

National Aeronautics and Space Administration

Office of Space Science

Sun-Earth Connection Advisory Subcommittee  
Meeting

March 10-12, 2004  
Washington, D.C.

**MEETING REPORT**

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Barbara Giles  
Executive Secretary

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Michelle Thomsen  
Chair

**SUN-EARTH CONNECTION ADVISORY SUBCOMMITTEE  
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*Meeting Reporting conducted by:  
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**SUN-EARTH CONNECTION ADVISORY SUBCOMMITTEE  
Meeting Minutes**

*Wednesday, March 10*

**Welcome Remarks from the Chair  
Michelle Thomsen**

New Sun-Earth Connection Advisory Subcommittee (SECAS) Chair Dr. Michelle Thomsen convened the meeting at 8:30 a.m. She welcomed members and expressed the appreciation of their colleagues in the broader science community for their service. The subcommittee also welcomed the new SECAS executive secretary, Dr. Barbara Giles.

**Welcome  
Dick Fisher**

Dr. Fisher thanked the members of the subcommittee for their efforts. He reviewed the successes and changes within OSS since the last meeting including the Space Infrared Telescope Facility (SIRTF), now known as the Spitzer Space Telescope, and the two successful landings on Mars. Dr. Fisher noted the possible connections between solar activity and possible anomalous atmospheric conditions during those landings and subsequent operations. During a visit to the Jet Propulsion Laboratory for the second Mars landing, he brought attention to the coronal mass ejection (CME) space event that would have arrived at Mars coincident with a time Spirit operations were most critical.

Dr. Fisher announced that SEC has a new Presidential vision and directive and budget changes. SEC has reasonable, achievable, and important science goals with significant cultural, economic, scientific, spiritual, and esthetic value. Dr. Fisher suggested that a good approach to adjusting to the changes within NASA was to assess the current status of SEC, assess the critical functions that may be missing after the budget impacts are considered, and decide what the next and best thing is to be done. The four top-level NASA vision goals were reviewed. The 2005 President's proposed budget was reviewed. Although much of the OSS science is resident in the budget under the heading of "Aeronautics and Other Science Activities," some is included under the "Exploration Missions" heading including science activities associated with the Lunar and Mars exploration missions and the Terrestrial Planet Finder (TPF) mission. The nuclear space power initiative will be split between NASA organizational codes S and T. Nuclear power, propulsion and optical communications are part of the "Exploration Missions" budget.

**Space Science and the President's Renewed Spirit of Discovery  
Ed Weiler**

Dr. Weiler started by explaining how The Vision for Space Exploration was developed. He then reviewed the scope of the vision and how the various NASA research enterprises would participate and be represented in the FY05 proposed budget.

The new vision includes not just human and robotic exploration. It responds to the Columbia Accident Investigation Board (CAIB) report and takes explorers back to the Moon. The pursuit of answers to compelling science questions will drive the vision. NASA has a Level 1 requirement – if humans go to Mars, they will be brought back alive. The agency will ask for a \$1 billion increase over the next five years to address this vision. In 2010, the shuttle will be retired upon completion of the space station. The office of Space Science (OSS) will manage the 2008 return to the Moon with a robotic mission; the missions will continue to be peer reviewed. The search for Earthlike planets will be part of the new initiative.

Three federal agencies received increases in the proposed FY05 budget: the Department of Defense, Homeland Security, and NASA. NASA's budget would increase 5% over the next 5 years and 2% after that. Dr. Weiler noted that NASA's budget is only seven-tenths of 1% of the total U.S. budget or, per taxpayer, about as much as the average American spends on cable television.

Dr. Weiler announced that NASA research would be refocused to emphasize science that is directly applied to human missions. The President has appointed a Presidential Space Commission to advise on implementation of The Vision for Space Exploration.

Within the NASA budget, the Exploration Enterprise, Code T, has responsibility for the CEV; Next Generation Launch Technology; and the power parts of the nuclear program, Project Prometheus. The radioisotope thermoelectric generator (RTG) development is retained in Code S. Code R will continue to lead aeronautics research although other technology responsibilities will be handled by Code T. Code U, which performs biological and physical research, will be refocused on biological issues for human exploration. Earth Science resources, Code Y, were reduced in the budget. The aeronautics and education budgets remained the same.

The Code S budget will see a 41% increase over 5 years, mostly in the Mars Exploration and lunar programs. The funding for the Sun-Earth Connection theme is growing, though less rapidly as previously planned. The budget for the Structure and Evolution of the Universe (SEU) theme is also growing though again less rapidly than previously planned. Both of these programs are in the lower priority "Aeronautics and Other Science" funding line. Astronomical Search for Origins (ASO) funding is steady, Solar System Exploration funding is increasing and the funding for Mars and Lunar Exploration efforts are increasing. The Jupiter Icy Moons Orbiter (JIMO) science program remains an OSS responsibility.

Code T is not a science driven program; the requirements are operationally based. Code T and U will give OSS their requirements. Those requirements are combined with the requirements for the OSS planetary division, which includes both the lunar and Mars programs.

Dr. Weiler discussed the increases in the Mars budget and the schedule of milestones, which include an additional Mars Scout mission and deploying a

telecommunications satellite around Mars. OSS plans to release an Announcement of Opportunity (AO) this year for the first lunar robotic mission. The Hubble Space Telescope (HST) end of mission and the James Webb Space Telescope (JWST) development status was reviewed.

The proposed budget for the SEC theme was discussed. Funding for the Solar Terrestrial Probes (STP) program was significantly reduced. Research and Analysis program funding (R&A) was frozen at the FY04 level. The Living With a Star (LWS) program received the funds requested. Dr. Weiler suggested that this was due to the recognition that sending humans into deep space required knowledge about solar activity and its effects. The Explorer program will experience a delay. The SScAC will be asked to advise on implementation issues related to that delay. Program delays for SEU, particularly the Einstein Probes, were also discussed. OSS launches, in general, will be three to five times a year.

OSS is committed to scientific exploration and strong international collaborations. Counsel will come from the advisory committees and the National Academy of Science (NAS). Robotic missions are considered a natural precursor to human space flight. The success of the recent Mars landings and the discoveries related to water were reviewed.

In answer to questions, it was stated that by petitioning congress, it is possible to move money between lines. Solar Probe is considered important and every opportunity will be taken to fund it. It will take work to connect STP and high-energy astrophysics with the new vision. OSS has a budget similar to Odyssey to Mars to do the lunar mission, which is thought to be reasonable. Further discussion included the relationship between science and the missions beyond Earth orbit. Dr. Weiler emphasized that any new initiatives had to support The Vision for Space Exploration. The President has taken a personal interest in the Mars missions. SEC will repackage itself before the next budget cycle to connect to the vision. In discussion, the committee discussed the possibility of revitalizing SEC with smaller, more agile missions to respond to changes in priorities. Shifting from a Sun-Earth connection theme to a Sun-solar system connection theme was suggested. The committee warned against shifting the SEC emphasis from basic science to implementation. A Department of Defense (DOD) study was mentioned that found that global change was the biggest threat to national security. SEC addresses that subject directly, but such science does not yet appear to be part of the vision. Comments were made that LWS is more than solar physics: it includes Sun-planetary relations as well. There is also a misperception that all space weather related research is done in LWS. There was discussion of small versus large missions and whether SEC had the right mix. Astronomy requires large missions. SEC is doing fewer small missions now than 30 years ago. The committee pointed out that human exploration will start out in near Earth space, and that cuts to the SEC Mission Operations and Data Analysis (MO&DA) will prevent the operation of the Space Weather Network Missions in near Earth space. Dr. Fisher will consider any advice the subcommittee has to offer on trades between MO&DA and development.

