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SPACE SCIENCE ADVISORY COMMITTEE

July 28-30, 1999
NASA Headquarters
Washington, DC

MEETING REPORT

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Executive Secretary

Steven W. Squyres
Chair

SPACE SCIENCE ADVISORY COMMITTEE (SScAC)
NASA Headquarters
July 28-30

MEETING MINUTES
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SPACE SCIENCE ADVISORY COMMITTEE (SScAC)
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Wednesday, July 28

Opening Remarks/Announcements
Dr. Steven Squyres, Chair of SScAC, welcomed members and meeting attendees and noted the presence of several new members—Dr. James Papike from the Institute of Meteoritics at the University of New Mexico; Dr. Molly Macauley, Senior Fellow at Resources for the Future; and Dr. Maria Zuber from the Department of Earth, Atmospheric, and Planetary Sciences at the Massachusetts Institute of Technology. After introductions, Dr. Squyres reviewed the agenda and noted that important topics to be discussed at this meeting were budget/program status, progress on the Strategic Plan, and review of the OSS FY 1999 Performance Report.

OSS Program and Budget Status
Dr. Edward Weiler, Associate Administrator for the Office of Space Science (OSS), provided an update on the Space Science Enterprise program, discussed recent House Appropriations Subcommittee actions on the budget, and reviewed the events leading to the cancellation of ST-4/Champollion. All of the FY 1999 launches to date have been successful; however, the Wide Field Infrared Explorer (WIRE) spacecraft failed after launch, and the TERRIERS mission had a programming error which has left it inoperable. The WIRE spacecraft is being used for engineering tests, and recovery options are being examined for TERRIERS. The major recent event has been the successful launch of Chandra, and everything is proceeding well so far on the checkout of the third Great Observatory. There is an aggressive launch schedule through CY 2002. Most of the missions in development are going well, although NASA does have concerns with the schedule for delivery of the German telescope on the Stratospheric Observatory for Infrared Astronomy (SOFIA). Gravity Probe (GP)-B is still overrunning; the Thermosphere-Ionosphere-Mesosphere Energetics and Dynamics (TIMED) mission also has a budget problem which is now under review. Dr. Weiler discussed the budget impact of the Chandra delays which have been substantial. The direct cost for the development delays was $50 million; the Inertial Upper Stage (IUS) sustaining engineering cost was $7 million; the cost for the additional Hubble Space Telescope (HST) servicing mission is $26 million; and the downstream impact to HST is $44 million. To accommodate these and other budget issues over the next several years, a decision was made to terminate the ST-4/Champollion mission. The savings realized from this action will be about $200 million over five years. While there will be continuing budget challenges in FY 2000-2004 (e.g., resource requirements for the Space Operations Management Office (SOMO) and further potential GP-B cost growth) at the moment, the OSS budget is now balanced. However, any further problems will lead to more mission cancellations. OSS no longer has any reserves or flexibility to accommodate problems.

The House VA-HUD Appropriations Subcommittee made an overall 10% cut to the NASA budget, and a large fraction of those cuts were directed at OSS programs. If passed, the Bill would have the following consequences: the Space Infrared Telescope Facility (SIRTF), Deep Impact, Messenger, and Comet Nucleus Tour would be canceled as of October 1. None of the five Mid-class Explorers (MIDEX's) under study could be selected, and no AO's for follow-on Explorers would be issued. Future Mars missions would either be canceled or significantly delayed. The proposed $200 million reduction in technology could result in cancellation of technology work on the Space Interferometry Mission (SIM), the Next Generation Space Telescope (NGST), Europa Orbiter, Pluto Express, Solar Probe, the Far Infrared-Submillimeter Space Telescope (FIRST)/Planck mission, the Gamma ray Large Area Space Telescope (GLAST), the Solar Terrestrial Relations Observatory (STEREO), and/or Solar B. If full replacement of the funds were regained the following year, about 70 percent of these missions could be saved. If the cuts were to continue into the following years, all of these programs would be canceled. This would represent a going-out-of-business budget for OSS. In addition, the budget markup contains a reduction of $120 million in Research and Analysis (R&A) which would lead to the cancellation of more than a thousand grants. Taken as a whole, this budget would represent the most severe cut to NASA in history and would be devastating to OSS. In addition to the reductions, there were about $25 million in earmarks, plus an additional $20 million for fundamental physics research. Considering the magnitude of the budget problems and all of the issues involved, it is unlikely that there will be any resolution of the situation before the beginning of the fiscal year. In response to a question,

Dr. Weiler noted that the funding for the National Science Foundation (NSF) that emerged from the mark-up is essentially flat, but that a number of new Initiatives proposed by the President for FY 2000 had been taken out. Many of the other agencies also fared very well compared to NASA. The total reduction to OSS is $665 million (excluding earmarks). The Senate has not yet taken any action on the budget and will not do so before Labor Day.

Dr. Weiler then explained the rationale behind the cancellation of ST-4/Champollion and outlined the chronology of events leading up to this action. In Spring 1998, the Advanced X-ray Astrophysics Facility (AXAF) launch date slipped from August 1998 to December 1998 due to continuing problems with flight software. One consequence was that HST immediately slipped its manifested 3rd servicing mission. At that time, the Office of Space Flight (OSF) said that the only orbiter that both missions could use was Columbia; therefore, the launch schedules were coupled. In August 1998, the AXAF launch date slipped another month to January 1999. Making this launch date required a scheduled shipment date to Kennedy Space Center (KSC) in late October. In parallel with these technical activities, in September 1998, the OSS budget was submitted to the Office of Management and Budget. In October 1998, a decision was made to not ship AXAF to KSC, and the launch date was uncertain but was obviously going to slip further. In December 1998, NASA received the OMB passback; and in response to this passback, Dr. Weiler, with the OSS Board of Directors, made some surgical cuts to the Explorer and Discovery Programs and Cassini. No missions were seriously impacted at this time, but these actions removed all flexibility in the budget. In January 1999, OSS discovered a major circuit board problem on AXAF which caused a further launch slip to May 1999. This was accompanied by a further HST launch slip to August 2000. In February 1999, the HST gyros started failing and a decision was made to do a contingency servicing mission in October 1999. The original third servicing mission was split into two parts. In addition, in March, GP-B was projecting an overrun of $20-$30 million in 2000 and 2001. During the February to June timeframe, both Mr. Goldin and Dr. Weiler discussed the budget problems in public and indicated that they were in the process of considering canceling missions in order to deal with all these liens on the budget. SIM, Mars Lander 01, and ST-4 were specifically cited as candidates for cancellation. This was explicitly discussed at a number of Advisory Committee meetings. To compound these problems, in June 1999, JPL presented a plan to get back to an adequate level of reserves on the Mars program which would require an extra $50 million. In addition, it became clear that major parts of the Mars Program in the outyears were unfunded. At this point, the budget could not be balanced without cancellation of a mission. It also became clear that ST-4 was the only mission that could provide enough money (particularly in the outyears) to deal with all these problems. In mid-June, the OMB and Congress were notified of the cancellation of ST-4. This action saved about $200 million and allowed for resolution of all of the outstanding budget issues over the next 5 years.

Dr. Weiler then explained in more detail why ST-4/Champollion was the mission selected for cancellation. He noted that Champollion was originally selected under competitive review as part of the ESA Rosetta mission. After the collaboration with the Europeans was canceled, the payload was approved by the New Millennium Program (NMP) ad hoc science working group to be put on ST-4. However, there was no OSS-wide competition for the scientific participation on ST-4, and there was no OSS Strategic Plan mission supported by ST-4. It became clear that the ST-4 mission was being driven by science, not technology. Furthermore, in the last budget cycle, OMB took issue with the apparent subterfuge of using a technology program to support a new science mission and canceled the New Millennium Program. OSS also received instructions to reexamine the rationale for New Millennium. Finally, ST-4/Champollion had spent relatively little money so far, and the funds from this mission could be used to solve outyear problems—a characteristic not shared by other candidates for cancellation. Therefore, it was selected for cancellation. Dr. Weiler noted that the FY 2000 budget has no money for NMP beyond ST-5. While he could not go into details about the possible future of NMP, he indicated that if the Program were to continue, it would have to be fully and openly competed, support all themes, and have technology requirements as a first priority.

Reports from the Theme Directors

Solar System Exploration

Dr. Carl Pilcher focused on the two new Discovery missions that were recently selected—Messenger and Deep Impact. These would both launch in 2004. When these two missions fly, Solar System Exploration will have launched eight Discovery missions in 9 years, clearly meeting the original program goal of launching one Discovery mission every 12-18 months. Messenger is a mission that has a science content similar to a "Flagship" mission such as Galileo and Cassini. It addresses a variety of questions relating to Mercury—origin of the planet's high density; geology (vulcanism); and magnetic field, trapped particles, and atmosphere. Deep Impact is a mission that

embodies the name of the Discovery program—exploration. Little is known about the nature of a comet nucleus. From this mission, a great deal will be learned about the structure and the nature of the material well below the surface. The mission will take 500 kg of copper and impact Comet Tempel 1 with the equivalent energy of 6 tons of TNT. The result will be the formation of a crater that is about the volume of a football stadium. The impact and aftermath will be observed by the Deep Impact orbiting telescope and other Earth-based and orbiting telescopes. The impact will occur on July 4, 2005, and should be a major public event. The Deep Impact and Messenger missions have extremely good public outreach and education plans. The excellent quality of the education and public outreach programs for both missions was, in fact, a consideration in their selection.

Dr. Pilcher also gave an update on the Mars Surveyor Program which is a major international and technical activity. NASA is working on three Memoranda of Understanding (MOU's)—with the French Space Agency (CNES), the Italian Space Agency (ASI), and the European Space Agency (ESA). NASA is having very serious discussions with Canada as well. The most advanced discussions are those with CNES, and many aspects of the MOU have already been worked out. NASA has exchanged summaries of technical discussions with ASI. NASA hopes to have MOU's with both CNES and ASI worked out by December 3. The funding problems in the Mars Surveyor Program have been dealt with; however, the budget cuts for FY 2000 described by Dr. Weiler would cancel all future Mars missions beyond FY 2001.

