

NASA ADVISORY COUNCIL

HELIOPHYSICS SUBCOMMITTEE

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MEETING REPORT

Roy Torbert, Chair

Barbara Giles, Executive Secretary

Table of Contents

Introduction and Announcements	3
Structure of Heliophysics R&A Refresher	3
Committee Work Session/discussion, R&A	5
Review of Heliophysics Data Policy	5
Heliophysics Division Overview	6
Flight Program Status	7
Q&A with Ed Weiler, SMD AA	8
Discussion/ad hoc meeting	8
Access to Space Options in Earth Ventures-2	8
R&A Discussion	9
Update on Sounding Rocket Program	10
Budget remarks	11
Discussion/ R&A	11
JWST Briefing	12
FY11 Performance Assessment/Voting	13
Findings	14
Debrief to HPD	14

Appendix A- Attendees

Appendix B- Membership roster

Appendix C- Presentations

Appendix D- Agenda

NAC Heliophysics Subcommittee Meeting Minutes, June 20-22, 2011

June 20 2011

Introduction and Announcements

Dr. Roy Torbert, Chair of the Heliophysics Subcommittee (HPS) opened the meeting, and deferred the introduction of the subcommittee's newest members to the time of the announcement of a new Director of the Heliophysics Division (HPD), as Dr. Richard Fisher has recently announced his intention to retire as Director of HPD. Dr. Barbara Giles, Executive Secretary reviewed the agenda for the day.

Dr. Torbert reported on the reception of HPS findings at the most recent NASA Advisory Council (NAC) meeting. A previous HPS finding on the HP Explorer program was deferred back to HPS; the HPS finding on the ICE Spacecraft was deferred to the NASA Senior Review process; and the Data Archiving finding was deferred back to HPS for action. All HPS findings were thoroughly discussed with the NAC Science Committee; however none of its most recent findings were brought to the full NAC for consideration. Dr. Torbert noted that the Science Committee discussed the James Webb Space Telescope (JWST) at great length, a large mission that is currently being re-baselined for a 2018 launch, on a budget of \$471M for FY11, and \$375M per year in the five-year budget run-out. The committee also considered the disposition of the Mars Science Lander (MSL), which appears to be on track for a November 2011 launch. The biggest issue remains the availability of Pu-238, which has yet to be solved. Two findings that went on to the full NAC concerned the recognition that the five-year budget run-out reflects a significant reduction and endangers the ability of NASA to carry out the recommendations of the Decadal Survey (DS). Small and medium missions are less affordable, and therefore NASA must tailor its policy document for lower-cost Science Mission Directorate (SMD) mission categories. The NAC also recommended that NASA work to reduce the costs of its expendable launch vehicles through block buys or other innovative contracts, pursuit of commercial and international collaborations, and acquisition of mid-range vehicles to address mission feasibility.

R&A Restructuring- Refresher

Dr. Mona Kessel reviewed the progress of HPD's recently initiated Research and Analysis (R&A) revamping effort. The goal of this exercise is to more tightly couple R&A with community input, and increase the emphasis on system science. In addition, restructuring is seen as a means of streamlining R&A to reduce the time spent on reviewing proposals and increase time spent on performing science. Step 1 of the process would be to define research areas; align and focus the complete R&A program from top to bottom; and align R&A goals with the Science Plan research areas: these are the Fundamental Processes, Origins and Impacts of Solar Variability; and Enabling Technology and Infrastructure. These areas also correspond with HPD themes: Our Home in Space, Safeguard the Journey, and Fundamental Processes.

Dr. Kessel described the varieties of science competitions within the Theory, Living with a Star (LWS) Targeted Research and Technology (TR&T), Focused Science, Tools and Methods, Strategic Capability, Guest Investigator (GI), Sun Climate, Archives, Virtual Observatory (VxO), and Mission Operations and Data Analysis (MO&DA) programs. Copies of the proposed organizational charts were distributed to the subcommittee for closer reading. Dr. Kessel further elucidated how, where previously the LWS Steering Committee and the Management Operations Working Groups (MOWGs) oversaw the various research programs, two Science Operations Working Groups (SOWGs) might oversee these programs in a similar fashion under a redesigned R&A program. An area termed Supporting Research, for example, could be set aside as the program for innovative, undirected proposals.

The overall goal of the restructuring is to keep programs more aligned with the larger science questions addressed by HPD, using a less *ad hoc* approach than has been used in the past. Dr. Lika Guhathakurta commented that the intent of the R&A was to eliminate identical proposals from being submitted to several different programs (frequently employed as a strategy for increasing chances of proposal acceptance). Dr. Allan Tylka expressed reservations about setting up the two SOWGs, noting that the roadmap and the DS should be enough to guide HPD. Dr. Jeff Newmark commented that the SOWG could help to identify the subsets of questions in the DS and the roadmaps that were appropriate for particular Research Opportunities in Space and Earth Sciences (ROSES) elements.

Dr. James Spann felt that the presence of no clear goals associated with the various programs had caused duplicative submissions to become the norm in competitions of late. The Geospace MOWG had been tasked to narrow the focus of some research areas to address this very issue; however it remains difficult to define the GI and Supporting Research and Technology (SR&T) programs. Dr. Spann felt that the roadmaps could provide some guidance here. Dr. Tylka contended that the first issue to be addressed in R&A competitions should be schedule—will the results of first competition be known before the second is due? The other issue is the tightness of funds- many excellent proposals do not get funded. If the R&A restructuring effort can't solve both of these problems, he felt there was little point in refurbishing R&A. Dr. Jeff Newmark commented that one goal of restructuring would to help grow R&A in the long term; there would still be a GI program for new missions, and funds would also come from the new mission. While NASA can change the schedule, it can't change the fiscal atmosphere. A meeting participant recommended examining the practices within the Planetary Science Division (PSD), which has many areas in which to propose; if the proposal process is very competitive, people understand there is a certain amount of noise in the process. If there is noise and the competition is harsh, people tend to re-propose. Good proposal and competition structures can help communication and efficiency in this area.

