☐ Space Physics Theory Program
- ☐ Large Flight Program(s)
- ☐ Small Flight Program(s)
- ☐ Mission Operations and Data Analysis
- ☐ Guest Investigator Program(s)
- ☐ Suborbital Program
- ☐ Other *(Specify)* ____________________

b. Comment: ____________________
____
____
____

50. If funding could be increased for the following research techniques, how would you rank them in order of priority? *(Mark 1 for the most important and 5 for the least important.)*

- ☐ Data Interpretation
- ☐ Theory
- ☐ Simulation/ Modeling
- ☐ Instrument Measurements
- ☐ Other *(Specify)* ____________________

COMMUNITY OPINIONS AND PERCEPTIONS (continued)

Part II — Structure of the Grants Program

51a. There is a diversity of opinion at present about the structure of the grants program for the NASA Space Physics Division. At present, grants are awarded competitively without preferential emphasis on individual seniority or institutional affiliation. If it were possible to invoke some other distribution, what would you favor, in order of priority? Assume no increase in total funding. *(Mark 1 for highest priority and 6 for lowest priority.)*

Increase the average grant award and duration in order to decrease the amount of time spent in writing proposals. Do this even though the number of grants and amount of money available for annual competition would decrease. ☐

Establish several "Centers of Excellence" both to concentrate scientific and interdisciplinary expertise and to focus on major Space Physics research problems. Do this even though the number of grants to individuals would decrease significantly. ☐

Divert some of the grant funding to support young faculty members preferentially in order to provide more tenured faculty positions. ☐

Pursue a distribution that ensures a significant number of new opportunities with funding at lower levels. This funding might include new Ph.D. researchers, young faculty, and researchers from other fields. Do this even though the number of grants to established researchers would decrease. ☐

Pursue a distribution that favors established researchers with good productivity and grant awards that can cover research scientists on "soft money." Do this even though there would be fewer grants and little turnover in investigators. ☐

Leave the system as it is. ☐

b. Comment:____

COMMUNITY OPINIONS AND PERCEPTIONS (continued)

Part III — Availability of Graduate Students

52a. How many graduate students per year do you feel would be optimum to carry out research in your group?

☐☐

b. Comment:____

53a. How many additional graduate students do you feel you could attract, effectively supervise, and place in careers if additional research funding were available?

☐☐

b. Comment:____

54. Are you experiencing difficulty in obtaining good graduate students?

Yes ☐ No ☐ *If no, go to question 56.*

55a. Rank the factors responsible for the increasing difficulty in obtaining good graduate students. *(Mark 1 for the most important and 4 for the least important factor.)*

☐ Limited number of graduate students

☐ Limited research funds

☐ More interesting work in other fields

☐ Lack of job potential

b. Comment:____

COMMUNITY OPINIONS AND PERCEPTIONS (continued)

56. Does your institution provide an opportunity for graduate students to receive training in the areas shown below? *(Mark all that apply.)*

- ❑ Data Analysis
- ❑ Flight Operation
- ❑ Modeling
- ❑ Laboratory Research
- ❑ Simulation
- ❑ Program or Project Management
- ❑ Flight Hardware Design and Fabrication (Hands-on)
- ❑ Theory
- ❑ Instrument Calibration
- ❑ Academic Preparation
- ❑ Other

57. Does your department provide an opportunity for graduate students in the categories given below? *(Mark all that apply.)*

Research Assistantship ❑ Teaching Assistantship ❑ Postgraduate Employment ❑

58. Are you aware of NASA's Graduate Student Research Program?

Yes ❑ No ❑ *If no, go to question 62.*

59. Has any graduate student from your group submitted a proposal to this Graduate Student Research Program?

Yes ❑ No ❑ *If no, go to question 62.*

60. How many such proposals were submitted to the Graduate Student Research Program in the last three years? ❑❑

61. How many of these proposals submitted to the Graduate Student Research Program received awards in the last three years? ❑❑

Part IV — Space Physics Data Accessibility and Availability

62a. How do you rate the service of the NSSDC?