Sun-Earth Connection

Dr. George Withbroe first discussed the recent measurements of neutral hydrogen in comet Hale-Bopp by the Solar and Heliospheric Observatory (SOHO). He noted that the SOHO team deserves real praise—the mission is now operating very effectively with no gyros. He then went on to discuss why people should care about issues associated with Sun-Earth Connections. Solar variability affects space systems (commercial satellites in operation), national defense (military satellites and tracking of space debris), human space flight (biological effects of energetic particle radiation), and where we live (effects on electric power grid, GPS signals, terrestrial climate). He noted that the traditional view that the Sun affects climate only through changes in luminosity may not tell the whole story. Cosmic rays may also affect climate though their influence on cloud formation, and this issue is currently under study.

Structure and Evolution of the Universe

Dr. Alan Bunner discussed the STS-93 launch (Chandra) and showed a short video of the past week's events and a simulation of the coming few days' activities. The launch was not without incident (it took three tries), but Chandra was successfully deployed and everything is going well. Chandra is in the middle of the second and third propulsion system burns; two additional apogee burns will boost it into its final elliptical orbit. "First light" is expected in mid-August. The first press conference showing initial images will be around August 19. The angular resolution will be a factor of ten better than any previous x-ray telescope. In response to a question, Dr. Bunner noted that all of the operations of the past several days (e.g., the propulsion burns) have been controlled by the Smithsonian Astrophysical Observatory.

SOMO Report to the NASA Advisory Council (NAC)

Dr. Squyres provided some brief background on SOMO for the benefit of new members—a subject which has been subject of considerable interest and concern to SScAC for some time. The intent of SOMO is to consolidate, within a single office and contractor, all of the Agency's key space operations functions and to save money by streamlining, eliminating redundancy, and establishing standard services. In anticipation that major savings would be realized in the outyears through this consolidation, funds allocated in out-year budgets have been substantially cut and allocated for other purposes within the Agency. Consequently, there has been considerable concern about possible degradation in services to missions, and a number of comments and recommendations have been made to the Agency concerning the possible impacts of the SOMO approach. At the last meeting, SScAC received an in-depth briefing from SOMO; and substantial concerns continued to be expressed about the implications of the consolidation. As a consequence of that briefing, SScAC and the Earth Science and Applications Advisory Committee (ESAAC) were asked by the NASA Advisory Council to form a joint study team to look at SOMO and the Consolidated Space Operations Contract (CSOC) and make recommendations to the Council for possible inclusion in its recommendations to the Administrator. In March, the joint study team was formed and met on April 19 at NASA Headquarters; it received a briefing from the Goddard Space Flight Center (GSFC) SOMO office and a

number of GSFC and Jet Propulsion Laboratory (JPL) Project Managers regarding the direct impacts of the SOMO/CSOC approach on their programs.

Dr. Squyres noted that CSOC is still at a very early stage of its work. It is, at least in part, an experiment in doing business a new way. It was clear from the briefings from the Project Managers that the full impacts (and the full benefits) have yet to be felt. During April and May, the team came to a set of nine consensus recommendations, and a subset (four) of those were presented to the NAC at its May meeting. Two of the recommendations were accepted by the NAC; the other two were rejected. The NAC did not accept the following two recommendations: (1) that the Enterprises and NASA managers should be empowered to make choices of their operations support contractor on the basis of minimizing costs to the Agency and (2) that the Deep Space Network (DSN) and Earth Observing System (EOS) Polar assets are used exclusively by OSS and OES, respectively, and that these organizations should be responsible for managing them. The NAC felt very strongly that the SOMO/CSOC experiment must be allowed to run its course at least for the first 5 year term to see whether it is working and significant savings result. If SOMO and CSOC are allowed to be dismantled (i.e., elements pulled out of CSOC at the first sign of problems), the long-term benefits will never be realized. The NAC felt that it was important to take a long-term view even if there are problems in the short term. Two recommendations were accepted, both dealing with the development of mechanisms to assure responsiveness to customers: (1) that a SOMO User's Group be formed that communicates both to SOMO and the SOMO Board of Directors to provide feedback from the end users and (2) that OSS and OES senior management, who will receive the reports of the User's Group, should participate in the determination of the CSOC award fee. Dr. Squyres noted that SOMO/CSOC will be an ongoing issue of concern for both the space and Earth science communities and that there will be near-term consequences. One of the reasons that the science community has been unsuccessful in getting its concerns heard is that the concept is sufficiently immature that it has not yet been possible to document the impacts. It is imperative that SScAC and the community stay on top of what is happening with SOMO/CSOC and hear from the projects that are working with them on an ongoing basis. It is clear that the community was caught by surprise by the SOMO/CSOC decision, and it will take a while to develop information and react to it. In response to a question regarding the proper conduit for collecting information, Dr. Squyres indicated that the User's Group should be the primary channel for collecting information. SScAC members felt that an official within OSS should be given the responsibility for monitoring SOMO, gathering information, and keeping the community (including SScAC) involved. Dr. Squyres noted that he would report back to SScAC by e-mail regarding the discussion of this subject at the NAC meeting next week.

Dr. Riegler commented on the four recommendations presented to the NAC. For new missions, OSS has written the principle of choice into the AO's, and this language is expected to continue until someone objects. The intent of full-cost management is to move funding for operations (e.g., DSN) to the Enterprises. As noted, a SOMO User's Group is being established, and progress is being made on having user input on award fee determination. A member of the science community will sit on the Performance Evaluation Board. Regarding measurement of CSOC performance, metrics for some services (e.g., tracking of missions) have been established; metrics for other services still need to be developed. With respect to costs, the CSOC approach so far has been for Code S to state requirements and then be told the costs for meeting those requirements. The costs of some things (such as antenna usage) are very well understood whereas for other things, the cost models are still very poor. Charging algorithms were just established in May and still must be validated. In response to a question regarding what happened to the full set of recommendations, Dr. Squyres indicated that he and Dr. Bras made a tactical decision to present only what they regarded as the most important issues to the NAC. The User's Group should get the complete set of recommendations from the team along with a briefing which Dr. Squyres offered to make. Dr. Vondrak noted that some of the SOMO funding shortfalls are now beginning to be felt. Dr. Riegler indicated that this has been a major issue and seems to be getting worse. These issues will have to be addressed during the upcoming budget cycle. Dr. Squyres noted that the budgetary effects of CSOC will clearly have to be revisited in February when the FY 2001 budget is released. Dr. Urry noted that neither SScAC nor the community really had an opportunity to make an impact on the decision for consolidated operations; it had already been made before SScAC first had an opportunity to register concern with the concept. Dr. Squyres added that when issues such as this come to SScAC's attention, it is important that the Committee take a proactive approach and take recommendations to the NAC. The science community, for the most part, did not realize the fundamental impact of the CSOC decision when it was made, and many people still don't understand the issues. The lesson to be learned is that, in the future, the Committees are going to have to watch things more carefully. Dr. Riegler noted that a number of the consolidation recommendations came out of the Zero-Base Review several years ago, but community representatives were not

participants in that Review. It was only discussed within the Agency. The SScAC was concerned about how to be involved in major changes like this in the future before irrevocable decisions are made.

In summary, Dr. Squyres observed that it would be very useful for someone within OSS to be explicitly tasked to continue to look at SOMO issues and bring them to the attention of the Committee. The SScAC was pleased that a Users Group has been established. Dr. Squyres volunteered to brief the User's Group on the full set of recommendations. OSS must inform the science community as well as Program and Project Managers about the expectations that the Agency has for SOMO and what impacts are expected on the community. The SScAC still needs to press the issue of accountability and take the position that cost savings should be expected sooner rather than later. It is important that records be kept on changes in procedures that may increase risk to assets. Risk to assets (safety) is a strong argument that the community should continue to make, and there is evidence that this message is beginning to be heard. Both SOMO/CSOC and OSS should give follow-on briefings at the next SScAC meeting. Final recommendations on this topic are included in the letter from Dr. Squyres in Appendix D.

Dr. Squyres next invited SScAC comments on the topics covered in Dr. Weiler's briefing. SScAC felt that there should be a general recognition that the House markup would be devastating to space science and that the great successes of the Space Science Program and the contributions that space science has made to the country must be affirmed. The Committee felt that it would be useful to go on record about NMP. It provides the opportunities for proposers of Discovery and other missions to have access to advanced technologies that have been validated in a flight program. The Solar Electric Propulsion demonstration on DS-1, for example, has opened up the use of this technology. The SScAC was fully supportive of a program that allows for technology validation for future missions. The initial concept of NMP was very close to what was described by Dr. Weiler. Questions were raised about the appropriate cost cap for such missions, but the Committee felt that it was not in a position to make a specific recommendation. A New Millennium briefing should be given at the next SScAC meeting to provide a basis for such a discussion. Dr. Hastings observed that in the Air Force, the technology demonstration programs are in the cost range of $25-$36 million, and that significantly larger technology demonstration programs probably will not "sell" with Congress. Larger technology demonstration programs require partnering with other organizations.

Before the discussion of the ST-4/Champollion cancellation, Dr. Squyres stated that he would recuse himself from the discussion because of his participation as a Co-Investigator on that mission. Dr. Andrew Christensen stood in as acting Chair of SScAC for this portion of the meeting. Dr. Chyba stated that Solar System Exploration Subcommittee (SSES) was concerned about the cancellation and comments on this subject have been provided directly to NASA Headquarters. ST-4 did play a role in the Subcommittee's thinking about future planetary missions. It was developing critical technology for the Europa Orbiter and was setting the stage for a future comet nucleus sample return mission. One of the reasons there was not a strong push for a comet sample return mission in the last Strategic Plan was because of the existence of ST-4. The SSES will be meeting in August to prioritize its missions for the new Strategic Plan, and the need for preparing for a comet sample return mission will be specifically taken into account in its deliberations.