Dr. Kessel continued the briefing, describing Step 2 as a process in which one might develop community questions for competed elements: e.g., should we combine the current Geospace and Solar and Heliophysics (S&H) program into a single competition? This combination might help system science proposals; e.g., solar and thermospheric proposals could be better reviewed under this arrangement. Should a new mission have a specific GI mission after launch? Should we continue Theory as a separate program? Should the LWS TR&T program continue as it is? Dr. Spann commented that part of the problem is that many proposers don't know or understand the mission statements associated with the ROSES elements.

Other questions being considered include: should we combine the Geospace MOWG and S&H MOWG combine into a single SOWG across the range of Heliophysics? Should the proposed SOWG go further and do some gap analysis? Dr. Kessel noted that the LWS TR&T Steering Committee goes through a year-long process, with community input, to produce the next goals for focused topics, then puts out a report, then goes to ROSES. Dr. Judith Karpen felt that the MOWG has a much broader charter, and expressed concern about turning the MOWGs into just an advisory body for program proposals. Dr. Newmark felt that the MOWG functioned as the first level of communication between NASA and community, and there is no steering at all at the MOWG. The question being considered by the restructuring is whether we want HPD wants combine some of these aspects of the groups.

HPD is also considering changing the size and length of proposals, and instead of considering dollar amounts in proposals, talking about full-time employees/equivalents (FTEs) to help better frame infrastructure costs for proposals. Dr. Torbert felt this was a multifaceted question, as many costs don't show up in the proposal.

NAC Heliophysics Subcommittee Meeting Minutes, June 20-22, 2011

Other questions being considered: should some program elements have larger awards, particularly to help system science? Should larger awards be competed as smaller individual awards joined as a team (a “shotgun marriage”); or one large team effort? Should the length of grants be 4-5 years for larger programs? Dr. Karpen suggested that even smaller grants might be longer; the community feels that the typical TR&T grant is too short. Cadence of competitions is also being revamped: the Senior Review is moving to a three-year review cycle, and the VxO/archives are moving to a five-year review cadence. Should systems science go to a 2-3 year cycle? Step 3 of the proposed restructuring would include the development of a detailed implementation plan, after receiving community feedback.

Discussion R&A

Dr. Torbert felt that there were three major issues to contend with in the R&A program as it now stands: efficiency, targeted elements, and an overarching SOWG. Dr. Newmark commented that the concept of the SOWG is geared to implementation only, as two problems that currently plague R&A are management practice, and the alignment or focus of competed R&A. Essentially, most felt that efficiency in review and submission of proposals, and how NASA runs the reviews, could stand some improvement. Dr. Guhathakurta felt that there were also problems in the way the language is developed in ROSES; there is no mechanism for separating themes in R&A. Important interdisciplinary science also does not get addressed at present.

Dr. Giles, for the benefit of the subcommittee, presented budget information and the structure of competed R&A funds, which are dispersed among programs. There is a pot of funding for competed R&A, and then there is the R&A money that comes with missions, data analysis, etc. This represents more than \$60M per year available for funding science. Dr. Torbert estimated the true total as being \$90M out of HPD’s \$550M budget. Dr. Stuart Bale disliked the idea of a SOWG, citing the need for free energy to produce new ideas. Dr. Guhathakurta urged clarification and sharper definition of science goals to make them easier to address. Four-year grants with a potential last year contingent might be one answer. Dr. Kessel noted that a contingent decision would add another review. HPS considered the idea a two-step process of developing a five-page proposal solely addressing science, including a boilerplate estimate, as a solution for programs with a large number of proposals and low success rates.

SMD Science Data Environment

Mr. Joe Bredekamp presented a briefing on working toward a uniform SMD data policy. The current guiding principles for managing science data were briefly reviewed. NASA has stewardship responsibility for integration and preservation of data. NASA maintains an open data policy to foster information-sharing with scientists, general public, etc. The third tenet of NASA policy is that one size does not fit all; therefore data must be organized around science disciplines to allow for diversity and tailored approaches. Each science division is responsible for its data environment, often in collaboration with other federal agencies and international partnerships.

Preservation of data is defined as maintaining bits with no loss as they move through the system and over time, ensuring readability of data over time; and providing long-term understandability. Dr. Torbert observed that these data preservation concepts can be misinterpreted; some data are junk and need not be archived, and there should be better, more restrictive guidance to determine what data must be archived. SMD’s generic approach to data preservation includes delivery of Project Data Management Plans at the onset of missions, and the addressing of data through the implementation process. Science mission processing systems are responsible for data functions throughout the mission, and timely delivery of data to public archives throughout the life of the mission. Dr. Paul Hertz commented that both Mr. Bredekamp and Dr. Elsbernd have the authority to refuse requests; the application of intelligence restricts data that can/should be archived.

Science missions are responsible for organizing data for long-term preservation and utilization in post-mission research, and also for creating the final archive record for that mission, which includes Level 0 data, engineering reports and relevant housekeeping data. This activity is organized late in the mission lifetime to incorporate recalibrations and reprocessing, ensuring capture of knowledge and Lessons Learned.