**New Space Policy, Budget, SEC Perspective  
Dick Fisher**

Dr. Fisher reviewed the 2005 President's budget by showing the ratio of funding given to SEC programs as compared to the NASA submitted budget. R&A/Operations (except for LWS) were frozen at the FY04 level, instead of increasing by about 1.9% per year. MO&DA was frozen rather than increasing moderately with a peak in 2008. There was no increase in sounding rocket funding despite the SEC request. An increase was expected for LWS, and it has been fully funded. An AO for the first Geospace mission needs to be released. For the upcoming SEC roadmap development, Dr. Fisher posed the question of what is the best use of LWS and the one that makes the most sense. New Explorer missions have been stretched out. There was some discussion of a trade-off between SMEX and MIDEX lines. The Space Technology (ST)-5 mission will be flown on a dedicated Pegasus launcher within two years. Additional costs will be taken from the New Millennium program. STP received one-fifth the budget expected. There are two STP missions in development, Solar-B and the Solar Terrestrial Relations Observatory (STEREO), for which funding will decrease as development is completed. The Magnetospheric Multiscale (MMS) mission is in extended Phase A and may launch two years later than planned. The start of Geospace Electrodynamics Connections (GEC) and Magnetospheric Constellation (MagCon) move beyond the 5-year budget horizon. The highest priority is to finish the missions that have been started. The best shot for a new flagship mission is Interstellar Probe (ISP).

**Solar System Exploration**

**Orlando Figueroa, Director, Division of Solar System Exploration; Director, Mars; Acting Director, Lunar Robotic**

Mr. Figueroa reviewed the Mars program milestones. The Galileo mission ended successfully with a de-orbit into Jupiter's atmosphere sending valuable data to the very end. In January, Stardust flew by Wild 2 and revealed sharp crater edges on the comet. Mars Exploration Rover (MER) landed on Mars 24 hours later. Visitors to the Mars website exceeded all expectations and broke previous NASA records. In May, the Mercury Surface, Space Environment, Geochemistry and Ranging (MESSENGER) Discovery mission is expected to launch. In July, Cassini will enter the Saturnian system. Genesis has closed its solar wind sample collectors and is returning home. It will be retrieved from the Utah desert in September 2004. New Frontiers Program candidate missions will be selected in July, and Discovery candidates will be selected in October. Lunar science is not excluded from Discovery competition (Lunar Prospector is an example). Depending on the budget, a 2008 Lunar robotic rover may be selected during the next year.

Mr. Figueroa then reviewed future Mars and Lunar program plans. The strategic roadmap for solar system exploration (including Mars) is consistent with The Vision for Space Exploration, but will require some adjustment to strengthen the connection to human exploration. There will be less fundamental research and more applied research. Scalable technologies and attention to flight safety will be important elements.

Changes to the Solar System Exploration theme were reviewed. The Mars Exploration Program developed a concept involving four pathways to follow up on current Mars exploration, depending on what was found. The wedge for the missions beyond 2009 was deleted in the President's budget: they will request a restoration wedge in 2005. The appropriate pathway based on current findings appears to be "Search for Past Life," which had a sample return mission, a Presidential priority.

With the new budget, a new theme has been introduced—Robotic Lunar Exploration. President Bush has directed that a series of robotic missions to be sent to the Moon no later than 2008 "to prepare for and support future human exploration." These missions will "practice" for Mars and allow optimal human-robotic skill in achieving exploration-enabled science goals. There is a new report, "Safe on Mars", from the National Academy of Science (NAS) Space Studies Board outlining issues to be addressed. Objectives and Requirements Definition Teams will be formed to plan for the Moon missions.

Mr. Figueroa suggested that understanding the physical environment was where SEC overlapped with the human exploration initiative and that more interaction between the groups is appropriate. Solar activity is a concern for the Mars missions and is even more important when astronauts are involved. Every mission will have real estate for key science measurements.

In answer to a question about a diminished emphasis on outer planet opportunities, Mr. Figueroa said that no one was happy with the delay of missions. The "and beyond" part of the vision statement is looking toward the outer planets. It would be prudent to fold in the concept of understanding the space environments and how that applies to the human side of the equation. The committee cautioned against a de-emphasis on science such that exploration is purposeless.

## **Mission Operations Working Group (MOWG) Reports**

### **Solar-Heliosphere MOWG**

#### **Dana Longcope**

Membership is transitioning since it has been three years since the Solar-Heliosphere (SH) MOWG was constituted. The SHMOWG recommended a science definition team for Solar Probe. In a teleconference the SHMOWG heard about the budget impacts, STPs, rocket program impacts and options between developing a high altitude capability and maintaining the current flight rate. On MO&DA, the decrease from the amount projected should accommodate STEREO and Solar-B. Five currently operating missions would end in 2006/2007.

### **Geospace MOWG**

#### **Jim Clemmons**

Dr. Clemmons reported the group's five conclusions:

- 1) The GMOWG unanimously recommended selecting two SMEXs, as planned, for the current Explorer solicitation.

- 2) The GMOWG recommended performing an early senior review of the operating missions with the criteria to evaluate how the missions work with each other to create an end-to-end observatory. SEC missions should be seen as a observing fleet rather than an individual science missions. There are few new missions on the horizon for Geospace, so extending the currently operating missions is important.
- 3) The GMOWG was concerned that the level of funding for Supporting Research and Technology (SR&T), particularly for the theory program, may be near the level below which it cannot adequately support all the SEC disciplines. Future selection criteria should include the cross-cutting value of proposed investigations.
- 4) In a June meeting, the GMOWG will address the sounding rocket program.
- 5) The GMOWG commended NASA Headquarters on their support of the group's work.

Dr. Clemmons also presented a recommendation for an Explorer AO that would solicit a Mission of Opportunity-only. Because the MIDEX AO is delayed, he asked SECAS to consider recommending a mission of opportunity (MO) solicitation so any short-time-scale opportunities are not missed during the full MIDEX AO delay. The recommendation would endorse the previous evaluation criteria. If the MO proposed was not "worth delaying the line by three months," there would be no selection.

## **LWS MOWG**

### **Dan Baker**

Dr. Baker expressed his gratitude that LWS was protected in the budget and asserted that LWS is more than just solar science. He mentioned a *Space News* OpEd piece he published applauding the President providing a vision for NASA, but calling for balancing scientific exploration with the human exploration. He suggested that the advisory committees provide more deliberation on the subject to NASA.

## **Sun-Earth Connection MO&DA Program**

### **Chuck Holmes**

Mr. Holmes reviewed the status of the SEC operating missions and the operations lessons learned from the October/November 2003 solar storms. Voyager has been registering elevated readings from particles fluxes in several instruments as it begins its approach to the heliopause. Ulysses is near Jupiter and results from its closest approach will be available in April. The Solar Anomalous and Magnetospheric Particle Explorer (SAMPEX) will terminate science operations July 1. It will continue to be operated as part of engineering training activities. Wind was at L2 and will return to L1 next summer. The Solar and Heliospheric Observatory (SOHO) has an antenna problem that has been overcome so that there are data outages only for short time periods every two to three weeks. Polar has had several resets of its telemetry processing module. The Ramaty High Energy Solar Spectroscopic Imager (RHESSI) started extended operations March 7. A white paper on operations lessons learned during the October 2003 solar storms will be published and presented at a couple of professional conferences.