Research Program Report

Dr. Guenter Riegler, Director of the Research Program Management Division, discussed recent personnel changes, the implications of the House markup, and a proposal for restructuring the Supporting Research and Technology (SR&T) Program. Dr. Hashima Hassan will be the new UV/Optical Discipline Scientist. Three senior civil service positions will be advertised on August 2. Proposal reviews under the Research Opportunities in Space Science (ROSS) NASA Research Announcement (NRA) are ongoing. If the SR&T budget stays as in the FY 2000 budget submitted to Congress, one out of three proposals can be selected for awards; if the budget is reduced by two-thirds, then OSS could only accept about one out of nine proposals, and many ongoing efforts would have to be terminated. Dr. Riegler then turned to a number of basic issues concerning the R&A Program. Currently, the SR&T program is about $180 million/year and consists of about 35 separate discipline-oriented programs. There have been concerns that the program was too fractured, that the content reflects past history rather than current needs, that more flexibility was needed to start new initiatives, and that more continuity in management was needed in the face of an increasing reliance on short-term IPA's.

In order to deal with many of these concerns, Dr. Riegler proposed a transition to a "Science Cluster" structure during the next three years. In this approach, all SR&T programs would be grouped into eight clusters, each of

which would be managed by a team containing at least one civil servant who would provide continuity. Proposals submitted to each cluster would go through two-stage reviews with the second stage being a cross-disciplinary panel review. Phase-in to this structure would occur over 3 years. Clusters would start off with budgets equal to the sum of the previously planned subdiscipline budgets, and there would be no budget changes between clusters during the initial three-year period. However, there would be flexibility to reallocate funds within a cluster. After the end of the 3-year phase-in period, there would be a "Senior Review" which would address three questions: (1) Is the current science cluster structure the best one? (2) What is the science quality and productivity of each cluster? and (3) Is the funding distribution across the eight clusters the right one (based on priorities contained in the Strategic Plan) or should funds be reallocated across clusters? In addition, the Senior Review process would be used to meet Government Performance and Results Act (GPRA) requirements for a periodic assessment of the R&A Program. The proposed clusters (and current funding levels) are: Cross-Theme Theory and Data Analysis Programs (with two subgroups—space physics and astrophysics)--$29 million; Solar and Heliospheric Sciences--$12 million; Ionosphere, Thermosphere, Mesosphere, Magnetosphere--$13 million; Origin and Evolution of Solar System Bodies--$34 million; Planetary Systems Science--$30 million; Astrobiology--$32 million; Astrophysics--$16 million; and High Energy Astrophysics--$20 million. Dr. Riegler noted that there is a mix of science and functional areas in some of the clusters. Some analog of the former Management Operations Working Groups (MOWG's) could provide scientific input to the managers of each of the clusters. If this approach makes sense, the next step is to prepare a detailed implementation plan which would detail when and how specific subdiscipline NRA/review cycles will be combined. Dr. Riegler invited feedback from SScAC on the proposed restructuring.

In general, SScAC felt that a lot of work had clearly been done and that the cluster concept with a Senior Review every 3 years was generally responsive to the Task Force recommendations. The challenge will be dealing with the details of implementation. There were concerns about the details of which activities were to be grouped in specific clusters and whether this approach really would be able to address the need to have some flexibility to redistribute funds. SScAC felt that it was important that the criteria by which the Senior Review will be judging the success of the cluster is established at the beginning of the restructuring. The final recommendations from SScAC on this subject are included in the letter in Appendix D.

Education Program Update

Dr. Jeffrey Rosendhal discussed the OSS Education/Outreach Program which was initiated about 5 years ago. The strategy is based on embedding education in all OSS missions and research programs and creating partnerships between scientists and educators. It is an integral part of NASA's overall Education Program. OSS has taken a phased approach to create this Program: (1) development of policy and overall direction; (2) development of a detailed implementation plan; (3) creation of the support structure; and (4) actual implementation through a "build a little, test a little" approach. The OSS Education Program is currently in the fourth phase. All new OSS missions have required, funded programs; and dozens of smaller activities are underway. The Education Forums are coordinating mission education/outreach activities. They are creating a Resource Directory that will provide ready access to OSS education products and programs and are collecting the data that will result in the publication of the first comprehensive OSS Education Report by the end of this year. A lot of effort has gone into working with science museums and planetariums. The Broker/Facilitators are proving to be effective in connecting researchers with the education world, assisting with proposal support, and arranging partnerships. A large number of activities are now underway. The focus of the effort has now clearly turned from planning to accomplishment.

Dr. Isabel Hawkins provided a perspective on how the science community has reacted to the mandate of Education and Public Outreach (E/PO) as well as a set of examples of programs currently taking place. Teachers and the public want to interact with "real scientists," but there is a challenge of scale. The American education system is very large and decentralized. One of the key elements for success is leverage—how to best amplify space scientists' individual contributions. There are a wide range of possibilities for scientist to be involved in E/PO. Some recent examples of success are: the planetarium show with the Boston Museum of Science (Structure and Evolution of the Universe); the Solar System Ambassadors Programs (Solar System Exploration); astronomy segments for the Marc Steiner NPR Radio Show (Astronomical Search for Origins); the "Eclipse '98" internet event (Sun-Earth Connection); and several Broker/Facilitator activities. Dr. Rosendhal noted that these examples represent just a small fraction of what will be coming together over the next year or two.

SScAC was impressed and pleased with the education and public outreach results to date. Dr. Hawkins emphasized that assessment is an essential part of the education activities and that OSS is now focusing on assessing the quality and effectiveness of its programs. With respect to E/PO funding, Dr. Rosendhal indicated that the target is 1-2 percent of the OSS budget. OSS now has the largest education program of any of the Enterprises and is now a significant element of the Agency's overall education effort. In many cases OSS is making strategic investments that leverage a number of other funding sources. Dr. Urry observed that a weak link in the chain is the process of assisting the science community in putting an effective education component into their proposals. Dr. Hawkins indicated that more proposers are turning to the Brokers for assistance and that there is a new Explanatory Guide to the Proposal Review Criteria which should be helpful. SScAC recognized that E/PO is a fundamentally important thing for OSS to be doing and strongly embraced the OSS Program.

Report From the Planetary Protection Task Force (PPTF)

Dr. Norine Noonan provided an update on the PPTF activities. This Task Force was chartered by SScAC to provide the Committee with findings and recommendations on matters pertinent to NASA's responsibility for planetary protection. The PPTF first met in March 1999. A large portion of this first meeting was spent discussing Mars issues and the findings of the Sample Handling Advisory Review Panel. The PPTF also identified a number of issues concerning the structure and function of the future advisory apparatus needed to advise NASA on these issues. The Task Force felt that future work in this area should take more of a risk assessment approach than NASA has done previously. Given the prominence of sample returns in the future OSS program, a very broad based, consultative approach is going to be required to alleviate potential public concerns. The PPTF has reached consensus about the structure, charter, membership, and governance of any future advisory apparatus. A separate Committee should be formed, organized under the NAC; membership should include other Government agencies and there should be a strong liaison with international groups. The Committee should report directly to the Associate Administrator for Space Science. Membership should be about 15 people, drawn from both scientific and lay communities. Dr. Noonan noted that the NIH Recombinant DNA Advisory Committee had a strong public representation and was a great success, because of this, in alleviating many public concerns. NASA may have similar needs. The next meeting of the PPTF will be September 20-21. In response to a question, Dr. Noonan said that the PPTF's charge would deal with all three topics of planetary protection: forward contamination, backward contamination, and inadvertent contamination of a returned sample that could compromise research. Dr. Squyres noted that planetary protection may wind up requiring a major public education effort. Dr. Papike and Dr. Kolb suggested involving the media and having public debate on the issues. The issues are going to get a lot of public attention, and that situation needs to be addressed sooner rather than later. Dr. Noonan noted that the level of visibility and the kind of organization inside NASA required to do the work are issues that will be addressed at the next meeting.

OSS FY 1999 Performance Report

Dr. Marc Allen reviewed the requirements of the Government Performance and Results Act (GPRA)—Strategic Plan, Performance Plan, and Performance Report. The purpose of the session at this meeting was to preview the Performance Report for FY 1999, both current status and where OSS expects to be by September 30. The FY 1999 Performance Plan required SScAC review of OSS's performance, and OSS has taken the approach making self-assessment to be validated by SScAC.

Following this general introduction, details for 16 individual program and project targets and general progress towards meeting 19 science objectives were presented by Dr. Allen, Dr. Riegler, and Dr. Howard. In general, SScAC agreed with the self-assessments (see appendix D), but a number of editorial clarifications and suggestions were made. Where necessary, individual members of SScAC were assigned to work with Dr. Allen to develop more appropriate wording following the meeting. Specific issues concerning the process itself which emerged during the overall discussion of the detailed performance indicators included the comment that the Committee needed to reexamine how it should be involved in future GPRA assessments and the need for SScAC involvement in arriving at the metrics if it is to be involved in assigning the grades.

The balance of the day was spent revisiting the proposed restructuring of the Research Program and receiving a report from Dr. Harley Thronson, Acting Director for the Astronomical Search for Origins. Dr. Christensen served as Acting Chair for these discussions.

Committee Discussion on the Research Program

SScAC returned to its discussion of the proposed restructuring of the Research Program. The basic issues were whether the proposal was really responsive to the R&A Task Force recommendations and whether the clusters as presented were really coherent groupings. Some members were concerned that the proposed process (without a forced reallocation) might be insufficient to force change. Also, there was no provision for new initiatives, as recommended by the Task Force. There were comments that some of the clusters seemed to involve strange marriages of topics. It was noted that review panels for the clusters would have to have very broad composition, and there is always a danger that smaller areas will be overwhelmed by larger ones in arriving at funding recommendations. Very good people capable of looking at the bigger picture will be required on these review panels. The Senior Review process could force individual clusters to optimize their use of funds in order to stand up to the competitive process. This could be an incentive for balance and reallocation. On balance, SScAC was supportive of the science cluster approach proposed by Dr. Riegler and considered it to be a step forward. As usual, the devil will be in the details. Further comments are contained in the letter in Appendix D.