HPS debated the utility of data forms, how they change over time, and how data remains accessible and up to date. It was agreed that clarity must be achieved concerning the term, “best data.” Dr. Hertz commented that at some point in the future, one must decide to use data sets “as is,” or to reprocess data to make it better or more useful; one approach is cheap and one is expensive. If the expense can be justified, the community will decide to allocate the monies for it. Dr. Arik Posner noted that real-time data are usually overwritten by archive products; as real-time data are used for modeling, there must be a way of preserving these. A participant remarked that the National Oceanic and Atmospheric Administration (NOAA) has the responsibility for real-time data, as it is not research data. Dr. Giles commented that beacon data can be picked up by anyone who has an antenna. The Deep Space Network (DSN) and ground-based (GB) network real-time data does, however, go through NASA centers. DSN data is automatically regarded as Level 0 data. After a mission ceases operations, research archives continue to maintain and serve the science data as long as they are used for science research; research archives are generally aggregated by discipline. Research archives continue responsibility for preservation aspects.

The current SMD science data environment includes the Earth Science Data Systems Program, the DAACs, Advancing Collaborative Connections, etc. Astrophysics data are organized by wavelength at the Science Archive Research Centers, ADS, and NASA Extragalactic Database. Planetary Topical nodes (e.g., planetary atmospheres) are also available. Heliophysics has Mission Science Centers, the Solar Data Analysis Center, Space Physics Data Facility, VxOs, etc. NASA also helps to maintain the National Space Science Data Center, Legacy Long-term Archive, Deep Archive for Space Physics, and Planetary Data System. With a view to the Future, SMD is planning to clarify roles, responsibilities, and requirements for data handling and preservation; consider alternatives for long-term safekeeping of massive datasets; evolve the infrastructure to enhance quality, accessibility and utilization of science holdings. SMD is also considering how to integrate with the evolving computational infrastructure for scientific inference and integration of future missions, including interagency and international collaborations. A draft data policy for SMD is still in development.

Lunch talk

Drs. Mary Mellott and Jeff Rusch presented a lunch discussion of the anomalous Solar Cycle 24.

HPD Status

Dr. Richard Fisher, Director of HPD, presented a status of the division. HPD supports an extremely active flight program, and flies more satellites than any other division. A major launch, Radiation Belt Storm Probes (RBSP) is coming up in 2012, and will help to support/refute current models; this mission represents the completion of the first quarter or half of LWS. The second big event will be the 2014/15 launch of the Magnetospheric Multiscale (MMS) mission, which will employ sophisticated instrumentation to study how the magnetic field is converted into other types of energy. MMS is a small Explorer (SMEX) high-resolution, temporal/spatial mission. What happens beyond these two missions will be budget-driven, and perhaps politically driven. Dr. Fisher noted that NASA awards had been presented to the Interstellar Boundary Explorer (IBEX) and CINDI missions, indicating that the agency

NAC Heliophysics Subcommittee Meeting Minutes, June 20-22, 2011

recognizes the value of heliophysics missions. He felt that HPD would continue to support a robust science program despite tight resources.

Dr. Fisher discussed his intent to leave NASA before December 2011; the process for choosing a new Director is ongoing. He expected heliophysics science to take off as more systematic connections are recognized within a dynamic system. The Heliophysics DS (expected to be complete in 2013) will help support this effort. Asked about new launch vehicles, Dr. Fisher felt that there is now a national recognition that there are no good options. The Department of Defense (DOD) is looking at replacements for Delta IIs down to the Pegasus class. The first interesting possibility for NASA is the Falcon vehicle. Commercial vehicles may become a viable solution.

Flight Program Status

Dr. Vicky Elsbernd presented an update on the HPD flight program. The division has received a good deal of press coverage of late, including an Op-Ed article in the *New York Times*, recognition of the Solar Dynamics Observatory (SDO), Voyager press releases on “bubbles” in the heliosheath, and new calculations on the distance to interstellar space. A number of rocket launches have been successfully completed. A high-altitude balloon was launched from Sweden, meeting minimum science requirements. The RBSP milestone is Aug 23, 2012; the manifest has been protected for September 2012. SET is a secondary payload for the Air Force; the Interface Region Imaging Spectrograph (IRIS) mission is working toward a launch for December 2012, and MMS still scheduled for an August 2014 launch. Operating missions (17 missions, 26 spacecraft) are all Green. There is one Yellow grade due to an IRIS re-schedule event, as parts delivery had been slipping. RBSP is currently undergoing a schedule re-plan. A content revision is also underway on Solar Orbiter-C. MMS has a Yellow grade due to low cost reserves in FY12, and is changing some Level 1 requirements, which will be reviewed in a Directorate Program Management Council (DPMC) on 12 July. MMS has also undergone several independent assessments.

Dr. Elsbernd provided some details on MMS issues; the project has requested an additional \$27M from Agency reserves; and an additional \$8M shortly thereafter. This total request of \$35M was not approved and is being held in abeyance. SMD agreed to fund \$13M for FY11, and will discuss the funding of MMS at a follow-up DPMC. Solar Probe-Plus (SPP)’s launch system underwent peer review at the Applied Physics Laboratory (APL) in mid-May. With regard to re-scoping of Solar Orbiter, the main instruments remain intact, however no extensions have been made for SPICE and SIS. Within the Explorer Program, HPD is proceeding with the split into Astrophysics and Heliophysics to maximize synergy between the two programs. Nick Chrosotimos will be Program Manager for the Explorer Program Office.

