Chapter 9

Recommendations for the Future

The Solar-Terrestrial Sciences Workshop has explored four major areas of concern to solar-terrestrial science:

1. The current level of understanding which will be gained from execution of NASA's current program of space and ground-based measurements
2. The major scientific questions facing solar-terrestrial science in the next decade
3. The identification and evaluation of the space capabilities available for undertaking new investigative programs
4. The development of strategy for identifying and implementing keystone programs, taking into account practical constraints and other factors.

Looking across the discipline reports given previously, it is possible to find common threads that can contribute to the development of NASA's programmatic strategy for the solar-terrestrial sciences. These are outlined in the following paragraphs.

9.1 Scientific Balance

We strongly recommend to NASA that progress in solar-terrestrial science must be seen and implemented in terms of the achievement of scientific goals rather than simply in the establishment of new space missions. While there is an important need to gather new information from space using new and improved sensors, platforms, and orbits, the measurement programs themselves must be undertaken within the context of a larger, balanced scientific undertaking. Theory, simulation, analysis of previously gathered data, and adequate analysis of new data must all be viewed in a harmonious balance. As any one phase of this balance is altered, so the overall science program is affected.

In the past, solar-terrestrial programs have focused on well-conceived flight programs. Unfortunately, as mission costs have risen, funds available for pre- and post-flight scientific analyses have been reduced, co-investigator participation has been reduced or eliminated, and instruments and spacecraft have been lost. This process leads to an inevitable fragmentation of the originally planned science objectives and organization. In these cases, some means must be found to absorb the changes while assuring the best possible science output measured in terms of the complete scientific program, not just the viability of the spacecraft portion of the undertaking.

9.2 The Value of Previously Gathered Information

We strongly recommend that in the next decade efforts must be made to integrate previously gathered scientific information into solar-terrestrial science studies. This workshop, composed largely of individuals who have participated in space experiments and observations, strongly recommends the concept of "missions to data." There is a virtually unanimous opinion that NASA's emphasis upon new missions, and inability to adequately fund long-term data analysis, retards the development of solar-terrestrial science. Older data, when interpreted in terms of new models and simulations, has the potential to provide new insights and knowledge important to all solar-terrestrial disciplines.

9.3 Imaging

We strongly recommend that steps be taken to advance capabilities and opportunities to view solar-terrestrial phenomena as two-dimensional images in many different wavelength bands. The capabilities for this have evolved to the point where most disciplines feel important, new scientific information can result from new missions using these type of detectors. Sun- and Earth-looking platforms can begin to assess phenomena in terms of global scale effects and relationships.

9.4 The Impact of Space Stations and Related Platforms

We recommend that the Space Physics Division take advantage of the opportunities for solar-terrestrial science associated with use of space stations, the space shuttle, and other vehicles which are related to the presence of humans in space. Depending upon different factors, each discipline sees these platforms in different ways. Those disciplines using active experiments find value to the presently conceived US/International Space Station in terms of its availability of energy, high peak power, commodious externally attached payload space, and the opportunity to have occasional human presence. However, the limitations of the space station orbit, the restrictions of field of view, and the possible presence of a deleterious environment are of concern to others, and especially those who use sensitive telescopes and other detectors.

We also recommend that the Space Physics Division pursue the use of potential resources offered by astronaut-tended space platforms, including both pressurized modules and open, unpressurized vehicles. In some cases, such platforms are to be preferred over the more dynamic accommodations associated with the space station. The attractive features include the possibility of semiannual visits, a capability for instrument/detector exchange and repair, and the absence of the inevitable outgassing associated with permanent human presence.

For many active experiments the space shuttle is still regarded as an important means to implement solar-terrestrial scientific studies. However, it is clear that there are many negative aspects to using the shuttle as a scientific platform. Many of these lie in the difficulties of dealing with the NSTS system and its stringent requirements for safety and mission planning rather than with shuttle performance on-orbit. We recommend that planning begin again for use of the shuttle when it becomes available for solar-terrestrial scientific research.

9.5 Vitality and Relevance

The results of this workshop demonstrate that solar-terrestrial science has lost none of its vigor or relevancy: Maturity has brought appreciation of the need for the fundamental information provided by study of the sun-earth system. Earth and its relationship to the space environment must remain as an important part of scientific study for the decades yet to come.

9.6 Future Studies

The present study has touched upon many different complex issues. It is recommended that further, in-depth studies follow soon. Each discipline has developed its own new ideas about what can be done in the decades ahead, and these deserve greater exposure to the solar-terrestrial scientific community. We recommend that this report be given wide distribution to solar-terrestrial scientists and that it be used as a means for sparking ideas and plans for future steps to be taken by NASA in pursuit of its mission to explore and understand the solar-terrestrial system.