Astronomical Search for Origins

Dr. Harley Thronson discussed recent theme highlights: measurement of the Hubble constant from HST; successful launch of the Far Ultraviolet Spectroscopic Explorer (FUSE) on June 24; delivery, installation, and testing of the SIRTF primary mirror; announcement of Phase A/B contractor selection on NGST; and appointment of a Director for the Astrobiology Institute. Although the failure of WIRE was a disappointment, a program of astroseismology has been initiated using the WIRE Star Tracker. Results to date look very promising. NASA is also using the WIRE spacecraft for mission operations training programs. The SIRTF Project is also examining how much of the WIRE science program can be accomplished by SIRTF. The next HST servicing mission (3A) is on schedule for an October 14 launch. The Wide Field Camera-3, scheduled for installation on the last HST servicing mission, has funding for the incorporation of the IR channel discussed at the last SScAC meeting. The instrument allocation on NGST will be determined between now and April 2000. A process has been established to decide which of the international partners will do each instrument. The various agencies will then conduct competition to select the specific developers of each instrument. ESA has also expressed interest in participating in the Terrestrial Planet Finder (TPF), but technology transfer will be a sensitive issue in this area. A team has been chartered to develop a plan for collaboration that will deal with these issues. There will be an architecture downselect for SIM around November. Astrometry capabilities for both architectures are identical but the imaging capabilities are different. In addition, technology readiness is an issue. The technology for SIM is not proceeding at the expected rate, so a delay in the mission is anticipated. As noted earlier, there is a problem with the schedule for delivery of the German telescope assembly for SOFIA. Both sides are working on this problem and the schedule is still under review.

Thursday, July 29, 1999

Dr. Squyres briefly reviewed the Strategic Planning process leading up to the Strategic Planning Workshop in Galveston in November. Community consensus prior to the Workshop is the goal and the Subcommittees should be working towards achieving such a consensus. The Strategic Plan should reflect the priorities of the community, but must also give the Associate Administrator some flexibility as to how to best proceed to implement the Plan.

Galveston Workshop

Dr. Allen discussed the details of the Strategic Planning Workshop. The goals of the Workshop are: to present and discuss the Space Science Enterprise proposed strategic program; review and refine the science goals, analyzing overlaps and gaps; review and refine the next level lower objectives for the goals; review the technology alignment with the science program, identify gaps and overlaps, and review the technology section draft; and identify E/PO strategies and special opportunities, and review draft material. Dr. Allen noted that both technology and E/PO needed to be more carefully integrated into the Plan than they were in the 1997 version.

The meeting will be 2 1/2 days (November 2-4, 1999). The first day will consist of presentations of the proposed strategic program, together with presentations on policy, science, technology, and E/PO; the second day will be the working day, with splinter groups on goals, objectives, technology, and E/PO; the third day will be devoted to

integration and discussion of remaining issues. Dr. Allen invited input on the format. Dr. Black noted that there should be an opportunity on the second day for discussion of potential issues coming out of the first day's presentations. Participants need to see as much material as possible before the Workshop and SScAC requested that the draft roadmaps (due October 1) be distributed to the attendees before the meeting. In response to a comment, Dr. Squyres reiterated that the process of consensus building needs to be worked at the Subcommittee level; SScAC members then need to continue to actively work with their colleagues in the community once there is consensus at the OSS level. He noted that the Subcommittees appear to be doing an excellent job laying the groundwork, and there should not be a major problem. Following the Workshop, a draft Strategic Plan will be released for broad comment by January 14, 2000, and will be formally presented to SScAC at its meeting in February 2000. Formal National Research Council (NRC) inputs will be received by May 2000, and SScAC will provide its final review in June 2000. The Strategic Plan will go into final production on July 1, 2000, with release by September 1.

Roadmapping Status/Programs and Priorities

Solar System Exploration

Dr. Chyba noted that the Subcommittee effort was still a work in progress. The meeting in August will be devoted exclusively to Strategic Plan issues and to the development of priorities. Therefore, the information he presented was preliminary. There are three broad quests: to seek the origin of life and its existence beyond Earth; to explain solar system formation and evolution; and to chart our destiny in the Solar System. The latter quest explicitly links with the Human Exploration and Development of Space (HEDS) and the Earth Science Enterprises. The three quests are addressed by three cross-cutting thrusts: "Exploring Organic-Rich Environments"; "To Build a Planet"; and "Bringing Mars to Earth". Mission planning is done within the three thrusts.

Dr. Chyba described each of the three thrusts and how present/planned missions, near-future missions, and examples of far-term missions would meet the objectives of each. The near-term future missions in each thrust have not yet been prioritized. Near-term priorities will depend on developments in technology, and there will be time to explore the readiness of each and the time sequencing. In the far term, the Subcommittee is thinking more about areas than specific missions. The highest priority near-future missions in the first thrust, which is the key to looking for life, are: Europa Lander; Titan Explorer; and Neptune Orbiter. Example far-term areas in this thrust include: in-situ exploration of Titan and Europa; exploration of the Kuiper belt and beyond; and sample returns from the outer solar system. The near-future missions in the second thrust are: Comet Nucleus Sample Return; Saturn Ring Observer; Venus Sample Return, and Lunar Giant Basin Sample Return. Example far-term areas are: asteroid sample returns; multiplanet probes; and seismic networks. Mars Exploration is being portrayed in a somewhat different way. It is a more clearly defined program, and the exploration process is much more mature. Mars Exploration addresses all of the solar system quests. Near-future missions include: subsurface sampling; in situ analysis of sites of biological interest; coordinated exploration networks; and a global telecom/navigation network. Example far-term areas are: self-sustaining interactive networks; seamless Earth-Mars internet; and human-assisted labs. SScAC suggested that the Roadmap needed to be very explicit about needs for capabilities to handle samples both for Mars and other bodies, since this is an important element. Dr. Chyba indicated that the SSES is composing a letter that addresses some of the sample return issues. Dr. Squyres noted that astrobiology needs to be integrated across all the themes, and serious thought must be given to how this subject is to be treated in the Strategic Plan. It should not just show up in the Origins or Solar System Exploration subsections of the report. It crosses all themes and needs to be integrated into them.

Technologies being roadmapped include: advanced propulsion (solar sail, low cost solar-electric propulsion, lightweight chemical); aeroassist (ballutes, aeroshells); planetary mobility (atmosphere, surface, subsurface); survivable systems; miniature science labs (prebiotic chemistry, age dating, geophysics); sample acquisition and handling (solid samples, ice/liquid sample, containment); bioload reduction and planetary protection; and robotic outposts. These technologies are enabling for almost all of the near-term missions. Dr. Chyba noted that E/PO gets integrated into the Strategic Plan in different ways, depending on the audience being reached. Solar System Exploration has high visibility, and the approach to E/PO must take advantage of this.

Sun-Earth Connection

Dr. Christensen reported on the status of the Sun-Earth Connection roadmap activity. This theme is using an approach to developing the Roadmap similar to the one used the last time—a roadmap team as author, the Sun-Earth Connection Advisory Subcommittee (SECAS) as reviewer, and NASA Headquarters as editor and publisher. There

has been a very strong interaction with the scientific community. The roadmap activities have been publicized in various announcements, and a Workshop was held in March. In addition, there were opportunities for community outreach at the AGU/AAS meeting in early June. A Web site on the roadmap activity is being maintained.

The Sun-Earth Connection goal is to understand the variable sun and its effects on planetary environments and life in the solar system. The implementation of this goal is also through quests and campaigns. There were three quests in the 1997 roadmap: Why does the Sun vary? How do the Earth and planets respond? How does solar variability affect life? A fourth quest has been added to this Roadmap, prompted by new scientific insight and technological advances: How do the sun and galaxy interact? It is now possible to think about traveling beyond the Solar System well into the interstellar medium, making the concept of an "Interstellar Probe" one which is realizable during the time horizon or this Plan. Associated campaigns deal with the origins of solar variability, solar wind and heliospheric environments, geospace environment, comparative planetary environments, the nearby galactic environment, and space weather. To illustrate the planning process, Dr. Christensen discussed outstanding questions and recent achievements in the four quests. SECAS has tried to prioritize missions based upon the most important scientific questions that can be addressed by an identifiable next step. Some of the resulting missions can be done within lines such as the Solar Terrestrial Probe series. The highest priority Solar Terrestrial Probes ($120-$125 million class) are: Solar Near-surface Active Region Rendering (SONAR); Inner Magnetosphere Constellation (IMC); Reconnection and Microscale Probe (RAM); and Ionosphere/Thermosphere/Mesosphere (ITM) Waves. Others will require more ambitious missions such as a Solar Polar Orbiter and the Interstellar Probe.

The Sun-Earth Connection technology requirements are: miniature satellites; advanced propulsion; high data rate communication from deep space; miniaturized instruments; data visualization and modeling techniques; and extended-life components. With regard to E/PO, a few existing E/PO highlights and future opportunities will be sprinkled through the document; in addition, there will be a separate E/PO section in the roadmap. This roadmap has a stronger emphasis on heliosiesmology, outer heliosphere, planetary missions, solar irradiance, and overlap with other NASA themes than the previous Roadmap did. The roadmap proposes accelerating the development of new missions within the Solar Terrestrial Probes (STP) line to an 18-month cycle (it is 30 months now) to re-attain the synergy between various missions proposed in the earlier roadmap and to develop technologies required to enable long-term missions. The Sun-Earth Connection theme will also propose at least one major new start in this Strategic Plan.