There are many uncertainties in the current and future budget, further reductions are most likely to occur, and re-phasing and rebalancing may occur as a result. The budget has little flexibility to absorb further cuts; this is the case for all of SMD. If HPD does incur a significant budget impact, the division would like to include the community in the decision-making process to re-order priorities, and to receive suggestions and ideas. The budget situation may require an additional meeting of HPS between now and the Fall. AIAA has also reported on an impending crisis in weather satellites, which may affect NASA. Fortunately, there are no Heliophysics missions in development that depend on Pu-238.

Q&A with Ed Weiler

HPS held a discussion with Dr. Ed Weiler, Associate Administrator (AA) of SMD. Dr. Torbert requested an augmentation of HPS membership. Asked to comment on budget threats, Dr. Weiler noted that JWST

is in re-planning mode, and is now an Agency-level program. SMD still provides technical and administrative support for JWST. Dr. Weiler reported that he had sent a letter to Administrator Bolden, requesting that any decision to direct general SMD (i.e. beyond the Astrophysics Division) funds to JWST would be taken to the subcommittees and the NAC. He noted that he might need help from HPS to support this request, and asked that HPS consider timing for an impromptu meeting in July, before the NAC meeting. Dr. Weiler noted that money has flowed into SMD only once in 33 years; when Dan Goldin taxed other divisions to buy a second Mars rover. It must also be considered that the HR1 bill in Congress may well lead to a 17% cut across the board for the entire Federal Government's FY12 budget.

Asked to comment on launch vehicles, Dr. Weiler reported that some progress has been made. All division directors have raised it as an issue during the last year. Mr. Bill Gerstenmaier, AA of the Space Operations Mission Directorate (SOMD), is actively looking at block buys for remaining Delta IIs. The Air Force is negotiating for Atlas Vs, which might bring down the price. A successful Falcon II or Delta IX launch would also be helpful. NOAA is a possible partner for the Delta IIs.

Regarding the process of replacing Dr. Fisher, Dr. Weiler explained that the Senior Executive Service (SES) selection process is carefully laid out. The AA is the selection official, but does not see the applications until they have been through an extremely rigorous process. He would probably interview only the candidates who are rated as "highly qualified." If the candidate is already SES, the transfer can take place immediately. If the candidate is a GS-15 civil servant, the Office of Personnel Management (OPM) will also have to screen the candidate.

Dr. Weiler noted some significant events, such as the successful launch of Aquarius, the imminent rendezvous with the asteroid Vesta, and the launches of Juno, GRAIL, NPP, and MSL, representing about \$4-5B worth of hardware, in just a few months. He felt that NASA should have a clearer idea of the budget scenario by August, as decision-making about JWST should be done by mid-July.

Planning for an Emergency Meeting in July

Dr. Torbert deferred discussion of R&A, while HPS planned for a 28-29 July meeting, preferring to meet face-to-face for a day and a half. Dr. Giles also suggested on going ahead with the appointment of 3 new subcommittee members; Dr. Tylka extended his commitment. Conflicts of interest on the subcommittee were also be taken into account for the discussion of possible cancellations, de-scopes, etc. of Heliophysics missions that may be necessitated by the JWST funding issue.

Access to Space Options in the Earth Ventures-2 AO

Dr. Paul Hertz, Chief Scientist of SMD, reported on the status of the Earth Venture-2 (EV-2) Announcement of Opportunity (AO). Earth Venture-2 has a different approach to access to space, thus necessitating the presentation for informational purposes. This is a SMEX-sized AO, with a \$150M cost cap that includes access to space (compared to the Explorer program, which is \$200M without access to space). The AO was released on 17 June in a single selection process. Launch is to occur within 5 years of selection. The Earth Science Division (ESD) initiated this AO as an experiment to enable the selection of a low-cost, rapid PI-led mission with as few strings possible. EV-2 includes three categories of access to space: NASA-provided launch services; investigations aboard the International Space Station (ISS); and hosted payloads. There will be a \$50M charge against the PI-managed mission cost for standard launch services, to buy a ride from NASA. In the case of the NASA-provided launch, NASA will be responsible for the expendable launch vehicle (ELV) cost risk, so reserves do not need to be held on the \$50M charge for standard launch services.

NAC Heliophysics Subcommittee Meeting Minutes, June 20-22, 2011

In the ISS category, NASA will provide transportation to ISS; the PI is responsible for meeting all ISS imposed requirements within the PI-managed mission cost, and will require a letter of feasibility from the ISS Payload Office. Alternative access to space may include non-NASA launch services as primary, secondary, or co-manifested payloads on a U.S.- or foreign-manufactured vehicle. NASA will accept a Launch Vehicle Risk Category 1 (one successful launch before NASA certification). This may include payload accommodations as a hosted payload on a U.S. or non-U.S.-provided spacecraft launching on a U.S.- or foreign-manufactured vehicle. The launch must also be consistent with U.S. Space Transportation Policy (no-exchange-of-funds basis for launch on a foreign-manufactured launch vehicle). The proposed investigation must be a complete investigation and the PI must remain in charge of the development, launch, and successful operation of the mission. Participation of EV-2 investigators as a contributor to a larger mission is not permitted in response to this AO.

The subcommittee reviewed rules in detail. In summary, Dr. Hertz related that the PI must find a ride, identify the launch opportunity, show how the proposal meets requirements, and must describe the approach for NASA's insight into the venture. Asked if there had been any discussion of this AO approach for other classes of Explorers, Dr. Hertz responded that no explicit discussion had taken place, but could indeed be arranged.