In the new budget, one year of content appears to have been taken out of the MO&DA program. These funds must cover the currently operating mission and be able to absorb the costs of any mission extensions for STEREO, Time History of Events and Macroscale Interactions during Substorms (THEMIS), Aeronomy of Ice in the Mesosphere (AIM), Two Wide-angle Imaging Neutral-atom Spectrometers (TWINS), Coupled Ion-Neutral Dynamics Investigation (CINDI), and Solar-B after their primary mission phase. Current plans are to maintain the Guest Investigator Program at present levels, data services, and the Multi-mission Operations project. SEC will need guidance to prioritize the existing missions if budget cuts remain. Would do this by moving the next Senior Review to April/May 2005, rather than the nominal schedule of 2006. System science may be a priority in the scheme of ranking for the senior review of existing missions. The European Space Agency (ESA) wants to fund Ulysses through the third solar perihelion.

The committee expressed the opinion that it would be unfortunate to prematurely end these missions as they clearly enable solar system exploration. It was suggested that the strategic plan clearly outline the cost of maintaining this system versus the development of an entirely new solar system space weather fleet.

### **Options for Future Explorer Programs**

#### **Paul Hertz**

Dr. Hertz reviewed the status of the Explorer Program. Five SMEXs and one Mission of Opportunity (MO) are currently in Phase A study. The cost cap for MIDEXs has been raised to \$240 million including launch and \$120 million for SMEXs. The MO current cost cap is \$35 million. The status of the current missions under development was reviewed. Under the President's new budget, there is no impact on Explorer missions in development. However, significant funding reductions will make it difficult to start new missions in the near term and will decrease the flight rate, at least temporarily, for future selections. SScAC will be asked to advise on whether to reduce the number of SMEX missions to be selected under the current procurement rather than delay future SMEX and MIDEX procurements and launch dates. Selecting the Antarctic Impulsive Transient Antenna (ANITA) MO will delay a selected SMEX launch by three months and the MIDEX AO release by three months. In discussion, Dr. Hertz said NASA could get an MO AO out in three months if they didn't release a draft first.

### **JIMO and Prometheus**

#### **Ray Taylor**

Project Prometheus team is designing for multimission modularity that includes the Jupiter Icy Moons Orbiter (JIMO) and future missions to Saturn, Kuiper Belts, and Jupiter's habitable water worlds of Ganymede, Europa, and Callisto. Europa is a top priority of the Decadal Survey. Surface power and cargo return technologies will also apply to the Moon and Mars missions. The technology development efforts will expand the types of measurements future missions can achieve. The JIMO launch would be no earlier than 2011 and would require a heavy lift Atlas. They are looking at the option of a two-part launch with subsequent in-orbit rendezvous and docking. The mission will make

observations at Jupiter for four to six years. Dr. Taylor reviewed project milestones and technical issues. Interstellar Probe (ISP) was mentioned as potential future mission. Unlike JIMO, ISP has no specific mandate in the Decadal Survey. ISP would need to be part of a strategic planning process reflected in the OSS roadmaps. SECAS was interested in making sure their interests were represented in the Project Prometheus program line. The committee suggested a workshop meeting like the one done at Harvard that produced a 30-article review. NASA is having a workshop this summer for the purpose of defining future Prometheus missions. There was a question about allocations of funds from other agencies. There are some in-kind trades. The Air Force is working on electric thrusters, but the technology requirements are fundamentally different. Dr. Fisher will make the JIMO Science Definition Team report available to the subcommittee.

### **Sounding Rocket Operations**

#### **Mary Mellott, Program Scientist for Sounding Rocket Operations**

Dr. Mellott reviewed sounding rocket (SR) program issues. The program had budget issues needing to be addressed before the funding shortfalls imposed by the FY05 budget. Most of the SR budget is allocated to fixed operational costs. In May 2003, the SR program received funding to support launches, but not enough to maintain program viability, i.e., to make planned motor purchases, support planned technical development, and develop the High-Altitude Sounding Rocket (HASR). The NASA requested FY05 budget run-out was compared to the President's budget and cost drivers for the program were reviewed, including launchers. The new budget may result in half the flight rate for 2007. The OSS Sounding Rocket team will work to prioritize the manifest and provide recommendations on services to retain.

The value of the program for education and training, technology demonstration, instrument and detector development, and for calibration underflights of operating missions has not been clearly defined. If the program is to remain viable, clear articulation of its goals and priorities is needed. Dr. Mellott would like to receive input on priorities from the different science disciplines. Raising the program's visibility in the SEC roadmap will be important. Investigation into whether the Mars program and other OSS programs might want to use the rockets for risk mitigation is needed. The PhD degrees awarded and instrument development efforts should be tracked.

### **Subcommittee Discussion**

The committee strongly supported maintaining a robust GI program. Dr. Fisher stated that a process is needed for prioritizing high-level trade-offs within the SEC program. Others endorsed balancing the GI program with data centers and ongoing missions. Maintaining Voyager as it crosses into the interstellar medium was also mentioned as a high priority objective. The committee suggested that Solar Probe and the Interstellar Probe (ISP) may be seen under the current climate as high-priority programs. Also LWS has been protected, and its definition might be broadened. As far as budget losses are concerned, support for the cadence on the Explorer program goes back decades. SEC's last roadmap emphasized the critical niche filled by Explorers and the sounding rockets. Those, along with the STP program, are considered the hardest to

salvage. The chair reminded the subcommittee that there has been a change in direction for the agency, and the committee needs to make recommendations within the new context. The committee will make the case for the importance of world-class science and the importance of this community's successful 50 years of science legacy. Others commented that with NASA being mission driven, it made sense to communicate how science is essential to the missions. The SEC fleet of spacecraft is one of the greatest research tools ever built and essential for enabling human exploration beyond earth orbit, but not everyone realizes that. It will also be important to make the case for the full relevance of LWS: it is not just solar science, but understanding of the planetary ionosphere and magnetosphere and the full heliosphere, too. With the budget cuts, the program has been narrowed to solar science, and SEC will have less ability to support the Vision for Space Exploration. The committee also brought up the issue of providing guidance for the senior review of the operating missions.

**Thursday, March 11**

**Update on Previous SECAS Findings**

**Dick Fisher**

SECAS Findings from November 11, 2003:

- 1.) HST transition and Explorer Program  
Superseded: Hubble Space Telescope (HST) Servicing Mission-4 cancellation was recommended by Mr. Reddy, Head of Code M and former shuttle commander, for safety reasons and approved by Sean O'Keefe.
- 2.) ST-5 launch crisis  
Chuck Gay will update the subcommittee concerning SEC decision to fly the mission on a dedicated Pegasus.
- 3.) Interactions with Project Prometheus: Interstellar Probe (ISP) has been recommended to the Prometheus program as a second mission goal after JIMO.
- 4.) Vigilance in Cost Control and return of coronagraph capability to LWS  
Cost control is a constant issue in program management. No domestic instrument provider has volunteered to provide a coronagraph for SDO but SEC has received a coronagraph proposal from Europe.
- 5.) Expanded role for LWS MOWG  
Lika Guhathakurta will update the subcommittee during her presentation.
- 6.) GI Grants are important: urge growth consistent with funding prime teams.  
Chuck Holmes will update the subcommittee during his presentation.

