Appendix B. Reconciling the Roadmap and Decadal Survey Approaches & Results

Recognizing that a 'business as usual' approach was not likely to be effective, this Roadmap has taken a different approach to prioritizing the SSSC strategy. Beginning with the NASA strategic objective assigned to the new Sun-Solar System Connection division, the Roadmap Committees performed a complete requirements-driven derivation of a program to meet the nation's needs. The committee was supplied by the reports developed by the NRC, including the Decadal Survey and the update to that survey. The committee was also informed by community input in form of formal reports, white papers, through a community workshop, and through personal contacts.

The three top SSSC objectives were broken down into research focus areas that support the achievement of the top-level goal. The focus areas in turn led to two somewhat independent, more detailed breakdowns of effort – investigations and targeted outcomes. This contrasts with past efforts that have been constructed essentially from the bottom up based primarily on scientific priorities and opportunities as well as the perceived needs of the users of SSSC science.

The investigations present the more familiar scientific approach to organizing the efforts, one that lays out a logical progression toward addressing the broad topics outlined in the research focus areas. The investigations are enumerated in Part II Chapter 1 with the descriptions of the research focus areas for each objective. With each investigation it was relatively straightforward to identify missions and supporting elements of the program required to made real progress. Setting priorities was more difficult.

The targeted outcomes provide an alternate basis for constructing a program; one that the Roadmap Committees found helpful for assigning priority to various components of the program. We identified for each research focus area the achievements that should be completed during each of the next three decades. The achievements are shown in Part II Chapter 2. Each achievement resulted in a flow-down chart listing first the required understanding, then the enabling capabilities and measurements, and finally the implementation linked to missions and other supporting program elements. One sample chart is shown in the accompanying figure.

The timing of the achievements was driven first of all by what is required to support the new Vision for Space Exploration with which NASA has been tasked. With an ambitious, though not fully developed, schedule for returning humans to the Moon for an extended period followed by human mission to Mars, certain information is critical for defining and designing a safe and productive exploration program. SSSC science contributes crucial information to inform and enable that phased effort and we have ordered our programs to provide the necessary information at the appropriate time. Of course exploration is more than human spaceflight and the program emphasizes robotic exploration in pursuit of transformational knowledge as well.

Second, the scientific development of the program requires a logical progression of discovery, understanding and prediction. While these go hand-in-hand and different parts of the program are in different stages, this criterion is similar to the drivers used to formulate our strategic plans in the past. The difference this time is that the scheduling is driven by more than just the simple desire to pick the questions that show the most promise for progress. This time we were looking for progress in particular areas.

Our final criterion was to define a program that is possible to achieve – both technically and financially. This was a real challenge with the reduced funding available in both the Explorer and STP programs.

Many important topics are deferred, put aside, or left for implementation in the Explorer program. The optimized plan restores many synergies lost in the realistic plan.

How did the resulting program compare to earlier recommendations provided in the decadal survey and previous SEC Roadmaps and NASA Enterprise Strategy?

The NRC and roadmap committees ended up in remarkably similar places. The science and exploration objectives, the research focus areas, investigations, and achievements match very well. There is a somewhat broader scope in this road map because of the connections with Earth science, the new emphasis on the journey of exploration, and the longer time period considered. The missions proposed include all the top priorities of the 2002 NRC Report *The Sun to the Earth - and Beyond* for NASA. Together with the completion of STEREO, Solar-B, and SDO and the continued operation of the SSSC Great Observatory, these include Solar Probe, MMS, RBSP & ITSP, JPO/Juno, IHSentinels, GEC, LCAS, MMS, L1/Heliostorm, GEMINI, L1 Monitor, Solar Orbiter, Explorers, and all of the relevant recommendations for vitality as well. (A few mission names have changed). Table B2 gives a detailed comparison between the 2002 Decadal Survey Science Challenges and the Research Focus Areas described in Part II, Chapter 1.

How can this be? 1) The basic science needed to predict conditions for safe and productive exploration is the same understanding required to handle the affects of the space environment on society. The requirements for the outward journey have been largely anticipated by LWS. 2) The strategy laid out in the past was robust, in the sense that the long-term objectives transcend most immediate changes in emphasis. Understanding of the entire system was crucial and remains crucial. The science questions and the order in which they must be addressed remain the same in order to open the frontier to space weather prediction. The STP missions fly at a slower rate, but the basic science they will provide serves the most important needs of the NASA vision. 3) With reduced resources the missions already initiated will take the remainder of the decade to complete. In our realistic scenario no mission will launch before 2015 that has not already begun and this time frame goes beyond the end of the decadal survey. Because these missions support the vision, the program looks very much the same in the near term as it did three years ago.

There are some important changes to the intermediate and long term program. The importance of the inner heliosphere through which disturbances propagate has increased. New missions to understand energetic particles have been identified and we have recommended increased collaboration with Earth science colleagues to understand the terrestrial radiation budget. There is also increased emphasis on the contributions our discipline can make to understanding the Martian atmosphere and the role space weather effects have on planetary habitability. Decision points have been set where choices need to be made about the direction of the program based on evolving priorities and what is learned in the mean time. As in previous Roadmaps, a suite of unfunded flagship and partnership missions has been identified to address problems that cannot be handled in the existing mission lines; however, some of the partnership missions have changed. The importance of L1 observations has increased. And, unfortunately, many of the intermediate term missions from the last Roadmap have been pushed farther into the future.