R&A discussion

HPS discussed how restructuring could reduce the inclination to write duplicate proposals to several opportunities. Dr. Robert McPherron commented that there are too many graduate students who don't know how to write proposals; they are in effect using the reviewers as critics and relying on them to correct proposals, while still not getting approved. Dr. Tylka again raised the concept of a two-stage process before acceptance of full-blown proposals, such as 5-pagers followed by 30-page full proposals. The downside is the extra review time. Perhaps younger people could be included in the review panels, and reviews held via teleconference, and more researchers could revise proposals and re-submit them. Dr. Newmark noted that NASA has stated publicly that it has a fixed budget and high proposal pressure. Dr. Karpen expressed confusion about research areas. Dr. Guhathakurta explained that LWS is mapped to home in space, and space weather objectives, and science with societal relevance, however fundamental science is also of great importance to LWS. Dr. Sanchez suggested that these research areas be described more explicitly. Dr. McPherron argued that sometimes one cannot see the applications of fundamental science immediately. Dr. Giles suggested starting with the objectives outlined in the budget, and how proposed research can meet those three objectives. HPD could restructure the "boxes" to meet these objectives as well. Dr. Kankelborg noted that LCAS has a spread of effects and covers several types of proposals. Dr. Newmark reiterated that HPD is trying to eliminate as much overlap as possible. Dr. Kessel recommended using the roadmap and the Science Plan to attain agreement on what all the proposed areas mean.

HPS debated whether the research philosophy should be reductionist vs. emergent: study the parts and then put them together, or study the system whose behavior is more than the sum of its parts? Strategic fundamental science within HPD is meant to accommodate larger groups/bigger problems.

Tuesday, June 21, 2011

Introduction to day

Dr. Torbert was compelled to depart due to illness, and Dr. Robert McPherron took his place as Chair for the remainder of the meeting.

Update on the Sounding Rocket Program

Dr. Cheryl Yuhas, the Program Executive for the Sounding Rocket Program (SRP) presented an update. Dr. Tripp Ransone, deputy program manager at Wallops, participated by telephone. Dr. Yuhas reported that Dave Pierce had been able to develop new rules for suborbital class programs that are aimed at reducing excessive or unnecessary mishap investigations. She also announced that the ROSES competition will now accept CubeSats and CRuSRs. If using CubeSats and CRuSRs, however, a proposer must find his/her own rocket; the SRP does not have funds to help build a Cubesat or CRuSR. Dr. Mary Mellott made the distinction that this class of proposal is called out in ROSES for compelling science, but through a separate and distinct ROSES budget.

The Airborne Science Program will be carrying out the EV-1 missions: CARVE and DISCOVER, which will begin flights this summer. The Student Airborne Research will be held for 6 weeks this summer. Balloon mission campaigns are set to begin in Sweden this summer, in the form of both Solar and Geospace missions. SRP has conducted a test flight of the Black Brant motor, and a test of the SubTECV. A report is forthcoming on the Brant test flight, which also tested the exit cone design. The payload has been recovered but snow-melt must occur before recovery of the find motor. The RockOn program, a student program, will launch a payload within the week, and another payload will be coming from the University of North Colorado.

SRP is programmatically stable, but is still having technical issues with the Brant motor, including problems with the igniter (now redesigned), combustion instability, excessive throat erosion, and motor casing burst test failures. There are currently only 3 Black Brants in hand, and three on their way. Combustion instability is still a watch item, but is believed to have been corrected. The exit cone has been redesigned as a one-piece design vs. the previous two-piece design. Vehicle dynamics have been observed in 3- and 4-stage rockets; it is believed that the propellant is not burning efficiently. Too much aluminum seems to be coming out of the nozzle and reacting with graphite, resulting in slag sitting in the throat. The corrective action would be to improve the combustion. A non-blended ammonium chlorate has been flown at Poker Flats; the results were not as good as hoped but an improvement. SRP is also dealing with materials variability; Bristol had been using Chinese ammonium perchlorate in the past, and just recently concurred on an export license for American ammonium perchlorate to go to Bristol. The tested motor has yet to be recovered to examine for erosion. White Sands Missile Range flights are to be concluded with the nonblended version of the fuel to examine throats.

In response to casing burst test failures, SRP has changed the steel, using 4140, which is more available. Previously the end caps had been forged, and now are being machined; machined caps are not considered as structurally sound as a forged unit. Thus SRP is going back to forging, but with the new steel. The near-term plan for existing motors is to complete the production of the last three 4335 steel casings and build hybrid motors. Use of the hybrid casings and Oriole motors will enable the program to produce another 10 motors; SRP is also talking to the Navy to obtain Oriole motors to help fill the gap, and is proposing a schedule with the Headquarters Sounding Rockets Working Group to prioritize launches for scientists and PIs. SRP still hasn't fixed problems with the multistage Black Brants; these are unavailable.

Flight Termination System

Anything that uses a guidance system requires a flight termination system (FTS); SRP cannot fly vehicles at White Sands for this reason. Thus far, the program has traced ordnance failures to excessive epoxy on the ends of charges. The FTS controller has been redesigned using all multiple solid-state relays, and a new bench test unit has been fabricated, which is expected to be available in November 2011. Orioles will also need FTS; both NSROC and Orbital electronics will be used on both the Brant and the Oriole. Asked if the Oriole were more reliable than the Brant, Dr. Yuhas responded that it has made about 15 flights.