**Summary of Missions in Development/Operation**

**Chuck Gay**

Mr. Gay summarized the status of both the SEC operating missions and the missions in development. Specifically, on the Space Technology-5 mission, Mr. Gay said NASA made the decision to buy a dedicated Pegasus launch if a launch date was available in the next two years. Issues with a redesign on the Pegasus have been resolved. A Pegasus costs \$30 million which will bring the total cost for ST-5 to \$120 million. ST-5 will demonstrate small spacecraft configuration flying with three nanosats. ST-9 is an important mission for solar sails; its NASA Research Announcement (NRA) is in development.

**SEC Roadmap/2006 OSS Strategic Plan**

**2006 Process**

**Marc Allen, Office of Space Science Strategic Planning**

Dr. Allen stated that the strategic planning process for 2006 had already begun. He reviewed the purpose and process of NASA strategic planning and the schedule for 2006. The OSS science theme roadmaps will be reviewed at SScAC in March 2005. Final drafts will be due in June 2005 in time for the OSS consensus workshop, final advisory committee review, and production. Release is scheduled for early in 2006. The release is timed so that the NASA Administrator has the input for the budget process. The new Vision for Space Exploration will be used as input for future NAC studies, senior advisory committees, and the theme roadmaps. The theme roadmaps will cover the following areas: Science Objectives, Mission Plans, EPO, and Technology. Science Objectives remain the prime focus; the rest is implementation with technology development being a key factor.

### **SEC Roadmap Lessons Learned in the 2003 Process** **Harlan Spence for Stephen Fuselier**

Dr. Spence reviewed the structure of the 2003 Roadmap team. SECAS tasks the roadmap group to create the SEC Roadmap on behalf of the OSS Strategic Planning process. The 2003 team was able to promote extensive science community involvement in the process. SECAS provided oversight and served as red team reviewers on the final document. The 2003 Roadmap was a 10-month process. The former chair of the roadmap team, Stephen Fuselier, communicated that he would be happy to help build on the previous roadmap, but if the basic science objectives were to be revisited, he would defer to others.

They need clear guidelines and SECAS oversight.

### **Update on Status of Roadmap Missions** **Neil Murphy**

Dr. Neil Murphy reviewed the status of efforts to further define the SEC roadmap mission concept studies and technology studies. Particular attention is given to cost credibility and toward methods of determining the recurring costs within multi-spacecraft missions. He reviewed studies for the Heliospheric Imager and Galactic Observer (HIGO), Inner Magnetospheric Constellation (IMC), Telemachus, and Reconnection and Microscale (RAM) missions. Mission cadence was considered and methods of capturing, processing, and storing data.

The Mission & Science Measurement (MSM) program was transferred from Code R to Code T. SEC technologists are engaging with Code T well, but if some SEC-relevant technology development proposals are not funded under the new initiative, SEC will need to find new ways to fund their initiatives.

The ST-9 Solar Sail Flight Validation NRA is scheduled for May 2004. It should help characterize solar sail technology and take measurements relevant for modeling the technology. The In-Space Propulsion (ISP) program is spon for the study. The New Millennium program paid for them to put the NRA together. They are close to proving solar sails, which could be used for small to medium missions. The committee expressed

concern about Code T imposing a filtering function on technology development which could adversely affect the development of enabling technologies for SEC missions.

## **Discipline Scientist Reports**

### **GEC SDT Activity Update**

#### **Phil Richards**

Last year the Geospace Electrodynamics Connections (GEC) mission science definition team assessed mission the implantation options of three dipping spacecraft as compared to four non-dipping satellites. The team concluded that science objectives may be met with a dipping mission with as few as two satellites. The 2005 budget cuts to the STP program threatens to move the GEC start date off the 5-year budget planning horizon. Dr. Richards posed the question of what should be done to keep the mission viable.

The subcommittee commented that the money available to STP after MMS is not sufficient to maintain the planned flight cadence. The most important crisis posed by the 2005 budget is not the Explorer program, but the STP program,. The committee commented that SEC should remain with their strategic science line, which was well developed and repeatedly validated through the National Academy. The SEC community must continue to educate the administration regarding the definition of "exploration" and the important role of SEC science in enabling exploration.

### **Solar Orbiter**

#### **Todd Hoeksema**

Dr. Hoeksema provided a status report on the ESA sponsored Solar Orbiter mission. The mission will get as close as two-tenths of an AU to the Sun. He reviewed the science goals and the anticipated instrumentation. A science definition team has completed it activities and has issued a report to ESA. The current launch date is no earlier than October 2013, but a subsequent Venus opportunity in March 2015 may be more likely. The NSF decadal report supports a Solar Orbiter mission.

### **LWS Geospace Missions**

#### **Barbara Giles**

Dr. Giles reviewed recent activity of the LWS Geospace mission definition team (GMDT) and the program status. The GMDT met in December at the American Geophysical Union (AGU) meeting to evaluate the science benefits and shortfalls to the LWS/Geospace science objectives that could result from a possible partnership with the ESA/Earth Science SWARM mission. NASA provided ionospheric instrumentation on the four SWARM platform has the potential to augment the LWS/Geospace Ionosphere-Thermosphere Storm Probes (ITSP). The GMDT was asked to comment on whether this additional instrumentation could substitute for one of the two planned Ionosphere-Thermosphere Storm Probe spacecraft. The GMDT decided that science disadvantages outweighed the small budget savings.

In answer to questions, Dr. Giles said there is as yet no LWS plan for an auroral imager and confirmed that LWS is fully funded in the new budget. SEC has a representative attending a payload planning meetings for the National Polar-Orbiting Operational Environmental Satellite System (NPOESS) program to communicate SEC interests. Canada is studying an auroral imaging mission.

### **Magnetosphere Constellation**

#### **Bill Peterson**

Dr. Peterson reviewed the status of the Magnetosphere Constellation (MagCon) mission. Updated science, and feasibility studies have been performed which look at, among other things, the number of spacecraft needed to meet the mission science objectives. A mission implementation concept has been identified.

### **Science Presentation**

#### **The Solar Storms of 2002 and 2003:**

#### **Upper Atmosphere Response and Speculations on Their Influence on Climate**

#### **Marty Mlynczak, NASA/Langley**

Dr. Mlynczak reported on the flow of energy from the Sun into the Earth's atmosphere and the Earth's atmospheric response during the solar storms of 2002 and 2003. The research focuses on atomic oxygen collisions as central to the radiative effect. Nitric oxide (NO) emissions provide more cooling than atomic oxygen. NO can act as "air conditioning" for the thermosphere, which in turn acts as a thermostat to maintain radiative balance when the atmosphere absorbs radiation from solar storms. From measurements of the energy input and output, the process appears to be very efficient; energy is dissipated very quickly.

Several programs contributed to this study. Missions from the Earth Science Enterprise (ESE) provided observations from the Earth's surface up to the mesosphere. Missions from the Office of Space Science provided observations the higher altitude observations from the thermosphere through the ionosphere and on to the Sun. The event is a prime example of the value of NASA's solar system fleet of research spacecraft. All regions affected by the storm were measured by science-class instrumentation. In this golden age of space and atmospheric science, the entire energy chain from the Sun to the Earth effects can be studied.

### **Living with a Star IRT/Non-Advocate Review**

#### **Dana Brewer**

Dana Brewer reported on the Solar Dynamics Observatory (SDO) and LWS Program confirmation reviews. She outlined the extensive scope of the reviews. The final program management review (PMR) is scheduled for June 2, 2004. The first non-advocate review (NAR) was held in December. A "delta" NAR was held Monday, March 8. The 12 issues raised by the Independent Review Team (IRT) during the first NAR were discussed. It is felt the issues indicated some confusion regarding centers of responsibility between the "generating knowledge" versus "providing products"

activities. Because this is the first time NASA has done a program level NAR, clearer direction regarding this was required; a written charter should have been provided.

