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SENSOR TECHNOLOGY WORKSHOP: STRUCTURE AND GOALS

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The Sensor Technology Workshop was held in Pasadena, CA, on January 23 - 25, 1991, as the second in a series of Integrated Technology workshops of the Astrotech 21 planning workshops. The charter of this workshop was to identify technology needs of the Astrotech 21 mission set in the area of electromagnetic radiation sensors, and to recommend a plan to develop the required capabilities that are not currently available. To this end, a set of panels was selected, and a two-day meeting was convened in Pasadena. Sensor requirements spanning the entire electromagnetic spectrum were addresses by four panels, with responsibility for gamma-ray and X-ray sensors, ultraviolet and visible sensors, direct infrared sensors, and heterodyne submillimeter-wave sensors, respectively. Because of the close relationship of readout electronics and cooler technology to the sensors themselves, it was decided to include these topics explicitly in the workshop, and two additional panels were convened to cover these areas. The panel chairs and participants are listed in Appendix A.

Prior to their arrival at the meeting, panel members received a briefing package prepared by the workshop chair which contained information on the Astrotech 21 mission set and science goals, and draft listings of (i) the sensor requirements not met by current technology and (ii) the relevant technologies offering promise in providing these capabilities in the future. Starting from this material, and from the results of any previous studies with similar focus, the panel chairs compiled straw man versions of their panels' reports to provide a framework for discussion at the workshop. The first (half) day of the meeting consisted of a review of the Astrotech 21 program, followed by presentations of the materials prepared by the panel chairs. During the second (full) day, the panels split into separate sessions to carry out their assignments. To ensure coordination of the reports from the sensor panels with those of the panels covering associated technologies, the Sensor Readout Electronics and Sensor Cooler Technology Panels sent representatives to each of the sensor panels for part of the first morning to carry on joint discussions. The Readout and Cooler Panels then reassembled for the remainder of their discussions. Following the day of splinter sessions, the chairs prepared a summary of their panels' findings and presented it at a plenary session during the final (half) day. The final reports prepared by the panel chairs following the workshop appear as the body of this proceedings.

The panel reports first describe the sensor capabilities desired for future astrophysics missions, and the performance specifically required to achieve the science goals of the Astrotech 21 mission set. Current state-of-the-art capabilities are then examined in this context, in order to determine the sensor areas in which advances are required, and the relative importance of the desired capabilities to the mission goals. To provide an understanding of the advancements and rate of progress of sensor capabilities in each area, comparison tables are provided highlighting sensor specifications for representative past and future missions, including missions from the Astrotech 21 set, and a snapshot of current state-of-the-art technology, represented by capabilities which have been recently demonstrated in the laboratory. The reports go on to discuss approaches which offer promise in eventually overcoming remaining shortcomings in sensor capabilities vis-a-vis the Astrotech 21 mission requirements, if further development is supported.

Finally, within the context of the Astrotech 21 mission needs, the history of sensor technology development in that wavelength regime, and the analysis of emerging technologies, the reports recommend to NASA a set of specific development plans to achieve the capabilities desired to meet the challenges of the Astrotech 21 science goals. Recommended dates and scope of effort are defined for each development program. To ensure uniformity of terminology among the recommendations generated by the six different panels, a consistent definition of program scope was identified at the workshop. It was decided that the most uniformly defined parameter is the number of lead technical personnel involved in a particular effort, rather than the financial resources required, which may vary considerably depending on the institution overhead, salary scales, etc. However, some allowance was made if significant build up of capital equipment was deemed necessary. The three defined ranges are (i) small - 1 - 3 lead personnel plus a comparably sized support staff, (ii) moderate - 3 - 10 lead personnel plus support staff, and (iii) large - 10 - 30 lead personnel plus support staff, possibly with additional significant equipment or facilities expenses. Even with these consistent scope definitions, some variations among the panels' interpretations of these definitions undoubtedly still remain.

It is important to keep in mind that the panels' charter was specifically to focus on those technologies and sensor capabilities relevant to the Astrotech 21 mission set. Thus the deliberations and reports exclude any consideration of other technologies, regardless of how important they may be to other classes of missions, such as Eos or planetary exploration. They also exclude technologies which may be of value to future astrophysics missions, but are not expected to be ready in time to benefit the particular mission set highlighted here. These restrictions naturally result in an arbitrary (and probably unrealistic) ramping down of the development plans as the relevant technology freeze dates of the Astrotech 21 mission set are approached. In fact, as time goes on, more distant missions, undoubtedly with even more demanding sensor specifications, will be defined, requiring continued sensor development beyond the limited scope considered here. Similarly, missions among the Astrotech 21 set, for which the panels found no evidence of sensor performance needs beyond current capabilities, are not discussed in the reports. These include the gravity and relativity missions, GP-B, GRACE and LAGOS, and the SOFIA mission, whose role at the time of the workshop was viewed primarily as a stratospheric testbed for new technologies being developed for other missions.

The Astrotech 21 mission set is part of an evolving plan, and consequently mission definitions, priorities, and requirements have continued to change during the period in which this Proceedings was being prepared. As much as possible, references to these missions have been updated to reflect the status as of July 1991, when the completed document was submitted for printing.

Because the names of the NASA missions and instruments appear repeatedly in this proceedings, in most cases the acronym is used, and to save space, definitions are provided only in Appendix B at the end of the report. Other acronyms utilized in the Proceedings are generally defined at their first use in each report, and are also included in Appendix B. Note that the use of Roman numerals II or III following a mission acronym is used to refer to refurbishments of the original mission equipment.

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