NAC Heliophysics Subcommittee Meeting Minutes, June 20-22, 2011

The Oriole is also twice as expensive, and would require a competitive procurement for the next step. Switching to the Oriole motor would require substantial engineering, as a one-time cost. NASA has flown Terrier-Oriole motors for the Navy, but can't use them in multi-vehicle stacks yet. Vehicle capabilities are pretty similar. Oriole is a little bigger and has a little more drag. Dr. Hertz added that LCAS has many options; if the best proposal is a rocket, balloon, CubeSat, etc., it will win on science merit only. LCAS does not have any increased funding profiles.

Budget Remarks by Hertz and Fisher

Dr. Fisher explained that the division has always had contingency plans for 5-10% budget cuts. Dr. Hertz reported that recent Congressional action may end up applying a nearly 20% budget reduction across all the discretionary agencies, and felt that this is a more serious exercise this year. The reductions have nothing to do with SMD performance. He pointed out that the Department of Energy (DOE) has been directed by Congress to create a performance ranking of all ongoing multiyear research programs by comparing current performance against original project goals. DOE was further directed to terminate the lowest ranking projects by \$25M (out of \$800M in DOE's research program). Dr. Fisher added that the point is to be prepared- if NASA is directed to do something similar, these cuts must be carried out with advice and insight. NASA will be compelled to follow any similar direction.

Discussion R&A Restructure

HPS engaged in discussion on how to restructure R&A. A number of members favored the two-step approach previously discussed, as well as teleconference-based proposal reviews. Dr. Giles took an action item to see how such changes would work within acquisition regulations, perhaps inviting procurement staff to the next meeting. Members argued for an increase in grant size to reduce volatility of funding, an increase in proposal acceptance rate, and quicker turnaround on decisions, resulting in fewer proposals, and more long-term stability. It was suggested that the S/H and Geospace MOWGs to review the concept of multi-stage proposals, the concept of fewer, larger grants, and the balance between directed and undirected research. Dr. Strachan suggested that enabling and technology infrastructures be kept separate from science, to keep from burying predictive modeling questions, or perhaps combining predictive modeling with systems science applications. Dr. Giles remarked that HPS should decide whether we want to organize the R&A structure around science goals, or implementation (the means to meet the goals).

HPS worked on rearranging charts defining research areas, arguing that all three major research areas (fundamental processes, origins and impacts of solar variability, enabling technology and infrastructure) have a directed component. Dr. Schrijver commented that creative opportunities have disappeared from LWS. Dr. McPherron noted that he had been participating on a new team project on the solar minimum, and that the experience had been much more cohesive thanks to NASA efforts. Dr. Schrijver recommended that teams should have their team leader write the proposal. HPS also felt that consulting with the TR&T steering panel to derive Lessons Learned might be useful. Dr. Sanchez noted that for directed research, a PI could specify instruments (and not specific people), which could be competed separately, to keep the usual suspects from continuing to band together. There was general agreement that 1/3 of the R&A should be directed.

Findings discussion

HPS proposed a finding on reorganization of the R&A structure, to improve efficiency of the program in both the writing and reviewing of proposals. A possible solution would be to move to fewer, larger awards (pending community feedback), and increasing the average size of grants. A member suggested an additional finding stating that 15% of HPD funding for R&A is not enough, and that the division should rebalance R&A and new missions. Dr. Giles reminded the subcommittee that Heliophysics will be receiving its DS next year, and consequently a new SMD Science Plan; the DS may suggest a proportion

of resources that would be more useful at that time. Dr. Bale suggested that NASA Headquarters prepare some budget scenarios to help HPS stay out of particular matters.

HPS considered a face-to-face meeting in late July to address emerging budget matters, a potential finding on JWST and its potential cost impact on SMD as a whole, an evaluation of ESD's new EV-2 structure for future Heliophysics Explorer missions, and the limited availability of the Black Brant.

JWST Briefing

Dr. Rick Howard, Program Director for JWST, briefed HPS informally on the status of the JWST re-plan. Programmatic management has been pulled out of both the Astrophysics Division (APD) and SMD. The JWST program is now reporting to NASA Associate Administrator Chris Scolese and to Dr. Weiler directly. The significant impact of this change is that JWST is no longer SMD only; it is an Agency program. Future decisions regarding the mission will be made by the Administrator. Baseline re-programming has just been completed, constrained within FY11 and FY12 at an 80% confidence level, in response to the Independent Comprehensive Review Report (ICRP) report. The program accepted all 22 recommendations of the ICRP. The project produced a baseline and had it evaluated by a Standing Review Board and a joint confidence level (JCL) exercise, both of which were in good agreement. The results of the baseline will be rolled up into the FY13 budget submission. The time of the FY13 budget submission would be the latest date that the public would know how much JWST will cost.

The ICRP concluded that the \$3B spent on the mission thus far was well spent for technical performance. However, it is recognized that JWST is a much more complex mission than originally thought. A total of \$5.1B has been estimated as the life cycle cost (LCC) for JWST, including 5 years of phase E. An additional \$1.4B would be needed to support a September 2015 launch date. A critical element to support that launch would have been the provision of \$500M of that \$1.4B in FY11 and FY12. It is now clear that this funding profile is not possible. In addition, the 80% confidence level condition pushed the launch out to 2018. The impact to the rest of Agency will arise beginning in 2013- it is essentially a 2013-17 problem. Dr. Eric Smith reminded HPS that the ICRP estimate is not a NASA estimate, and that for the moment, the agreement is that no more money will be allocated to JWST in 2011-12. ICRP estimates the LCC at over \$6B. Other decisions can continue till the budget goes to press in September. The trade space is wide open for all types of decision-making.