### **Living With a Star Program Update Including Solar Probe: Actions on Previous Findings**

#### **Lika Guhathakurta**

Dr. Guhathakurta reviewed the LWS program and addressed actions taken in response to the subcommittee's previous findings. The Science and Technology Definition Team (STDT) for the Solar Probe mission, chaired by former SECAS chair Dr. David McComas, met March 3-4, 2004. The team includes the two chairs from the previous Solar Probe definition teams. A Sun Climate task group report and a Targeted Research and Technology (TR&T) program report have been released. Copies of those reports are available from the LWS web site: <http://lws.gsfc.nasa.gov>. LWS is looking for launch partners for the Space Environment Testbeds (SET). Early results from SET data mining efforts are being used by James Webb Space Telescope (JWST) engineers. On March 10, NASA received a letter from ESA proposing a European consortium, Eurocor, to provide a coronagraph for SDO. NASA will evaluate the offer. The main question is whether this offer comes too late in the development phase of SDO. Dr. Guhathakurta appreciated Dr. Dan Baker's participation in the November LWS/MOWG meeting and felt that the MOWG was expanding its participation. She reviewed the science workshops and MOWG meeting schedule. The program is reworking its vision to orient it towards the Presidential vision. The committee suggested highlighting a connection with DOD on national security. An update on Sentinels should be ready for the next (July) meeting. Sentinels fit in well with the new vision for space exploration, but needs definition. The LWS program outreach activities were reviewed. A large increase in the number of proposals and a cut in TR&T funding has resulted in a factor of two increase in pressure on TR&T proposal selection. Selection will be in mid-April. LWS may sponsor a workshop to present work from the selected investigations and to solicit community input as to the future direction for the LWS Targeted Research and Technology (TR&T) program.

### **ILWS**

#### **Lika Guhathakurta**

Dr. Guhathakurta presented an organizational chart, including working groups, for the International Living With a Star (ILWS) program. ILWS acts as an integrator between the solar-terrestrial programs of the many space-faring nations. Dr. Guhathakurta reported the status of recent efforts. China has launched Doublestar. The United States will share in data from that mission. Canada is looking at two proposals to study magnetospheric storms and image the auroral oval. They are considering providing an electric field experiment for ESA's SWARM mission. The committee suggested that further international ground-based collaborations can trigger some synergistic system science investigations. ESA may augment the Space Weather Aeronomical Responses Models (SWARM) or Advanced Composition Explorer (ACE).



### **Discipline Scientist Roundtable**

The chair thanked the SEC science staff for their work and asked if they had any issues. Comments ranged from appreciation for the positive response of the community in dealing with issues surrounding the new budget, to a call for suggestions for new IPAs at HQ. Program Executive Dana Brewer received praise for taking LWS through the first program-level NAR. There was worry expressed about the Geospace science program which was hit hard by the budget, and the possibility of losing operating funds for Voyager which will soon cross the termination shock. Robust science goals were recognized as a stabilizing influence to withstand the budget shortfalls. Dr. Holmes praised Joe Bredekamp's successful program of research grants for computer science. The result has been more access to computer cycles, better management of the deep archives, and better definitions for permanent archiving. Dr. Guhathakurta acknowledged the work of Dave Sibeck, whose one-year temporary assignment at HQ is ending. She also related that LWS had a booth in the main hall of the United Nations meeting in Vienna for the Committee on the Peaceful Use of Outer Space.

### **Subcommittee Discussion**

The subcommittee discussed the direction the SEC roadmap should follow. The major issues with the roadmap are whether the new roadmap should be an incremental change of the previous roadmap, whether the roadmap should continue with the existing science objectives but with some reorientation to the new Vision for Space Exploration, or should the roadmap be a new approach. Dr. Harlan Spence was assigned to write up a draft recommendation for the roadmap committee.

A candidate list of findings was discussed. The topics for recommendations to SScAC were reviewed and SECAS members were assigned to write drafts.

- 1.) Definition of "exploration" and the STP line
- 2.) MO&DA/GI/Flotilla, senior review
- 3.) Explorer MO-only AO
- 4.) Supporting Solar Probe
- 5.) Sounding rocket/suborbital
- 6.) Encouraging broader participation in post-JIMO
- 7.) Technology development and the new Code T

In addition, the subcommittee wanted to commend the SEC team on receiving a coronagraph proposal from ESA. The response to the November 2003 SECAS recommendation regarding the need for a coronagraph on SDO was well appreciated.

The chair envisioned a statement responding to the issue of the new vision. The subcommittee is pleased with the recognition from the Administration of the value of exploration but dismayed by the implementation and narrow interpretation of "exploration." Important exploration science is falling off the table. The recommendations should state the negative impact to SEC scientific goals and the need for breadth and balance.

***Friday, March 12***

**Subcommittee Discussion**

The subcommittee completed work on drafting the recommendations. Each committee member was then given time to voice final comments. Dr. Fisher thanked the subcommittee for their help. He asked SECAS members to refer colleagues for IPA positions at NASA HQ. The SECAS chair praised the service NASA has given the community. The meeting adjourned at 2:00pm.

**Next Meeting**

The next SECAS meeting is planned for July 26-28 in San Diego. It will be a joint meeting of all OSS subcommittees and will be followed by an SScAC meeting.

**APPENDIX A****AGENDA**

SECAS – MARCH 10-12, 2004  
NASA HEADQUARTERS – 9H40

**WEDNESDAY, 10 MARCH 2004**

0815	Meeting Room Open, Coffee	
0830	Welcome	Michelle Thomsen
0840	Prefatory remarks	Dick Fisher
0900	New space policy, budget, OSS priorities	Ed Weiler
1000	Break	
1015	New space policy, budget, SEC perspective	Dick Fisher
1115	Solar System Exploration	Orlando Figueroa

1200	Break for lunch	
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1315	MOWG reports SH Geospace LWS	Dana Longcope Jim Clemmons Dan Baker
1400	FY05 Budget Impact on the Operating Missions	Chuck Holmes
1430	Explorer Program	Paul Hertz
1500	Explorer Program Discussion	Committee
1530	Break	
1545	JIMO and Prometheus, Code T	Ray Taylor
1615	Sounding Rocket Operations	Mary Mellott
1645	Discussion	Committee
1730	Adjourn	

**THURSDAY, 11 MARCH 2004**

0815	Meeting Room Open, Coffee	
0830	Update on previous SECAS findings	Dick Fisher/Barbara Giles
0845	Summary of Missions in Development/Operation	Chuck Gay
0900	Roadmap/2006 Strategic Plan 2006 Process (30min) Insights from the 2003 Process (30 min) Update on Status of Roadmap Missions (20 min) Discussion (25 min)	Marc Allen Fuselier/Spence Neil Murphy Committee
1045	Break	
1100	Discipline Scientist Reports (10 min each) GEC – Phil Richards Solar Orbiter – Todd Hoeksema LWS Geospace Missions – Barbara Giles Magnetosphere Constellation – Bill Peterson Discussion on Panel Review Issues	

1200	Catered lunch in HQ 9H40/Science presentation Marty Mlynczak (NASA/LARC): The Solar Storms of 2002 and 2003: Upper Atmosphere Response and Speculations on Their Influence on Climate	
1345	LWS	
	IRT/Non-Advocate Review	Dana Brewer
	Update (inc. Solar Probe), Actions on previous findings	Lika Guhathakurta
	ILWS	Lika Guhathakurta
1500	Break	
1515	Discipline Scientist Roundtable	
1545	Committee Discussion and Writing Assignments	Committee
1700	Adjourn	