Astronomical Search for Origins

Dr. Black reported on the strategic planning progress of the Origins Subcommittee (OS). The structure of the previous Roadmap remains valid and is being used as a point-of-departure for the current work. There has been a focus in getting strong community input which has been obtained through outreach at the AAS meetings in Austin and Chicago, informal interactions with the NAS Decennial Survey, and hearing from NASA-sponsored community-based working groups. The Astrobiology Roadmap has also been explicitly considered. One of the major challenges facing Headquarters will be how to smoothly integrate Astrobiology into the overall endeavor. Science priorities were developed at the May OS meeting based upon inputs from various advocacy groups. E/PO input was obtained through working with the Origins Education Forum at the Space Telescope Science Institute. An Origins Program Architecture Team (OPAT) was formed to coordinate the overall development of the OS roadmap and to ensure integration of technology work into the Roadmap. The team includes three OS members (plus the Chair), the OS Education Forum Director, a technology representative, an astrobiology representative, the NGST Project Scientist, and various members of the Headquarters staff. Writing assignments have been given to OPAT/OS, and a first draft of the roadmap will be available August 5. It will be reviewed, sent back with comments, refined, etc. The draft roadmap will be sent to the OS for review on August 26, and the OS will reach a concurrence on the roadmap at its next meeting September 1-2. In response to a question, Dr. Black indicated that the existing pieces in the Astrobiology roadmap have been reviewed with the astrobiology representatives and will be smoothly integrated into the OS roadmap. This is one of the major challenges for the OPAT. OS will have a strong emphasis on the search for habitable planets; this emphasis will feed back heavily into the R&A and astrobiology programs. In response to a question from Dr. Squyres regarding mission priorities, Dr. Black indicated that Origins does have a mission priority: the Terrestrial Planet Finder moves into the sequence of major missions after SIM and NGST. The other two high priority missions being considered for the intermediate term are a large filled-aperture cooled IR device and ST 2010. Beyond that, OS looked at other options for the longer term, e.g., a submillimeter interferometer of a large scale. In response to Dr. Squyres' concern over the absence of more

modest-sized missions in this roadmap, Dr. Black noted that most of the more modest missions which lead up to these proposed missions are now in development. Achieving theme goals requires very difficult measurements and ambitious missions. Smaller investigations and other innovative ideas can still be proposed to the Explorer and Discovery Programs. Dr. Black noted that the roadmap explicitly points out that there are science objectives that can be met with something less than a flagship-type mission. Dr. Squyres stated that this point needs to be made very clearly in the Roadmap. Dr. Thronson has been very actively working with Dr. Pilcher to explore missions of common interest, and this ongoing dialogue needs to be continued. Dr. Chyba indicated that he would have a closer dialogue with Dr. Black over the next few months. Such close coordination is clearly needed.

Structure and Evolution of the Universe

Dr. Bruce Margon reported on the status of the Structure and Evolution of the Universe roadmapping effort. This theme encompasses a very diverse set of techniques, considers projects across a wide range of the electromagnetic spectrum, and explicitly involves a number of techniques that do not involve photons. The Structure and Evolution of the Universe Subcommittee (SEUS) is finished with the prioritization process, and a clear consensus and a clear set of priorities have emerged from that process. The 1997 roadmap had three quests and three "flagship" missions: FIRST, GLAST, and Constellation-X. All three are in the current Strategic Plan; FIRST and GLAST are in the current budget. Dr. Margon discussed the process for developing the new roadmap. Nine Working Groups/Task Forces were established to obtain broad community input. Oral preliminary reports were presented to SEUS in February and June, with formal "white papers" being developed by most of the nine Working Groups. In parallel, a technology panel provided input throughout the roadmap, and an E/PO task force (including the SEU Education Forum) provided input in this area. Three top priority science objectives (and three missions to accomplish them) have been identified for the near term. Multiple candidate midterm (2008-2013) new starts have been identified. There is a set of vision missions for the far term. For the near term, the three top priority science objectives and the missions to accomplish them are (in order): high throughput X-ray spectroscopy—addressed by Constellation X; gravitational radiation—addressed by the Laser Interferometer Space Antenna (LISA); and cosmic rays—addressed by the Advanced Cosmic Ray Composition Experiment for Space Station (ACCESS). Dr. Margon discussed each of these missions and the scientific questions they would address. These three major missions are in different stages of technology development and reflect a wide range of cost scope. Substantial international collaboration on LISA is anticipated, and developing the technology will be a challenge; however, the SEUS was unanimous in its position regarding the importance and priority of LISA. Sample midterm missions (the list will be prioritized and shortened for the roadmap submittal) include: the Advanced Radio Interferometry between Space and Earth (ARISE) mission; the Energetic X-ray Imaging Survey Telescope (EXIST); the High-Resolution Spectroscopic Imager (HSI); the Micro Arcsecond X-ray Imaging Mission (MAXIM) Pathfinder; the Orbiting array of Wide-angle Light detectors (OWL); and the Space Infrared Interferometric Telescope (SPIRIT)/10m mission. Sample "vision" missions include: the Cosmic Microwave Background (CMB) polarization mission, an 8m UV/O telescope, Generation-X, the full MAXIM mission, SPECS, and S-Z Mapper. For the latter group, the science problems are clear, but the technology is clearly not ready. The Roadmap document is now being written, and there will be a SEUS meeting to review the final language. In response to a question regarding cost, Dr. Margon noted that LISA has been well studied, and the cost is about $500 million; Constellation-X is also in the neighborhood of $500 million, and ACCESS is about a $100 million program. There is intense interest in Europe concerning the LISA mission, and it is a strong candidate for an international mission. Both Constellation-X and LISA require substantial technology development. The Constellation-X technology development plan is well understood and is being paced by the availability of funds. LISA will probably require an extensive program of on-orbit technology development. The Roadmap will be explicit about the needs for technology.

Following these presentations, Dr. Squyres began a general discussion of strategic planning by identifying four issues for SScAC to consider: how to handle cross cutting science themes such as astrobiology; how to deal with cross cutting technology needs such as solar sails; how to identify cross cutting instrument opportunities for missions such as the Space Infrared Interferometric Telescope/10m mission; and what steps needed to be taken to prepare for the Galveston Workshop. Dr. Squyres noted that the four Subcommittee Chairs needed to examine carefully all the programs emerging in all the themes and look for connections.

Dr. Squyres invited comments from SScAC members on the roadmapping progress. Dr. Papike observed that the moon appeared to be overlooked in the planning process and that there was an important tie to potential human exploration of the moon. Dr. Squyres encouraged Dr. Papike to address this issue at the SSES level. Dr. Richstone

noted three areas of common technology in both the Origins and Structure and Evolution of the Universe themes: low-thrust solar-electric propulsion systems, laser interferometry, and detectors. Dr. Macauley suggested some general themes that should be addressed in the Strategic Plan. For cross cutting themes, the groups should identify a role for industry as a partner wherever possible and highlight international participation. The roadmaps should also identify the class of mission envisioned (flagship, etc.) for addressing each objective. Dr. Gehrz advised the roadmap groups to make sure the context of their plans are clear (e.g., which missions are assumed to be under development, etc.). It is important that the roadmaps contain accomplishments, particularly things that have been "solved" (e.g., the question regarding the origin of gamma-ray bursts). Also, every theme needs to address opportunities for Discovery/Explorer missions. Dr. Squyres reiterated the point that all Subcommittee roadmap and working groups should look carefully at material from the other themes and identify opportunities where a mission/concept in another theme has the potential to be of direct benefit to that Subcommittee's theme. It is essential that the Plan be integrated at the overall science content level. Dr. Kolb added that all of the roadmaps should show a vision of where they would like to be in 2010, as was done by the Solar System Exploration Subcommittee.

Lunchtime Science Talk

During lunch, Dr. Karel Schrijver from Lockheed Palo Alto Research Labs discussed the solar corona and transition region as seen by the Transition Region and Coronal Explorer (TRACE). As an introduction, he showed computer simulations of expected field behavior and flux at the surface of the Sun and then proceeded to show how the high resolution observations from TRACE were providing insight on what was really happening. TRACE is sun-synchronous and provides uninterrupted viewing of the Sun. Dr. Schrijver compared images from TRACE, SOHO, and Yohkoh and showed high-resolution time-lapse TRACE images of coronal mass ejections and filaments and other interesting reconnection phenomena. He summarized a number of discoveries, observations, and conclusions from TRACE.

Space Science Planning in Europe, Japan, and Canada

Dr. Allen introduced the international visitors. Dr. Takeo Kosugi from ISAS briefly discussed ISAS and its achievements. One important aspect of recent ISAS space-related activity is international collaboration particularly with NASA. ISAS is planning for Astro-E to be launched at the end of this year. ISAS, in connection with NASDA, will launch a moon mission in 2003. There are no approved spacecraft projects beyond Astro-F (an infrared project) to be launched in 2003 and Solar B (to be launched in 2004), but several pre-Phase A studies are in progress. By this fall, the groups will have prepared proposals for the selection process for the next set of missions.

Dr. Giacomo Cavallo from ESA noted that the ESA science program also suffered budget reductions last May and received a strong message that science planning would have to be adjusted. In response, there will be a call for small missions by the end of this year. No missions will be canceled, but missions will be stretched out and final approval will be delayed until funds are available. Costs will be cut by taking more risks, and ESA will be relying more on international collaboration, even for the cornerstone missions. Dr. Cavallo expressed the opinion that there should be common global roadmaps developed for all of space science. There has been considerable international collaboration in astronomy; there should be more in planetary science.

Dr. Gernot Hartmann from DLR discussed DLR planning. Most of the money in the German space program is spent on ESA programs. German scientists are involved in all of the ESA programs and in many NASA programs as well. With the recent change of priorities in Germany (a greater focus on space applications), there has been a 30% reduction in space science funding, and it is no longer possible to do significant national programs. The issue of priorities in the German space program will be revisited this fall..

Dr. Giovanni Bignami from ASI discussed the ASI science program. The ASI budget is about the same as Germany ($800 million/year total) but the budget for science has doubled over the past few years. About one-third of the budget goes to ESA; about two-thirds for national work. ASI has started a program of small missions (similar to SMEX and MIDEX). The small science mission program is open worldwide, and U.S. scientists are welcome to participate through an open AO. Groups of GSFC scientists are already interested. The next round of selections of missions for small science should start the end of this year or the beginning of next.