Dr. Howard continued the briefing, addressing the several reasons why JWST had been elevated to Agency management; first, a large mission is difficult to manage within a division that has many other complex missions to run. Another reason for the change was to increase visibility in communication, especially with the contractors. At this level, when problems come up, they can be fixed immediately. This elevation had also been recommended by the ICRP. Goddard Space Flight Center has also elevated the program managerially. Seventy-five percent of the dry mass of JWST is essentially complete; the mission would not benefit from a de-scope. While the Astrophysics Decadal Survey contained useful triggers for LISA and IXO de-scope situations, any missions in development were ruled out of bounds for such de-scopes, thus JWST remains intact. At a proposed rate of a \$375M per year flat-funding profile, the JWST launch would be pushed out past 2020. Dr. Howard expressed deep concern over storing JWST components for many years; overall his three major worries were hardware, shelf life and work force.

June 22, 2011

FY11 HP Science Performance Assessment

NAC Heliophysics Subcommittee Meeting Minutes, June 20-22, 2011

HPS performed its annual assessment of HPD's science accomplishments, as required by the Government Performance and Results Act (GPRA). Evidence for progress would be based on published peer review literature, or NASA press releases.

Performance and Accountability Report (PAR) final voting outcomes

Dr. Giles presented the three Annual Performance Goals (APGs) in the NASA budget against which HPD is measured:

APG 2.2 (Understand the Sun and its interactions with the Earth and the solar system)

APG 2.2.1 (Improve understanding of the fundamental processes of the space environment from the Sun to Earth, to other planets, and beyond to the interstellar medium)

APG 2.2.3 (Maximize the safety and productivity of human and robotic explorers by developing the capability to predict extreme and dynamic conditions in space)

Based on this information, the HPS convened to develop a high-level, subjective evaluation, in the form of a color grade: Green (achieved APG), Yellow (failed to achieve APG, progress significant, and expectation of reaching APG within next fiscal year) and Red (failed to achieve APG, no expectation of achievement in the next fiscal year, and target may be infeasible), for each Annual Performance Goal.

APG 2.2.1 Fundamental processes

Accomplishment 1 *New SDO and ACE observations yield vital clues about dynamic coronal heating.*

Accomplishment 2- *Two NASA missions have made new and unanticipated discoveries about conditions at the edge of the heliosphere.*

Accomplishment 3- *Rapid energy transfer in the Van Allen Radiation Belts.*

Accomplishment 4- *Noctilucent clouds reveal a surprising and fast coupling between hemispheres.*

Unanimous green vote (8 members voting)

APG 2.2.2 Technical systems and habitability

Accomplishment 1- *Solar minimum produces dramatic and unexpected changes in the Earth's ionosphere.*

Accomplishment 2- *New insights into the formation of ionospheric bubbles that interfere with communications*

Accomplishment 3- *Refilling one of nature's vacuums: measurements of the lunar plasma wake*

Accomplishment 4- *Oxygen ion outflows from the ionosphere significantly modulate magnetospheric dynamics*

Unanimous green vote (7 members voting)

APG 2.2.3 Predict dynamics

Accomplishment 1- *First observations of global disturbances on the Sun.*

Accomplishment 2- *Space weather shock forecasts*

Accomplishment 3- *Geospace responds strongly even during quiet solar conditions*

Unanimous green vote (7 members voting)

Findings discussion

HPS narrowed down its findings to:

- Pending FY12 and FY13 Budget Issues, possible July 28/29 meeting
- Study of Earth Science Concept for Earth-Ventures 2
- Availability of Black Brant Motors
- Potential Changes to Heliophysics R&A Programs

Debrief to Ed Weiler

Dr. McPherron introduced HPS findings to Dr. Weiler.

As to budget issues, Dr. Weiler feared that SMD would be facing one of the most difficult periods for science funding; JWST is the least of the issues compared to the Congressional language under consideration, the outcome of the Biden commission, etc. The earliest time to take any useful action on budget matters would be in September. He felt a July meeting would therefore not be necessary; but agreed that HPS should meet as it deems appropriate.

Dr. McPherron adjourned the meeting at 12:52 P.

Appendix A Attendees

Committee members

Roy Torbert, Chair Heliophysics Subcommittee, University of New Hampshire
Stuart Bale, University of California
Judith Karpen, NASA Goddard Space Flight Center
Charles Kankelborg, Michigan State University
Robert McPherron, University of California
Ennio Sanchez, SRI International
Karel Schrijver, Lockheed Martin
Charles Swenson, Utah State University
Leonard Strachan, Harvard Smithsonian Center for Astrophysics
Allan Tylka, Naval Research Laboratory
Barbara Giles, HPS Executive Secretary, NASA HQ

NASA Attendees

Marc Allen, NASA HQ
Max Bernstein, NASA HQ
Joseph Bredekamp, NASA HQ
Victoria Elsbernd, NASA HQ
Richard Fisher, NASA HQ
Lika Guhathakurta, NASA HQ
Jeffrey Hayes, NASA HQ
Paul Hertz, NASA HQ
Rick Howard, NASA HQ
David B Jarrett, NASA HQ
Ramesh Kakar, NASA HQ
Jennifer Kearns, NASA HQ
Mona Kessel, NASA HQ
Robert Leamon, NASA HQ
John Lee, NASA HQ
Greg Mann, NASA OIIR
Mary Mellott, NASA HQ
Thomas E Moore, NASA GSFC
Marian Norris, NASA HQ
Jeff Newmark, NASA HQ
Craig Pollock, NASA GSFC
Arik Posner, NASA HQ
Jenny Rumburg, NASA HQ
Eric Smith, NASA HQ
James Spann, NASA MSFC
Greg Williams, NASA HQ
Dan Woods, NASA HQ