❑ Adequate ❑ Inadequate ❑ Don't Use

b. Comment: ____________________

COMMUNITY OPINIONS AND PERCEPTIONS (continued)

63a. The NASA Space Physics Division is planning to establish a Space Physics Data System. Do you think this data system should be primarily a centralized or a distributed facility, considering that both would have network access?

Centralized ☐ Distributed ☐ No Preference ☐

b. Comment:____

Part V — Large Versus Small Missions

64a. Should NASA provide more frequent spacecraft opportunities with smaller missions (like Explorers, rockets, and balloons) even though this may cause the number of Space Physics large missions to decrease?

Yes ☐ No ☐

b. Comment:____

65. Would you like to make further comments regarding any aspect of NASA's Space Physics Division program?

Yes ☐ No ☐

If yes, please provide your comments on a separate page, and return it with the completed questionnaire.

After completing this questionnaire, please return it with your comments in the enclosed postage-paid envelope to:

Space Physics Division Questionnaire
Science Applications International Corporation
600 Maryland Avenue, SW, Suite 307W
Washington, DC 20024

If you have concerns about this questionnaire, please contact Dr. Rikhi Sharma at the above address, or call him at (202) 479-2119 or at his NASAMAIL address RSHARMA.

Appendix B. Survey of the NASA Space Physics Community—Graduate Students

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1990 NASA Space Physics Community Questionnaire

TO BE COMPLETED BY SPACE PHYSICS GRADUATE STUDENTS

If you wish to remain anonymous in your response to this portion of the questionnaire, or if you wish to update your address with us without completing this questionnaire, detach this page and return it separately. Fold and staple this page so that the return address on the reverse side of this page appears for mailing. Otherwise, complete this page and return it with the completed questionnaire.

POST ADDRESS

Please give us your postal address.

Name ______________________________

Institution ______________________________

Address ______________________________
Street

____

____
City State Zip

Telephone (   ) ______________ Fax (   ) ______________

SPAN/E-MAIL ADDRESS

We would like to be able to provide information rapidly to the Space Physics community by the way of electronic mail. Please provide your electronic mail address:

SPAN (Space Physics Analysis Network)

Address: ______________________________

Other Electronic Mail

Name of Network: ______________________________

Address: ______________________________

QUESTIONNAIRE RESULTS

Would you like to receive the results from this Questionnaire? Yes ☐ No ☐

MAILING LIST

Would you like to receive information about NASA's Graduate Student Research Program? Yes ☐ No ☐

Would you like to receive the quarterly *Space Physics Newsletter?* Yes ☐ No ☐

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NASA's SPACE PHYSICS DIVISION

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Space Administration

Washington, D.C.
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Science Applications International Corp.
600 Maryland Avenue, SW, Suite 307W
Washington, DC 20024

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1990 NASA Space Physics Community Questionnaire

QUESTIONS TO SPACE PHYSICS GRADUATE STUDENTS (Continued)

1. What is your research area at present? *(Mark 1 for primary and 2 for secondary area.)*

☐ Cosmic Ray ☐ Heliosphere ☐ Solar ☐ Magnetosphere

☐ Ionosphere ☐ Thermosphere/ Mesosphere ☐ Upper Atmosphere ☐ Solar-Terrestrial ☐ Other

2. What techniques do you use in your research at present? *(Mark 1 for primary and 2 for secondary research technique.)*

☐ Data Interpretation ☐ Theory ☐ Simulation/ Modeling ☐ Instrument Measurements ☐ Other (Specify) ________

3. Are you a citizen of the U.S.A.? Yes ☐ No ☐

4. Towards what degree are you working at present?

☐ Ph.D. ☐ M.S. ☐ Other *(Specify)* ________

5. Upon completion of your degree, do you expect to continue to participate in the U.S. Space Physics program? Yes ☐ No ☐ Uncertain ☐

6. What *type* of financial support do you receive for your graduate work?

☐ Teaching Assistantship ☐ Research Assistantship ☐ Fellowship ☐ Other*(Specify)* ________