Dr. Wauquiez Fredene from CNES highlighted some of the collaborative space science projects. CNES is very pleased to collaborate with NASA on the Mars Sample Return and with ESA on Mars Express. There is also considerable CNES interest in Solar Probe and NGST.

Dr. Terry Hughes from CSA discussed the recent actions on the Canadian space budget and the CSA science program. In February, CSA received ongoing funding of $300 million (Canadian) per year which was less than expected. CSA has flexibility to move funds around the Agency. Space science was in good shape initially; but due to budget constraints and clear priorities for Space Station and Radarsat, there is not much funding for other areas until about 2002-2003. There will be a workshop in October to consider a possible Canadian role in planetary science. There is a strong interest in the Mars Program. CSA is involved in NGST, and there is interest in FIRST/Planck. CSA is also involved in life sciences experiments which are manifested for future Shuttle flights so available funds are being stretched to cover many things. Space weather is of prime interest in Canada. CSA will be issuing AO's for the small payload program (microsatellites, balloons, and rockets). Much of the work is done through collaboration with NASA, ESA, and Japan.

Technology Task Force

Dr. Ralph McNutt gave an interim report on the Technology Task Force activity. The charter of the Task Force is to provide input to SScAC on the current technology strategy process to ensure that there is close linkage between science mission planning and technology and to ensure cross-theme coordination of technology requirements. The Task Force activity is moving in parallel with the strategic planning process. At the most recent meeting, the Task Force looked at whether the missions for the near term and visions for the far term have been articulated in sufficient detail to derive technology objectives (for the near term) and required capabilities (for the far term). At the next meeting (September 15-17), the Task Force will look at the integration of objectives and capabilities across the four themes and whether the technology developments in various program are appropriately scoped, scheduled, and funded to satisfy the missions and visions of the Enterprise. The membership of the Task Force has provided a wide variety of perspectives on the issues. There were a lot of accolades for what has been accomplished to date in the strategic planning process. So far, quests are well articulated. There has been a good integration of technology into the process. The Task Force noted that the proposed missions are of high value to the science community, high interest to the public at large, and are aimed at maintaining U.S. space science and technology leadership. However, there were a few concerns and issues: there need to be measurable technology objectives (cost, schedule, risk, and performance) as related to missions; there need to be realistic measurable major milestones for the required technologies along with exit criteria; and a unifying technology vision to support the space science vision needs to be developed across the themes.

The Task Force made some theme-specific observations. Most of the concerns were related to ensuring that all of the technology thrust areas have been appropriately identified and measurable technology objectives have been derived. In general, across the themes, the Task Force felt that missions had been sufficiently articulated to derive technology objectives and capabilities but the depth of technology planning needed to be substantially increased. In the particular case of "Origins" the difficulty of the technology challenges may not have been emphasized enough.

Dr. McNutt noted that the major concern of the Task Force, particularly those members external to NASA, was with control of schedules and expenditure of resources in achieving technology readiness for new programs. They felt that the only way to achieve these ends effectively is to have some way of measuring performance/accomplishment as a function of time. He emphasized that this was an interim report, that the Task Force recognized that the answers to many of the questions they had raised really required the ongoing existence of a science/technology mission group for several years, that the process will have to be highly iterative, and that additional work to understand these issues is being done as part of the process.

Legislative Affairs

Because of the extraordinary interest in the House appropriations action, Mr. Ed Heffernan, Associate Administrator for Legislative Affairs, provided a brief overview of the legislative situation. The Administrator has sent a letter to Chairman Bill Young of the House Appropriations Committee outlining his many objections to the markup received earlier this week. NASA will do everything possible to let members of Congress know the impact of these reductions for FY 2000 and the implication of these reductions for the future. There have been several editorials noting that the proposed cuts are too deep, and concerns have been expressed over what this action will do to the

science and technology base of the country. The full House Appropriations Committee will mark up the bill tomorrow; the Senate mark-up of the Bill will occur in September. The Administration has also put out a statement of policy and is strongly opposed to the House Bill in its current form. Members of Congress need to know the impact on all of the programs enumerated in the Bill. Doing this will be a top priority for NASA over the next few weeks. Every science program that was zeroed out needs to be restored. In response to a question, Mr. Heffernan stated that the Administration has not come to a conclusion with respect to a veto of this Bill. He noted that there is an expectation on the part of some of the members that the cuts will be restored. NASA will be doing an intensive analysis over the next 30 days on how these cuts would impact the Agency in terms of facilities and personnel as well as missions. In response to a question, Mr. Heffernan indicated that the Congressional staff members are very familiar with NASA programs and facilities; however, the members of Congress need to be informed directly.

Technology Program

Mr. Rick Howard discussed some recent technology accomplishments, activities in support of the Strategic Plan, and how priorities for technology funding are established. The two recent accomplishments highlighted were: the successful testing of a 412 x 512 Si:As IBC (the leading candidate for the NGST mid-infrared detector); and the detection of fringes on an efficient X-ray interferometer, an accomplishment that may open up the prospect of x-ray interferometry being a reality for future missions. With regard to support of the Strategic Plan, Mission and Project Design Centers are being used by the roadmapping teams to provide mission design technology and expertise, carry out technology tradeoffs, and do preliminary costing. The Division has been supporting mission technology requirements definition and carefully analyzing current/planned technology programs to see whether they meet requirements. The output of this analysis will be ready for the next meeting of the Technology Task Force. A set of integrated technology requirements has been completed. Cross-theme integrated technology requirements have been developed. The Division is finalizing the development plans for each technology requirement or family of requirements. These plans will describe the technical approach, schedule, status, technical risk, required budgets, and relation to other programs both inside and outside of NASA. Information will be available to support the development of the Strategic Plan.

With respect to the establishment of priorities, the priorities for the focused programs (those that directly support future OSS missions) are established within each theme by the Science Theme Director in consultation with the theme Subcommittee and roadmapping team; cross-theme activities are prioritized by the Associate Administrator and the Board of Directors. The Cross-Enterprise Program is organized into ten thrust areas with a Manager for each area. Each thrust area develops a plan based on a number of inputs including Enterprise technology requirements and Enterprise Relevance reviews. The thrust area plans are integrated by the leads at the Centers and the Headquarters staff into a Program Plan for Headquarters approval. Eventually, a significant part of this work will be competed through an open NRA, but a number of policy issues are still being resolved prior to proceeding with such a competition. The New Millennium Program (NMP) is being restructured to focus on technology validation. The Strategic Plan and theme technology roadmaps will set the technology requirements. Headquarters will set the priorities and constraints and determine the implementation Center for each NMP project. Project concepts will be subjected to independent peer review. Projects will be driven by technology needs. Besides NMP, there are other opportunities for technology development and demonstration. Within OSS, the R&A and Suborbital Programs play an important role in technology development. Mr. Howard noted the Division's new product—a compilation of all technology done within OSS and the Cross-Enterprise Program that supports OSS needs. The intent is to give a snapshot of all OSS technology across the Enterprise. This document should be on the Web in a couple of weeks.

General Discussion of Strategic Planning Process

Dr. Squyres opened the discussion saying that there seemed to be good progress being made on the development of the Strategic Plan, but there seemed to be some issues requiring further consideration: cross-cutting science, cross-cutting technologies, cross-cutting mission opportunities, and the strategic planning process between now and the November Workshop in Galveston.

Dr. Allen summarized the outline for the 2000 Strategic Plan that had previously been distributed to the Committee. The first part will deal with the science goals and objectives, the role of technology and the role of E/PO (an overview of what OSS wants to do); the second part is a more detailed discussion of the program (how OSS plans to

do it). The discussion of technology and E/PO will be strengthened and better integrated into the Plan than was done the last time. Dr. Vondrak noted that the first section needed to present a very clear and coherent view of the OSS program starting with the basic questions. Dr. Allen noted that the first section will address the OSS vision and major questions: How does the universe work? Where did we come from? Where are we going? Are we alone? Dr. Squyres indicated that at Galveston, the content should be clearly enough articulated so that a small writing group can then put together the actual document. This was the process used at Breckenridge. The SScAC felt that the current missions should be discussed, and that the Plan should clearly show the relationships between recent accomplishments, the current program, and the future program.

With respect to the issue of who will be at the Galveston Workshop, Dr. Allen indicated that participants would include: SScAC, additional representatives from each of the Subcommittees; the four Subcommittee technologists, the Co-Chairs of the Technology Task Force; four outside people representing E/PO; and one additional outside scientist from each theme area (to be identified by the Theme Director) who is not a member of SScAC or Subcommittees. Dr. Squyres noted that there was insufficient expertise in biology and suggested that a few additional people should be specifically invited from the life sciences/biology area. Dr. Vondrak suggested inviting the Chief Scientist and the new Director of the Astrobiology Institute. Dr. Allen noted that he needs to keep the attendance under 80 people. NASA Headquarters invitees will include the Theme Directors, Dr. Rosendhal, Dr. Allen, one person from each theme in the Research Program Division, a senior astrobiology representative, Dr. Ulrich, Dr. Riegler, and three open slots for invitees of Dr. Weiler. In addition, a representative from OMB will be invited. SScAC suggested inviting someone from the Office of Science and Technology Policy (OSTP) as well. Members (Chairs) from the NAS Space Studies Board will be invited for the first day to talk about goals and objectives (similar to Breckenridge). The NAS will be formally asked to review and comment on the Plan later in the process. Information packages will be mailed out to participants around the second week in October.

The process for getting technology appropriately built into the Plan was discussed. Several groups are working on technology and all of the information will have to be brought together. There will have to be a writing group to focus on the technology section (Drs. Ulrich, Hastings, Anderson, etc.). The text and supporting material needs to make sure that the technology requirements of the Themes are presented in an integrated way and that cross-cutting areas are properly addressed. The SScAC felt that the Technology Task Force should prepare an interim letter report for distribution to the Workshop participants along with the information package. The formal report from the Task Force will be delivered to SScAC in February. Another iteration may need to be done while a draft of the Strategic Plan is being prepared in December.