NAC Heliophysics Subcommittee Meeting Minutes, June 20-22, 2011

Other Attendees

Dom Conte, Orbital Sciences

Lamont DiBiasi, L. DiBiasi Associates

Larry Richardson, ULA

Joan Zimmermann, Zantech IT

Appendix B
Subcommittee Membership

Roy B. Torbert (Chair)

Space Science Center
University of New Hampshire

David Alexander
Department of Physics and Astronomy
Rice University

Stuart Bale
Space Sciences Laboratory
University of California

Barbara Giles, Executive Secretary

Heliophysics Division, Science Mission Directorate
NASA Headquarters

Charles Kankelborg
Physics Department
Montana State University

Judith Karpen
NASA Goddard Space Flight Center

Robert McPherron
Institute of Geophysics and Planetary Physics
University of California at Los Angeles

Zoran Mikic
Predictive Science, Inc.

Ennio Sanchez
SRI International

Karel Schrijver
Principal Physicist
Solar and Astrophysics Laboratory

NAC Heliophysics Subcommittee Meeting Minutes, June 20-22, 2011

Leonard Strachan
Harvard-Smithsonian Center for Astrophysics

Charles Swenson
Center for Space Engineering
Utah State University

Allan Tylka
High Energy Solar Radiation Section
Naval Research Laboratory

Appendix C Presentations

1. Structure of the Heliophysics Research and Analysis Programs; *Mona Kessel*
2. Review of Heliophysics Data Policy; *Joseph Bredekamp*
3. Heliophysics Division Overview; *Richard Fisher*
4. Heliophysics Flight Program Status; *Victoria Elsbernd*
5. Access to Space Options in the Earth Ventures-2 AO; *Paul Hertz*
6. Update on the Sounding Rocket Program; *Cheryl Yuhas, Tripp Ransone*
7. Heliophysics Science Performance Assessment; *Barbara Giles*

Distributed materials:

Heliophysics Division Performance Highlights

James Webb Space Telescope Independent Comprehensive Review Panel (Final Report)

Appendix D

Heliophysics Subcommittee Meeting June 20-22, 2011

NASA Headquarters, see conference rooms below

Monday, June 20 - Room 9H40

8:30	Subcommittee Room Open	
9:00	Welcome, overview of agenda, introduction of new members	Roy Torbert, HPS Chair
9:15	Structure of the Heliophysics Research and Analysis Programs – Refresher on the task	Mona Kessel, NASA HQ
9:45	Continuation of work on the Structure of the Heliophysics Research and Analysis Programs – Committee Work Session	Subcommittee
10:00	BREAK	
10:15	Continuation of work on the Structure of the Heliophysics Research and Analysis Programs – Committee Work Session	Subcommittee
11:00	Review of Heliophysics Data Policy, in the context of the previous HPS finding and work toward a SMD Data Policy	Joe Bredekamp, NASA HQ
NOON	LUNCH IN ROOM: Causes and Consequences of Solar Cycle 24: Report on a Workshop, Mellott and Rusch	
		TELECON LINE OPEN: 866-453-7557 Passcode: 5625587
1:00	Heliophysics Division Overview	Richard Fisher, NASA HQ
1:30	Flight Program Status	Victoria Elsbernd, NASA HQ
2:00	Q&A with SMD Associate Administrator	Ed Weiler, NASA HQ
		TELECON LINE CLOSED
2:30	General Discussion	Subcommittee

3:00 BREAK

3:15 Access to Space Options in the Earth Ventures-2 AO Paul Hertz, NASA HQ

3:45 Continuation of work on the Structure of the Heliophysics Research and Analysis Programs – Committee Work Session Subcommittee

5:30 END OF DAY

7:00 Group Dinner, tbd, suggestions welcome

Tuesday, June 21, Room 8R40

TELECON LINE OPEN: 866-453-7557 Passcode: 5625587

8:30 Subcommittee Room Open

9:00 Update on the Sounding Rocket Program Cheryl Yuhas, NASA HQ
Tripp Ransone, NASA Wallop

TELECON LINE CLOSED

9:30 Discussion Subcommittee

10:15 BREAK

Tuesday, June 21, Room 8R40 ... continued

10:30 Discussion Subcommittee

NOON LUNCH IN ROOM

1:00 Heliophysics Science Performance Assessment, input for the FY2009 NASA PAR – Overview Barbara Giles, NASA HQ

1:30 Heliophysics Science Performance Assessment, input for the FY2009 NASA PAR – Review and Assignments Subcommittee

NAC Heliophysics Subcommittee Meeting Minutes, June 20-22, 2011

3:00 BREAK

3:15 Heliophysics Science Performance Assessment, input for the
FY2009 NASA PAR – Review and Assignments Subcommittee

4:15 News from, and then preparation for, the Aug 2-3 NAC
Science Committee Meeting Roy Torbert, HPS Chair

5:00 ADJOURN

Wednesday, June 22, Room 3H46

8:30 Subcommittee Room Open

9:00 Heliophysics Science Performance Assessment, input for the
FY2011 NASA PAR – Final Work and Voting Subcommittee

10:15 BREAK

10:30 Subcommittee Work Session Subcommittee

11:30 Debrief with Heliophysics Director
Richard Fisher or
Vicki Elsbernd, NASA HQ
Subcommittee