7. What is the main *source* of financial support for your graduate work?

☐ University ☐ NASA Space Physics Program ☐ Other NASA Programs

☐ Other Government ☐ Industry ☐ Other*(Specify)* ________

8. If you are supported at present by NASA's Space Physics program, what funding category supports your graduate work? *(Mark all that apply.)*

☐ Supporting Research and Technology ☐ Space Physics Theory Program ☐ Flight Program(s) in Development ☐ Mission Operations and Data Analysis

☐ Suborbital Program ☐ Graduate Student Research Program ☐ Other*(Specify)* ________

1990 NASA Space Physics Community Questionnaire

QUESTIONS TO SPACE PHYSICS GRADUATE STUDENTS (Continued)

9. Are you aware of NASA's Graduate Student Research Program? Yes ☐ No ☐

For information, please contact the office of Mr. J. K. Alexander, NASA Headquarters Code S, at (202) 453-1430.

10. Have you submitted a proposal for a grant under the Graduate Student Research Program during the past three years?

Yes ☐ No ☐ *If no, go to question 12.*

11. Were you successful in obtaining a grant under the Graduate Student Research Program during the past three years?

Yes ☐ No ☐

12. Does your institution provide training in the following areas? *(Mark all that apply.)*

☐ Data Analysis ☐ Modeling ☐ Simulation ☐ Flight Hardware and Fabrication ☐ Instrument Calibration ☐ Observations

☐ Flight Operation ☐ Laboratory Research ☐ Program or Project Management ☐ Theory ☐ Teaching ☐ Instrument Measurements

☐ Proposal Writing

13. Rank the following factors, in order of priority, that you would consider important in a decision to stay in Space Physics research after your graduation. *(Mark 1 for highest and 5 for lowest priority.)*

☐ Salary ☐ Job security ☐ Excitement in research ☐ Ability to propose for research funding ☐ Ability to obtain research funding

14. What is your perception about the *availability* of the following in Space Physics research after your graduation? *(Mark all that apply.)*

	High	*Medium*	*Low*
Salary	☐	☐	☐
Job security	☐	☐	☐
Excitement in research	☐	☐	☐
Ability to propose for research funding	☐	☐	☐
Ability to obtain research funding	☐	☐	☐

1990 NASA Space Physics Community Questionnaire

QUESTIONS TO SPACE PHYSICS GRADUATE STUDENTS (Continued)

15a. What is your perception about the overall availability of postgraduate employment in Space Physics?

Adequate ☐ **Inadequate** ☐

b. Comment: ____

____

____

____

16. Is your access to Space Physics mission data and other relevant databases adequate to support your research and interests? **Yes** ☐ **No** ☐

17. Do you consider the computer resources available through your institution adequate to support your program and/or research? **Yes** ☐ **No** ☐

18. Do you see a need for the use of a supercomputer in your future research?

Yes ☐ **No** ☐ ***If no, do not answer the next question.***

19. How many hours of supercomputer CPU time do you think you will need for your research in calendar year 1991?

☐☐☐☐

After completing this questionnaire, please return it with your comments in the enclosed postage-paid envelope to:

Space Physics Division Questionnaire
Science Applications International Corporation
600 Maryland Avenue, SW
Suite 307W
Washington, DC 20024

If you have concerns about this questionnaire, please contact Dr. Rikhi Sharma at the above address, or call him at (202) 479-2119 or at his NASAmail address RSHARMA.

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13. ABSTRACT (*Maximum 200 words*)

This report summarizes the results of a survey of the members of the space physics research community conducted in 1990-1991 to ascertain demographic information on the respondents and information on their views on a number of facets of their space physics research. The survey was conducted by questionnaire and the information received was compiled in a database and analyzed statistically. The statistical results are presented for the respondent population as a whole and by four different respondent cross sections: individual disciplines of space physics, type of employers, age groups, and research techniques employed.

Data from a brief corresponding survey of the graduate students of respondents are also included.

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