**FRIDAY, 12 MARCH 2004**

0815	Meeting Room Open, Coffee	
0830	Committee Writing Time	
0930	Review Findings	
1030	Break	
1045	Review Findings with Dick Fisher	
1200	Adjourn	

**APPENDIX B**  
**SUN-EARTH CONNECTION ADVISORY SUBCOMMITTEE**  
**MEMBERSHIP**

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**APPENDIX C  
MEETING ATTENDEES**

Committee Members

Michelle Thomsen, <i>Chair</i>	Los Alamos National Laboratory
James Clemmons	The Aerospace Corporation
Jim Klimchuk	Naval Research Laboratory
Dave Klumpar	Montana State University
Janet Kozyra	University of Michigan
Jim LaBelle	Dartmouth College
Dana Longcope	Montana State University
William Matthaueus	University of Delaware
Doug Rabin	Goddard
Nathan Schwadron	Southwest Research Institute
Ruth Skoug	Los Alamos National Laboratory
Harlan Spence	Boston University

NASA Attendees

Marc Allen	NASA Headquarters
Jay Bergstralh	NASA Headquarters
Joe Bredekamp	NASA Headquarters
Kent Bress	NASA Headquarters
Dana Brewer	NASA Headquarters
Mike Calabrese	NASA Goddard
Eric Christian	NASA Headquarters
O.C. St. Cyr	NASA Goddard
Phil Eberspeaker	NASA Goddard
Orlando Figueroa	NASA Headquarters
Richard Fisher	NASA Headquarters
Greg Garbs	NASA Headquarters
Chuck Gay	NASA Headquarters
Barbara Giles	NASA Headquarters
Jane Green	NASA Headquarters
William Grose	NASA Langley
Lika Guhathakurta	NASA Headquarters
Paul Hertz	NASA Headquarters
Ken Hinkle	NASA Headquarters
Todd Hoeksema	NASA Headquarters
Robert Hoffman	NASA Goddard
C.P. Holmes	NASA Headquarters
Mary Mellott	NASA Headquarters
Marty Mlynczak	NASA Langley
Michael Moore	NASA Headquarters

Neil Murphy  
Marian Norris  
Robert Pfaff  
Bill Peterson  
Phil Richards  
David Gary Sibeck  
Jim Spann  
C. Varsi  
Richard Vondrak  
Bill Wagner  
Dan Woods

NASA JPL  
NASA Headquarters  
NASA Goddard  
NASA Headquarters  
NASA Headquarters  
NASA Goddard  
NASA Marshall Space Flight Center  
NASA Headquarters  
NASA Goddard  
NASA Headquarters  
NASA Headquarters

*Other Attendees*

Dan Baker  
Kathleen Beres  
Dave Chenette  
Dom Conte  
John Cullen  
Michael Ledford  
Randy Showstack  
Larry Zanetti

University of Colorado, Boulder  
Orbital  
Lockheed Martin  
Spectrum Astro  
Senate Commerce  
Lewis-Burke Associates  
American Geophysical Union –EOS  
JHU/APL



**APPENDIX D  
RECOMMENDATION LETTER**



Los Alamos National Laboratory  
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March 19, 2004  
 ISR-1-04-027

Dr. Andrew Christensen  
 Northrop Grumman Space Technology  
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Dear Andy,

The Sun-Earth Connections Advisory Subcommittee met in Washington on March 10-12. We had a very full agenda, a copy of which is attached to this letter. We appreciate the informative presentations we heard, and we are particularly grateful to Ed Weiler and other Headquarters personnel for taking the time to be with us.

As you are well aware, the OSS portion of the recently released President's FY05 budget request contained some big changes from the budget that emerged from the extensive strategic planning process NASA has pursued for a number of years. The impact of these changes is particularly severe for the SEC and SEU themes, and much of our discussion was aimed at trying to understand the consequences for the SEC program and what actions might be taken to alleviate some of the problems.

To illustrate the level of impact on SEC programs, here are the ratios of funding proposed for certain program areas in the President's FY05 budget request, relative to what was submitted by NASA to OMB in the fall of 2003 for the same categories:

Program Area	FY05	FY06	FY07	FY08	FY09
MO&DA	1.0	0.95	0.83	0.78	0.74
Rocket Ops	0.95	0.83	0.77	0.74	0.74
Explorers	0.42	0.68	0.50	0.86	0.99
Solar-Terrestrial Probes	0.22	0.18	0.25	0.54	0.51

SECAS is greatly concerned that this budget, if realized, would damage a healthy, productive, and popularly-valued part of its exploration mandate, namely the SEC science program. Thus, you will see that several of the SECAS findings detailed and summarized

in the attachments are intended to call attention to the impact of the proposed budget and to request assistance in ameliorating some of the most severe consequences. Our other findings propose actions that can be taken in light of the proposed budget to rescue important near-term science opportunities.

SECAS welcomes the upcoming roadmap process as an opportunity to clarify the vital role of SEC science in fulfilling the nation's vision for the exploration of the solar system and beyond.

Our specific findings and a brief summary thereof are attached.

Best regards,

Michelle F. Thomsen  
SECAS chair

cc Dr. Richard Fisher

**SECAS Findings from 10-12 March 2004 Meeting**1) *SEC and the Presidential Vision for Exploration*

SECAS is pleased that the value and importance of space exploration have been acknowledged at the highest levels of our government. We believe that the nation is well served by a vigorous program to explore and understand our space home and the wider universe beyond. However, we are greatly concerned that an overly narrow interpretation of "exploration" will seriously affect the current vibrant and productive exploration programs in SEC and SEU. A vital program of scientific exploration is needed both to support human exploration and to advance our knowledge of space and the fundamental processes that operate throughout the solar system and beyond. The business of the SEC theme is exactly such exploration. Planned SEC missions and programs systematically probe regions of space and physical processes throughout the solar, heliospheric, planetary and Geospace environments. SEC explores the inter-relationships that exist within the coupled solar-planetary system, and SECAS believes that this science is essential to realizing the newly enunciated vision of exploration.

Based on the President's proposed FY05 budget allocations, SECAS is concerned about the future of the SEC science enterprise. The proposed budget includes large reductions in the planned funding for the Solar Terrestrial Probes line, the Explorer line, the Sounding Rocket and Research and Analysis programs, and Mission Operations, even though these programs have been repeatedly studied, endorsed by the National Academy of Sciences and strongly supported by the space science community. If this budget is realized, it will lead to shortfalls in scientific progress, lack of synergy between the program elements, missed opportunities, and deterioration of the research base. Beyond this, there are wider impacts, including a weakening of US leadership in space sciences. Lost will be carefully planned, valuable contributions to society, technology, national security, and to the goals of exploration.