With respect to astrobiology, Dr. Squyres stated that there should not be a separate astrobiology theme or chapter; rather, as each theme puts together its roadmap, it should look to the three other themes and astrobiology for cross-cuts. Each theme must highlight the fact that biology is now a fundamental part of much of what is done in space science. The Committee agreed that the Astrobiology Roadmap should be handled by each of the roadmap teams in the same manner as other theme roadmaps. It was also pointed out that the Strategic Plan needs to point out that this Plan involves a fundamentally new class of mission—sample returns. Explicit steps have to be taken to get ready for this class of mission and there are particular needs in instrumentation that must be highlighted.

Friday, July 30

Discussion/Preparation of Recommendations

The Committee reviewed recommendations on the following topics: SOMO, the need for technology validation, and the proposed restructuring of the R&A program. Final recommendations are included in the letter in Appendix D.

Dr. Squyres then invited final comments from SScAC members. Several of the members expressed concern about SScAC coming into issues too late and being caught by surprise on issues that turn out to be important (e.g., SOMO, the Astrobiology Institute, ST-4, and GP-B). Topics raised (beyond those previously discussed at the meeting) included: lunar missions are underplanned; SScAC needs to be more involved in developing performance metrics for the next plan if it is to be involved in rating OSS performance in the future and that, in general, the metrics need to be improved; staffing/workload at NASA Headquarters and the impact on the review process (this

will be a topic at the next SScAC meeting); the need for scientists to learn more about and get more involved in the policy process; the importance of NMP and the flight validation of technology; and the need for SScAC members to take an advocacy role for education and public outreach with their colleagues. There was a general concern over whether there would be enough time at the Galveston Workshop to get the integration job done in only 2 1/2 days. Dr. Squyres suggested identifying a subset of the group that could stay one additional day to polish things should additional time be needed.

Dr. Gehrz noted that the current R&A program does not provide enough opportunity for training young instrument and technology people (balloons, sounding rockets, detector evaluation programs can be extremely valuable). The SScAC agreed that this is a particularly important issue that SScAC should address in the future. The Strategic Plan should also address the issue of human resource needs for implementing the future program. Dr. Kolb suggested a new initiative for OSS—fundamental physics in space. Following his speech at Fermilab in May, Mr. Goldin asked that a group be formed to examine how fundamental physics might be done in space. There will be three meetings of the group. NSF, DOE, and NASA are involved in the planning, and Dr. Kolb is a member of the group. The SScAC requested a briefing on the progress of this initiative at the February meeting. The Committee also requested a briefing on the Astrobiology Program. Dr. Squyres noted that with the increased emphasis on sample return missions, planetary protection, and what rules are laid down have the potential to be a significant programmatic and financial issue to OSS. The SScAC must pay attention to this issue. Dr. Chyba noted that the SSES clearly needs to spend more time considering sample handling, return, and analysis issues.

Discussion with the Associate Administrator

Dr. Weiler noted that the full House Appropriation Committee will vote on the budget today. If the House does not rescind the cuts that are in the current Bill, all OSS grantees will be informed by e-mail of the situation and told that approximately 60 percent of current grants will not be renewed, and future commitments should not be made. Senate views on the budget issues are not known and will not be known until after Labor Day.

Dr. Squyres reviewed SScAC recommendations and items that will be addressed in the letter. He congratulated Dr. Weiler and OSS on the recent successful launch of Chandra. The SScAC was pleased to hear that a SOMO User's Group is being established, and Dr. Squyres offered to brief them on the findings of the Study Team. The Committee felt that it has been very useful to have an individual on the OSS staff to act as a focal point for SOMO issues. SScAC will continue to watch this issue carefully. It is important for the science community to be informed about the impact of SOMO and CSOC. Dr. Weiler assured the Committee that it was his goal that SOMO/CSOC have no negative impact on OSS missions. The intent of SOMO/CSOC was to reduce the cost of operations so that the Agency could launch more missions. If the Agency has big bills from SOMO/CSOC, the funds will have to come from missions, and some missions might even have to be canceled. This contradicts the original intent of the SOMO concept. Such a situation, if it happens, will be a major embarrassment to the Agency and is likely to get significant outside attention.

The SScAC strongly endorsed the original concept of NMP—a flight program whose goal is to validate new technology that will enable future OSS missions—and hoped that such a program would be a major part of the OSS program for years to come. The SScAC felt that it would be important to take this recommendation to the NAC.

Dr. Squyres noted that SScAC focused on the proposed restructuring of the R&A program and the OSS response to the Task Force recommendations. The SScAC was pleased with the general concept of science clusters (although some details remain to be worked out) and believes that the proposed Senior Review process is appropriate and should provide some flexibility. One of the specific recommendations of the Task Force was that there needed to be a mechanism for periodically redistributing funds to deal with new opportunities. The SScAC continues to feel that this is a good concept and hopes that whatever specific implementation is put into place captures the spirit of this recommendation.

The SScAC felt that Dr. Allen did an excellent job with the GPRA Performance Assessment.

The SScAC was pleased with the progress being made on strategic planning; all of the Subcommittees have done an excellent job and have worked hard to develop a consensus in their communities. The next job will be to build a consensus on the OSS-wide program.

The SScAC felt that technology, education and public outreach, and astrobiology were themes that needed to be woven into the fabric of the new Strategic Plan. It appears that there is a process in place that will facilitate this happening. Dr. Weiler stated that SScAC must become more involved in Astrobiology and encouraged SScAC to invite the new Director of the Astrobiology Institute to the next meeting.

The SScAC stated the importance of ensuring that some particular types of invitees were present at the Galveston Workshop—people who have a strong interest in education and public outreach; biologists; representatives from OMB and OSTP; people who have expertise in communicating science to nonscientists; SScAC alumni or alumni of past strategic planning retreats; and scientists-at-large from the various communities. Dr. Weiler suggested adding the Chief Technologist and the Chief Scientist to the invitation list.

In response to a comment regarding public outreach, Dr. Weiler noted that more scientists need to be engaged at the local level in communicating the excitement of science and NASA's missions. Much progress has been made in 10 years, but more must be done. The people of this country need to know why they should care about space science. The recent Congressional action should be used as an opportunity to wake people up. Dr. Rosendhal added that the education program is starting to make some headway in addressing these areas.

Before adjourning the meeting, Dr. Squyres scheduled the next SScAC meeting for February 29-March 2, 2000, at a location to be determined.

July 26, 1999

Final Agenda
Space Science Advisory Committee Meeting
NASA Headquarters/MIC 6
July 28-29-30, 1999

Wednesday, July 28

8:15 AM	Opening Remarks/Announcements	Squyres
8:30	OSS Program and Budget Status	Weiler
9:45	Theme Status Reports (15 minutes each)	
	- Solar System Exploration	Pilcher
	- Sun-Earth Connection	Withbroe
	- Astronomical Search for Origins	Thronson
	- Structure & Evolution of the Universe	Bunner
10:45	SOMO Report to the NAC	Squyres
11:00	General Discussion	
NOON	Working Lunch	
12:45 PM	Research Program Report	Riegler
	- Response to the R&A Task Force	
1:30	Education Program Update	Rosendhal/Hawkins
2:30	Report from the Planetary Protection Task Force	Noonan
3:00	OSS FY 1999 Performance Report	Allen/ Committee
4:30	Issues Discussion	
5:30	ADJOURN	
6:30	Group Dinner—Le Rivage, 1000 Water Street, SW	

Thursday, July 29

8:00 AM	Announcements	Squyres
8:15	Galveston Workshop	Allen
8:30	Roadmapping Status/Programs and Priorities	
	- Solar System Exploration	Chyba
9:30	- Sun-Earth Connection	Christensen
10:30	- Astronomical Search for Origins	Black
11:30	- Structure & Evolution of the Universe	Margon
12:30 PM	Lunchtime Science Talk: The Solar Corona and Transition Region as Seen by TRACE	Schrijver
1:30	Space Science Planning in Europe and Japan	
2:00	Report from the Technology Task Force	McNutt
	- Integration of Technology into the Strategic Plan	
2:45	Technology Program	Howard
	- Technology Support of the Strategic Plan	
	- Establishing Priorities for Technology Funding	
3:30	General Discussion of Strategic Planning	
4:15	Committee Discussion/Preparation of Recommendations	
5:30	ADJOURN	

Friday, July 30

8:15 AM	Announcements/Plans for Future Meetings	Squyres
8:30	Discussion/Preparation of Recommendations	
11:30	Report to the Associate Administrator	Squyres
12:15 PM	ADJOURN	

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SPACE SCIENCE ADVISORY COMMITTEE (SScAC)
NASA Headquarters
July 28-30

MEETING ATTENDEES

Committee Members:

Squyres, Steven W. *(Chair)*	Cornell University
Black, David C.	Lunar and Planetary Institute
Christensen, Andrew B.	The Aerospace Corporation
Chyba, Christopher F.	SETI Institute
Des Marais, David J.	NASA/Ames Research Center
Gehrz, Robert D.	University of Minnesota
Hastings, Daniel E.	U.S. Air Force
Hawkins, Isabel	University of California, Berkeley
Kolb, Edward W.	Fermi National Accelerator Laboratory
Macauley, Molly K.	Resources for the Future
Margon, Bruce H.	University of Washington
Mewaldt, Richard A.	California Institute of Technology
Papike, James J.	University of New Mexico
Richstone, Douglas O.	University of Michigan
Rosendhal, Jeffrey D. *(Executive Secretary)*	NASA Headquarters
Smith, William	AURA
Urry, C. Megan	Space Telescope Science Institute
Vondrak, Richard R.	NASA/Goddard Space Flight Center
Zuber, Maria T.	Massachusetts Institute of Technology

NASA Attendees:

Brody, Steve	NASA Headquarters
Bunner, Alan	NASA Headquarters
Calabrese, Mike	NASA/GSFC
Faster, Bob	NASA/JPL
Holt, Steve	NASA/GSFC
Horowitz, Steve	NASA/GSFC
Howard, Rick	NASA Headquarters
Jones, W. Vernon	NASA Headquarters
Lavery, Dave	NASA Headquarters
Lindstrom, Kurt	NASA/JPL
Ling, James C.	NASA Headquarters
Morrison, David	NASA/ARC
Netting, Ruth	NASA Headquarters
Norris, Marian	NASA Headquarters
Pilcher, Carl	NASA Headquarters

Richie, R. W.	NASA/LaRC
Riegler, Guenter	NASA Headquarters
Rummel, John	NASA Headquarters
Schmidt, Greg	NASA/ARC
Six, Frank	NASA/MSFC
Sorrels, Carrie	NASA Headquarters
Thronson, Harley	NASA Headquarters
Varsi, Julio	NASA Headquarters
Weiler, Ed	NASA Headquarters
White, S. Slade	NASA/JPL
Withbroe, George	NASA Headquarters
Zanetti, Lawrence	NASA Headquarters

Other Attendees:

Akinwote, Barbara	NAS/NRC
Andreoli, Leo	TRW
Appleby, John	JHU/APL
Bailey, Kathie	AAU-SSWG
Beres, Kathleen	TRW
Bignami, Giovanni	ASI/Italy
Brennan, Don	Orbital Sciences
Burnham, Mark	Caltech
Burrowbridge, Don	Orbital Sciences
Cavallo, Giocomo	ESA
Christian, Carol	STScI
Demas, Louis	Demas Science & Engineering
Domian,Brian	Contraves Brashear Sys.
Fredene, Wauquiez	CNES/France
Giovane, Frank	NRL
Hartmann, Gernot	DLR/Germany
Hassan, Hashima	STScI
Herman, Dan	[consultant]
Hertz, Paul	NRL
Hughes, Terry	CSA/Canada
Kinney, Anne	STScI
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Matsumoto, Toshio	ISAS/Japan
McNutt, Ralph	JHU/APL
Morrill, Jeff	NRL
Noonan, Norine	EPA
Reese, Terry	Lockheed Martin
Roeder, Herbert	Orbital Sciences
Schrijver, Karel	LMMS

Targulian, Nadia	SSB/NRC
Whitney, P.	NRC/SSB

SPACE SCIENCE ADVISORY COMMITTEE (SScAC)
NASA Headquarters
July 28-30
FINDINGS AND RECOMMENDATIONS

Cornell University
Center for Radiophysics and Space Research

August 4, 1999

Dr. Ed Weiler
Associate Administrator for Space Science
NASA Headquarters
Washington, DC 20546

Dear Ed:

The Space Science Advisory Committee (SScAC) met at NASA Headquarters on July 28-30, 1999.

The highlight of the meeting was hearing from you about the successful launch of the Chandra spacecraft. This was a momentous event for Space Science, and one for which the science community has waited eagerly. The committee congratulates you warmly for this accomplishment, in which we know you played an essential role.

On a diametrically opposing note, we heard with enormous dismay about the severe cuts proposed in the recent House Appropriations markup of the NASA budget. Given the Agency's outstanding performance in recent years, we trust that the budget process that will unfold over the coming months will ultimately restore these cuts.

We also considered a number of other issues, and our findings and recommendations concerning these issues are summarized below.

SOMO and CSOC

As has become almost customary at SScAC meetings, we had a discussion of SOMO and CSOC. ***We were pleased that the NASA Advisory Council accepted our recommendations*** that a SOMO user's group be formed, and that Code S and Y management participate in determination of the CSOC award fee. ***We were even more pleased to hear*** (via a recent letter from the AA for Space Flight to the AA for Policy and Plans) ***that the Agency will implement these recommendations.***

We continue to have concerns about SOMO and CSOC, especially in the area of safety of NASA's space assets. ***A crucial next step toward addressing these concerns will be to develop metrics*** against which the success of SOMO can be assessed. These metrics should focus on spacecraft safety, science productivity, financial accountability, and cost visibility. ***We urge that OSS play an active role in the development of the metrics.***

We note that the impact of SOMO on the Space Science Enterprise is potentially so significant that it is crucial that the science community be clearly informed about how SOMO practices will impact current and future OSS missions. We look forward to continued reports at our upcoming meetings on the impact of SOMO on the Enterprise.

New Millennium

The recent cancellation of the Champollion/ST-4 mission occasioned a brief committee discussion of the New Millennium program. We note that cutting-edge technologies continue to be of fundamental importance to the vitality of the Space Science Enterprise. Therefore, ***we reiterate our strong support for a flight program whose dominant or even sole aim is the validation of key technologies.*** We look forward to hearing about NASA's plans for such a program at an appropriate future SScAC meeting.

R&A Program

SScAC has been interested for some time in steps that can be taken to maximize the scientific return of the Enterprise's Supporting Research and Technology (SR&T) Program. An SScAC Task Force chaired by David Black made a number of specific recommendations on this topic some time ago, and at this meeting we heard from Guenter Riegler on Code S's response to the Task Force's recommendations. ***The new "science cluster" structure outlined by Guenter is consistent with the spirit of the Task Force's recommendations, and also with the advice of the Committee.*** We believe that this planned restructuring will help allow flexibility for new initiatives and promote strong cross-disciplinary research.

An important component of the planned restructuring is a series of Senior Reviews, to be held once every three years. Such reviews were an essential part of the Task Force's recommendations. ***We hope that these Senior Reviews will allow for and (where appropriate) will promote periodic intra-cluster and inter-cluster financial reallocations*** that are essential to keeping NASA's Space Science R&A funding targeted at scientific objectives that best support the Code S strategic plan.

It is important that the criteria by which the success of the clusters will be judged in the Senior Review be established at the beginning of the restructuring. These guidelines should be made clear to each cluster management team, and SScAC would like to review the guidelines, as well as the final cluster structure, at our February 2000 meeting.

Government Performance and Results Act

The Government Performance and Results Act (GPRA) requires that federal agencies establish a performance plan, and that their performance be evaluated annually against that plan. At this meeting, SScAC took on the task of evaluating the Space Science Enterprise's performance against their Fiscal 1999 Performance Plan. This plan included a number of specific targets against which performance could be judged.

Before our meeting, ***Marc Allen had put together a strawman set of scores ("green", "yellow", or "red") for each of the Enterprise's performance targets.*** SScAC had a lengthy and detailed discussion of all the targets and the Enterprise's success or failure in meeting them. In the end, ***we concurred with all of Marc's strawman scores.*** We were pleased to see that nearly all the scores were either green or anticipated to be green by year's end, reflecting the fact that Code S continues to excel at what it does. There were a number of areas in which we felt that the explanatory text accompanying the scores could be strengthened, and several SScAC members were assigned the task of helping Marc to rewrite specific sections of the evaluation.

We continue to be impressed with and thankful for the enthusiasm and skill with which Marc approaches the GPRA task.

Education and Public Outreach

One of the more enjoyable parts of our meeting was a presentation from Jeff Rosendhal and Isabel Hawkins on the Space Science Enterprise's continuing efforts in education and public outreach. This program is one of the primary ways in which the benefits of what Code S does are transferred to the American public, and we were reminded at our meeting of just how important this transfer is. We commend the Enterprise for its strong commitment to education and public outreach, and we reiterate the importance of making education and outreach an integral part of the next Code S Strategic Plan.

Strategic Planning

A substantial fraction of our meeting dealt with strategic planning, and particularly with preparations for the upcoming Strategic Planning Workshop in Galveston. Strategic planning efforts by SScAC's four subcommittees are approaching completion, and I'm pleased to report that ***all of the subcommittees have done an excellent job of winnowing a large number of scientific desires to a manageable number of high-priority objectives.*** Draft roadmaps will be produced by each of the subcommittees by September 10th of this year. It will then be the job of the Enterprise, with substantial help from SScAC, to integrate these roadmaps into an Enterprise-wide strategic plan around which a strong community consensus can be built. The successes that the subcommittees have found in building consensus within their own communities bodes well for this effort.

As we have discussed with you in the past, we anticipate that the next strategic plan will have many structural and thematic similarities to the last plan, with updates to take into account the significant advances in Space Science that have occurred in the past three years. We see the most significant improvements to the next plan being to integrate technology, astrobiology, and education/outreach more deeply into the plan.

That summarizes the results of our meeting. Please don't hesitate to contact me if you would like any clarification or further detail on any of the points I've raised above.

Best wishes,

Steve Squyres
Chair, SScAC

cc: SScAC
B. Parkinson
L. Garver
J. Rosendhal

SPACE SCIENCE ADVISORY COMMITTEE (SScAC)
NASA Headquarters
July 28-30

LIST OF PRESENTATION MATERIAL[1]

1) Space Science Enterprise Update [Weiler]
2) Space Science Research [Riegler]
3) OSS Education and Outreach [Rosendhal/Hawkins]
4) Planetary Protection Task Force Report [Noonan]
5) FY 99 GPRA Performance Assessment [Allen]
6) Theme Report [Thronson]
7) Galveston Strategic Planning Workshop [Allen]
8) Exploration of the Solar System Science and Mission Strategy [Chyba]
9) Sun-Earth Connection Status of the 2000 Roadmap [Christensen]
10) Origins Subcommittee: Strategic Planning Progress Report [Black]
11) Structure and Evolution of the Universe 1999 Roadmap Status Report [Margon]
12) NASA Space Science Advisory Committee Task Force on Technology Readiness [McNutt]
13) Technology Program [Howard]

Other material distributed at the meeting:

1) Press Release 99-86: Administrator Call Cuts to NASA Budget "Devastating"
2) Mission and Science Overview: Deep Impact
3) Mission and Science Overview: Messenger
4) Mission and Science Overview: Interstellar Probe
5) 99 Eclipse
6) FY 2000 Estimates - Budget Summary
7) House Subcommittee budget language
8) Image taken by the Transition Region and Coronal Explorer (TRACE)
9) FY 2000 Budget vs. History
10) Astrobiology Roadmap

[1] Presentation and other material distributed at the meeting is on file at NASA Headquarters, Code S, Washington, DC 20546.