

# SOUTHWEST RESEARCH INSTITUTE™

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## SUN-EARTH CONNECTION ADVISORY SUBCOMMITTEE

30 July 2002

Dr. Richard Fisher, Director  
NASA Headquarters  
Sun-Earth Connections Division  
Code SS, Office of Space Science  
Washington, DC 20546-0001

RE: SECAS Meeting, 16-18 July 2002

Dear Dick,

The Sun-Earth Connection Advisory Subcommittee was happy to meet and review the state of the SEC Division and theme from 16-18 July 2002. We were delighted to find that SEC continues to be healthy as it aggressively pursues a broad-based range of research and flight programs aimed at understanding space physics phenomena from the interior of the Sun to beyond the outer reaches of the heliosphere. Living with a Star (LWS) continues to develop into a robust program, which extends our basic research efforts to form a more complete and holistic understanding of the Sun-Earth connection system and its real-world implications for effects on life and society.

In keeping with our previous reports, this letter will focus only on the top few issues that need special or urgent attention. We hope that this format of highlighting the most crucial areas that come out of each meeting will spotlight their urgency and help you focus your limited resources on these most critical issues.

### L1 CONSTELLATION

SECAS notes that there is significant current scientific interest in employing existing spacecraft as a cluster for multispacecraft studies near 1 AU. Multiple spacecraft near L1 would enable multi-point investigations of turbulence, discontinuities, shocks, CMEs and large scale solar wind shear. These observations would enable significant new basic science and address the important issues of the geoeffectiveness and predictability of various solar wind structures and phenomena. There is strong community interest in these goals, as has been noted to SECAS by



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the Roadmap Committee. At present what is envisioned is to employ instruments from ACE, SOHO, Genesis and WIND to create this ad hoc multispacecraft "mission of opportunity." This would involve redeployment of some missions, tracking coordination, cooperation of various PI groups, and planning and integration of the data acquisition. Therefore additional support and authorization for these purposes is required. SECAS believes that this may be feasible for an additional cost that is modest measured in comparison to the substantial and valuable datasets that would be obtained. This opportunity could be implemented efficiently in the very near term and may become less practical as time passes. Therefore SECAS requests and advises that the feasibility of this L1-multispacecraft project be investigated immediately.

## **ILWS AND INTERNATIONAL COLLABORATION**

The SECAS was happy to see that a truly International Living With a Star (ILWS) program is beginning to emerge, in keeping with our previous recommendations. Such efforts should bring significant added value to the program by allowing a broader set of ideas, international scientists, and the support from various national and international space programs to bear on the goals of LWS. We encourage the continued evolution of this process to include international partnering both by developing a funding mechanism for supporting US investigators on appropriate international missions and by welcoming foreign participation on and contributions to US-led LWS missions. Such collaborations should include shared mission development, shared roles and responsibilities, and shared planning and analysis of the observations. We note that LWS is a system and needs to be understood through a systems approach. Thus, international partnering should be inclusive of inputs and perspectives from all partners, however contributions should not be treated simply as a windfall for whatever area or mission some partner chooses to contribute on, but rather as support for the overall program with appropriate redirection of US funding to the bolster the portions of the program which most need the additional support. NASA should invite its international partners to participate in the whole program, and thereby help to optimize the whole system.

## **TECHNOLOGY DEVELOPMENT FOR MULTI-SPACECRAFT MISSIONS**

The Sun-Earth Connections community has identified numerous future science missions that call for a few to as many as 100 satellites. Implementation of these missions, in many cases, will require technologies that, to date, have not been fully developed. Examples include: multisatellite packaging, in-orbit dispensing, formation control, etc.. However, SECAS is quite concerned that, despite important technological gains that will come with the NMP ST-5 mission, there does not seem to be a path for developing the additional technologies necessary to implement these future satellite missions. While mechanisms finally exist to advance instrument technologies for such missions, there is a need for a mechanism for making technological gains in multi-spacecraft-related technologies as well. The SECAS recommends that a mechanism be found to more aggressively pursue technology development for multi-spacecraft missions.



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## **NASA/NSF COLLABORATION**

The SECAS was interested to hear that there may be high level interest in areas where NASA and NSF effectively collaborate on issues and projects of mutual interest, each bringing their own needs and their own funding to the table in order to accomplish significantly more than either organizations could on its own. The Sun Earth connection area is rife with such examples and we are delighted to share a few of them here.

Simultaneous ground-based (GB) and space-based (SB) measurements significantly enhance investigation of the ITM (Ionosphere-Thermosphere-Mesosphere) system. For instance, SB measurements usually sample atmospheric properties over the globe while precessing slowly through local time. For temporally evolving phenomena, smearing occurs and much physics is lost. However, by assimilating together GB measurements at high temporal resolution distributed around the globe, temporally-evolving structures can be recovered. In addition, clusters of GB instruments investigate localized structures and processes at high time resolution, utilizing SB measurements to delineate the larger- and longer-scale contexts. These are the types of activities ongoing within the NASA TIMED (Thermosphere – Ionosphere – Mesosphere Energetics and Dynamics) Mission and NSF CEDAR (Coupling, Energetics and Dynamics of Atmospheric Regions) Program to elucidate such phenomena as global wave structures; small-scale waves and instabilities; wave-wave interactions; Joule heating; and coupling between chemical processes, dynamics, and electrodynamics at all scales.

Solar physics is another area that has benefited greatly through the years from a close coordination of synergistic activities supported by NASA and NSF. Among them are the magnetogram observations from NSF facilities that have proved crucial to maximizing the scientific return from a number of NASA missions. Similar success stories can be expected in the future. In particular, NASA's Solar Dynamics Observatory (SDO) will combine with NSF's Advanced Technology Solar Telescope (ATST) and Frequency Agile Solar Radiotelescope (FASR) to study how magnetic fields at and below the solar surface produce heating and activity in the corona above. Here, as in all cases, the NASA and NSF observations are complementary rather than duplicative. NASA missions make the measurements that require a space platform, while NSF facilities make the measurements that can be done more cost effectively from the ground.

## **LOW COST ACCESS TO SPACE**

Amongst all of the technological, political and financial issues to be overcome in carrying out an effective and efficient Sun Earth Connection program, perhaps the greatest is the lack of low cost launch capability available and permissible for use on NASA missions. Probably more so than any of the other Space Science disciplines, SEC depends for much of its strategic mission on regular, reliable, low-cost access to space on small launch vehicles and as secondary payloads on other larger launches. While we certainly understand that there is a desire among some to protect US suppliers against competition from overseas companies and institutions, it is not clear what is to be gained by protecting a market that is so small. The SECAS urges NASA to begin working immediately on finding innovative ways to mitigate this critical and urgent problem.



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On behalf of the entire Sun Earth connection community, we wish to note the outstanding service that Jim Spann and Jim Sharber have provided over the past several years as they have served as IPAs at NASA headquarters. Finally, we congratulate Mary Mellott and Bill Wagner for winning Exceptional Service Medals and echo the thanks and appreciation of the entire SEC community for their years of tireless service. As usual, we thank you and your staff for an excellent meeting and for allowing us the opportunity to provide a community perspective and advice for your consideration.

Sincerely yours,

David J. McComas, Chairman  
Sun-Earth Connections Advisory Subcommittee



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