Nowhere are these potential impacts more evident than in the de-emphasis of the Solar Terrestrial Probes line. As an illustration, consider the status of our understanding of the role of magnetic fields and magnetic energy release throughout the solar system. Energy is stored in magnetic fields by the solar dynamo and subsequently released and converted into heat, flows and radiation. High-energy particles and massive ejections of solar material can accompany magnetic energy conversion on the sun, leading to great changes in interplanetary conditions, to magnetospheric storms, and to dangers to technological assets and human activity in space, as well as other possible effects not yet discovered. Understanding how these fundamental and ubiquitous processes work is a crucial and intellectually challenging underpinning to exploration of the solar system and beyond. However, the only possibilities in the foreseeable future to directly investigate magnetic energy release and its consequences are found in the near-Earth environment. Through a carefully planned and overlapping sequence of STP missions, SEC will first directly explore the physics of the flow of energy in the terrestrial magnetosphere (the MMS mission), then will examine the global consequences for the magnetospheric system (the MagCon mission), and finally will elucidate the implications for the Geospace environment (GEC mission). Under the President's proposed budget, these missions are delayed such that only the first one even appears on the horizon. We believe that this slow-down does major damage to NASA's space science program by curtailing

the access to space for missions aimed at exploring the fundamental nature of the universe in which we live. It also indirectly affects our ability to address some of the crucial societal impacts of space weather since STP science (such as magnetic reconnection) forms part of the underpinnings of Living With a Star research. We conclude that the essential STP line should be restored to its carefully planned and integrated schedule as soon as possible.

A robust program of fundamental space science objectives is necessary to achieve the goals of the new exploration vision. SECAS believes that our ability to support this vision requires a breadth in SEC missions, including both a discipline balance and a balance between small, medium and large missions. We also believe that the process of revising program priorities would greatly benefit from input from the science community. NASA has a responsibility to carry out appropriately motivated basic research. We therefore urge NASA and SEC to firmly maintain NASA's longstanding commitment to understand the space environment, supporting a robust SEC program including the foundational STP line.

## 2) *Operating Missions: A Distributed SEC Observatory*

SECAS notes that the fourteen currently operating satellites of the Sun-Earth Connection Division span the solar system from the Sun and near-Sun interplanetary medium to the edge of the Heliosphere, and near Earth from the top of the atmosphere to the top of Geospace. This fleet of spacecraft is unprecedented in the quality and breadth of data being gathered, returned, and analyzed, enabling for the first time the pursuit of a complete picture of the sun and its relationship to the planetary system. For example, these satellites, and those at Mars, chronicled the violent October-November 2003 solar eruptions as they wreaked havoc throughout the solar system. Without these complementary satellite assets, our exploration of the coupled Sun-planetary system would be greatly compromised, as would be our ability to support future human and robotic exploration of the Moon, Mars and beyond.

SECAS views with concern the prospect that budgetary impacts to the MO&DA, Supporting Research and Technology, and Guest Investigator programs will result in the loss of significant key elements of this unique flotilla of space explorers at a time of increasing need to understand the effects of solar variability throughout the solar system. The scientific value of the fleet cannot be overemphasized. The costs to operate it at full capacity pale in comparison to replacement costs. Once lost, these capabilities cannot be re-established without significant expenditures. The new missions planned for future years will add capabilities in key areas but will not replace those that already exist in the current operating satellites. Thus, every possible effort must be made to exploit the nation's investment in these assets for continued exploration of the sun's influence throughout the solar system.

SECAS urges SEC to consider innovative ways to sustain this irreplaceable portfolio of extended missions and the science activities that utilize their observations. If NASA deems it necessary, we also support an early Senior Review to reorder priorities to make most effective use of this coordinated capability.

### 3) *Restoring a Healthy Sounding Rocket Program*

The sounding rocket program, like the Explorer program, makes crucial and productive contributions to NASA's mission of discovery and exploration. From the earliest discoveries of space exploration to those of today, sounding rockets provide a mechanism for cutting-edge science, the only access to certain regions of space, the fastest and most cost-effective access to space, and an irreplaceable opportunity for training space scientists and developing and testing instrumentation. For more than a decade, the sounding rocket operations and science budgets have been inadequate. The recent National Academy of Sciences decadal survey recognized the value of this program to the nation and recommended increasing the funding level to bring the program back to health. The President's proposed FY05 budget freezes the sounding rocket operations budget at roughly the current level for five years, losing sight of this NAS recommendation and forcing a choice between falling behind in technology and inventory or halving the flight rate. Either choice brings negative long-term consequences for space science in terms of scientific achievement, instrument development, and training of scientists and engineers required for future space exploration.

In the short term, SECAS urges that the funding for this essential infrastructure and science program be restored to the previously planned levels. In addition, SECAS supports the ongoing activity of a task force that has been created to chart the future direction of the sounding rocket program. This task force will be consulting with stakeholders in the program to identify needed developments and the most productive path for the future.

### 4) *Explorer AO for Missions of Opportunity*

Explorer missions are meant to provide frequent and rapid access to space for investigations to address compelling science questions. The SEC community places a very high priority on Explorer missions because they allow us to respond quickly to new scientific and technological developments and they support the future vitality of the field by providing a competitive opportunity for young experimentalists and developing groups. The major reduction in funding for the Explorer line in the proposed FY05 budget will translate into a significant delay in the development of future Explorer missions. SECAS therefore endorses the idea of releasing as soon as possible an Explorer Announcement of Opportunity (AO) that solicits only Missions of Opportunity (MOs). This AO, replacing this year's postponed full MIDEX AO, would potentially allow the recovery of some near-term science returns without making a large impact on the Explorer budget or out-year flight cadence. It also would provide impetus to the science community to keep considering new ideas in the upcoming period of limited opportunities. The understanding of the committee is that such an AO could be released with a relatively modest amount of effort by Headquarters staff in a reasonably short time interval (a few months). Furthermore, the committee expresses its desire that proposals tendered in response to this special opportunity be evaluated against the same quality standards already established for Explorer MOs.

#### 5) *Future Prometheus Missions*

SECAS was very interested in presentations of the Prometheus Project and Solar System Exploration Program by Ray Taylor and Orlando Figueroa, and we greatly appreciate additional SEC representation on the Prometheus MOWG, as suggested in our previous letter (November 11, 2003). SECAS continues to be extremely supportive of the developments in the Prometheus Project, which will benefit an array of notional missions that need dependable, cost-effective and/or long duration nuclear propulsion. We also applaud the plan for an upcoming workshop to consider candidate Prometheus missions to follow the Jupiter Icy Moons Orbiter (JIMO). Such a workshop begins a prioritization process that must engage all relevant divisions in the Office of Space Science. One mission that we particularly hope will receive attention is Interstellar Probe (IsP), which has consistently received the highest scientific ratings but was deferred in the NAS Decadal Survey as a high-priority flight mission because advanced propulsion developments are needed to accomplish it. IsP embodies the spirit of the President's Exploration Vision by exploring the limits of the solar system and galactic medium beyond.

#### 6) *Continued Support for Solar Probe*

SECAS reiterates its previous support for a Solar Probe mission. Solar Probe will provide the first opportunity to explore the region of space very near the Sun (to 0.02 AU), including studies of magnetic fields, coronal heating, and particle acceleration at the Sun. SECAS recommends that this mission be funded and implemented at the earliest possible opportunity. Solar Probe is clearly strongly aligned with the objective to explore the solar system outlined in the President's vision for space exploration. The strategic importance of this mission is underscored by the high rating given to Solar Probe in the most recent NAS Decadal Survey. In addition, the understanding of solar energetic particle acceleration obtained from this mission will be important for future manned missions by providing insight into one of the hazards faced by humans in space.

## Summary of SECAS Findings

### 1) *SEC and the Presidential Vision for Exploration*

**Issue:** Based on the President's proposed FY05 budget allocations, SECAS is concerned about the future of the SEC science enterprise.

**Background:** A vital program of scientific exploration is needed both to support human exploration and to advance our knowledge of space and the fundamental processes that operate throughout the solar system and beyond. The business of the SEC theme is exactly such exploration, but the President's FY05 budget request includes large reductions in the planned funding for the Solar Terrestrial Probes line, the Explorer line, the Sounding Rocket and Research and Analysis programs, and Mission Operations. We believe that this budget will lead to shortfalls in scientific progress, lack of synergy between the program elements, missed opportunities, and deterioration of the research base.

**Subcommittee recommendation:** SECAS urges NASA and SEC to firmly maintain NASA's longstanding commitment to understand the space environment by supporting a robust SEC program, including in particular the foundational STP line. Therefore, we recommend that budget priorities be reexamined and that the essential STP line be restored to its carefully planned and integrated schedule.

### 2) *Operating Missions: A Distributed SEC Observatory*

**Issue:** Budgetary impacts to the MO&DA, Supporting Research and Technology, and Guest Investigator programs threaten to result in the loss of significant key elements of the unique flotilla of existing satellites at a time of increasing need to understand the effects of solar variability throughout the solar system.

**Background:** The fourteen currently operating satellites of the Sun-Earth Connection Division span the solar system from the near-solar interplanetary medium to the edge of the Heliosphere, and near Earth from the top of the atmosphere to the top of GeoSpace. This fleet of spacecraft is unprecedented in the quality and breadth of data being gathered, returned, and analyzed, enabling for the first time the pursuit of a complete picture of the sun and its relationship to the planetary system. The scientific value of the fleet cannot be overemphasized. Once lost these capabilities cannot be re-established without significant expenditures. Every possible effort must be made to exploit the nation's investment in these assets for continued exploration of the sun's influence throughout the solar system.

**Subcommittee recommendation:** SECAS urges SEC to consider innovative ways to sustain this irreplaceable portfolio of extended missions and the science activities that utilize their observations. If NASA deems it necessary, we also support an early Senior Review to reorder priorities to make most effective use of this coordinated capability.

### 3) *Restoring a Healthy Sounding Rocket Program*

**Issue:** The President's proposed FY05 budget freezes the sounding rocket operations budget at roughly the current level for five years, bringing negative long-term consequences for space science in terms of scientific achievement, instrument development, and training of scientists and engineers required for future space exploration.

**Background:** The sub-orbital program provides an essential mechanism for cutting-edge science, the only access to certain regions of space, the fastest access to space, and an irreplaceable opportunity for training space scientists and developing and testing instrumentation. For more than a decade, the sounding rocket operations and science budgets have been inadequate. The recent National Academy of Sciences decadal survey recognized the value of this program to the nation and recommended increasing the funding level to bring the program back to health. However, the recently proposed FY05 budget would make this dire situation even worse, forcing a choice between falling behind in technology and inventory or halving the flight rate.

**Subcommittee recommendation:** SECAS has on several occasions expressed its support for a strong sounding rocket program and now urges that the funding for this essential infrastructure and science program be restored to the previously planned levels. In addition, SECAS supports the ongoing activity of a task force to chart the future direction of the sounding rocket program, including consultations with stakeholders to identify needed developments and the most productive path for the future.

### 4) *Explorer AO for Missions of Opportunity*

**Issue:** The major reduction in funding for the Explorer line in the proposed FY05 budget will translate into a significant delay in the development of future Explorer missions. Some near-term science return could be recovered by issuance of an Explorer AO soliciting only Missions of Opportunity.

**Background:** Explorer missions are meant to provide frequent and rapid access to space for investigations to address compelling science questions. In the face of major proposed cuts to the Explorer budget, the release of an Explorer Announcement of Opportunity (AO) that solicits only Missions of Opportunity (MOs) would potentially allow the recovery of some near-term science returns without making a large impact on the Explorer budget or out-year flight cadence. It also would provide impetus to the science community to keep considering new ideas in the upcoming period of limited opportunities.

**Subcommittee recommendation:** SECAS endorses the idea of releasing as soon as possible an Explorer Announcement of Opportunity (AO) that solicits only Missions of Opportunity (MOs). Furthermore, the committee expresses its desire that proposals tendered in response to this special opportunity be evaluated against the same quality standards already established for Explorer MOs.



5) *Future Prometheus Missions*

**Issue:** There is continued SEC interest in the Prometheus program and mission concepts enabled by it.

**Background:** SECAS heard presentations of the Prometheus Project and Solar System Exploration Program by Ray Taylor and Orlando Figueroa, and we greatly appreciate additional SEC representation on the Prometheus MOWG, as suggested in our previous letter (Nov 11, 2003). We were pleased to hear of plans for an upcoming workshop to consider candidate Prometheus missions to follow the Jupiter Icy Moons Orbiter (JIMO). Such a workshop begins a prioritization process that must engage all relevant divisions in the Office of Space Science. One mission that we particularly hope will receive attention is Interstellar Probe (ISP).

**Subcommittee recommendation:** We continue to be supportive of the Prometheus Project, and we applaud plans for a post-JIMO mission candidate workshop, where we urge consideration be given to the merits of the Interstellar Probe mission.

6) *Continued Support for Solar Probe*

**Issue:** SECAS strongly endorses the Solar Probe mission to explore the Sun. This mission is well-aligned with the President's goal of solar system exploration.

**Background:** Planning for the Solar Probe mission has been ongoing for more than 20 years. Despite the compelling nature of studying the central object of the solar system, funding for a flight opportunity has not been found. The basic science is important for our understanding of processes at the Sun and in the solar system, some of which lead to hazards for humans in space.

**Subcommittee recommendation:** SECAS recommends that the Solar Probe mission be funded at the earliest possible opportunity.

**APPENDIX E**  
**LIST OF PRESENTATION MATERIAL<sup>1</sup>**

- 1) Space Science and the President's Renewed Spirit of Discovery
- 2) Solar System Exploration, Orlando Figueroa
- 3) Options for Future Explorer Program, Paul Hertz
- 4) Sounding Rocket Operation, Mary Mellott
- 5) Project Prometheus/Jupiter Icy Moons Orbiter, Ray Taylor
- 6) SEC MODA Program, Chuck Holmes
- 7) Report of the Geospace Management Operations Working Group to the Sun-Earth Connection Advisory Subcommittee, J. Clemmons
- 8) SECAS Findings from November 11, 2003
- 9) Space Science Enterprise Flight Program Review
- 10) Strategic Planning, Marc Allen
- 11) Solar Orbiter, Richard Marsden
- 12) Roadmap Mission Status Update, Neil Murphy
- 13) Roadmap Lessons Learned, Stephen Fuselier
- 14) Magnetospheric Constellation: A Stereo Class STP Mission, W.K. Peterson
- 15) Living With a Star Program, Madhulika Guhathakurta

Other

Should a Mission of Opportunity Only AO be Released this Year?

Budget figures for SEC

LWS Science Definition Team Report. CD

LWS: New Opportunities in Sun-Climate Research, Report of the LWS Sun Climate Task Group. CD and spiral bound report.

Operations Lessons Learned. White paper on operations lessons learned at Goddard on impact of space weather event.

Vision Mission Selections, Marc Allen

Statement by Lennard A. Fisk to the House Science Committee Hearing: "Perspectives on the President's Vision for Space Exploration" from a recent NRC workshop on National Space Policy.

LWS Geospace Mission Definition Team response to the 12 December, 2003 update on Geospace investigations to Dr. Barbara Giles.

The natural thermostat of nitric oxide emission at 5.3  $\mu$ m in the thermosphere observed during the solar storms of April 2002, *Geophysical Research Letters*, Vol. 30, No. 21, 2100, 2003. Marty Mlynyczak, et. al. White paper.

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<sup>1</sup> Presentation and other materials distributed at the meeting are on file at NASA Headquarters, Code S, Washington, D.C. 20546.