Working Together for Solar Science
L. Acton
29 June 2016

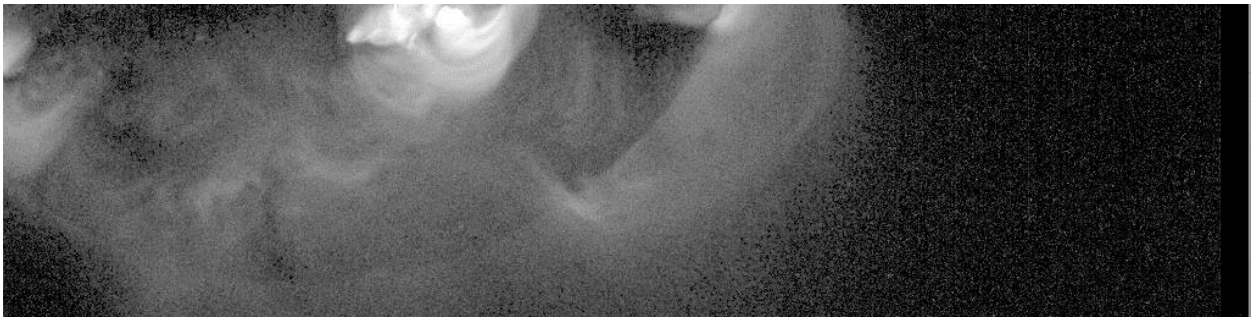
After flying as a Payload Specialist on the SPACELAB 2 mission in 1985 I was faced with a decision, "What shall I do next, career wise?" There are many opportunities offered after one has flown in space. This question was clearly answered shortly after our mission was over when NASA published an announcement of opportunity to fly a soft x-ray telescope on Japan's High Energy Solar Physics (HESP) mission. This was precisely the solar experiment of my dreams! The opportunity to do such an investigation with Japanese colleagues made it even more appealing because of my long friendships with M. Oda and K. Tanaka.

A U.S. proposal team was quickly formed combining theory (P. Sturrock), ground based observations (R. Canfield), solar particle expertise (S. Kane), and strong talents in instrument development (M. Bruner). The good news of our selection arrived in 1986 and we immediately undertook a very busy schedule to meet the 1991 launch date – after learning that ISAS very seldom slipped a launch schedule. T. Hirayama was the Japanese principal investigator on the Soft X-ray Telescope (SXT). I was called the U.S. PI to NASA. The early HESP meetings under the leadership of Y. Ogawara, to define all details of mission and hardware configuration, were extremely productive and interesting. I quickly learned that the J-side and U-side handled such discussions slightly differently. The U-side tended to make decisions fairly quickly but often needed to alter these decisions as the project moved ahead. My J-side colleagues made important decisions somewhat less quickly – but very seldom had to change these decisions later on. The real hard work on the program was accomplished by the young Japanese scientists T. Kosugi, S. Tsuneta, and T. Watanabe while the NASA Project manager, J. Owens, was tremendously helpful in many ways.

The launch of HESP on 30 August 1991 was the culmination of one of the finest, best run, space projects I've ever experienced. We produced a minimum of useless paper but the crucial interface agreements and documents were kept up to date. Minimal problems were encountered when integrating the SXT into the spacecraft.

On launch day tension was high at Kagoshima Space Center – replaced by joy and celebration with the news that HESP was alive, stable, and in an almost perfect orbit. Shortly thereafter E. Hiei approached me with the information that the mission was now to be renamed *YOHKOH* and a question, "How do you think the word should be spelled with rōmanji characters?" So, if you do not like the spelling, blame it on me.

The next big tension was whether the SXT would deliver a good x-ray image of the corona. At last, on 3 September 1991 this SXT thin-aluminum-filter image was downloaded and reformatted.



The picture itself is not great because the CCD was warm, the background was high, and *YOHKOH* wasn't perfectly pointed--but we knew at this point that the SXT was performing as we'd built it to do. Great was the joy of Ogawara sensei and within the SXT team!

In 1991 the internet was not very reliable nor was ISAS set up for remote operation of space instruments. Thus, the SXT U-side team rented apartments in Fuchinobe and became full partners in the scientific operation of *YOHKOH* at ISAS. It was unbelievably exciting to watch the data come in and see, in x-ray movie mode, the tremendous dynamism of the x-ray corona and flares. The combination of *YOHKOH* instruments accomplished just what we had hoped to illuminate the high energy processes of solar activity. Before the end of 1991 the importance of magnetic reconnection in flares had been proven and new active-sun phenomena, e.g., x-ray jets, had been discovered.

The scientific operation of *YOHKOH* was collegial in a way that may not be so much the case with similar contemporary missions. Essentially all of the initial data review and research was carried out at the ISAS experimenters operating facility in one room. Regular scientific and planning meetings were held with strong participation of the *YOHKOH* team and visitors. Over its decade of scientific operation the *YOHKOH* mission provided a remarkable scientific return as evidenced by the more than 1500 papers published referencing the mission and its data.

Level 0 *YOHKOH* data are archived at several sites. The *YOHKOH* Legacy archive at http://solar.physics.montana.edu/ylegacy/ has been created (mostly by A. Takeda) over the decade and a half since the end of YOHKOH operation in December 2001. This archive provides levels 0-3 SXT data, extensive data catalogs from the other *YOHKOH* instruments, a thorough description of the SXT data and file structure, convenient browse and data search capabilities, movie making capability, and very extensive documentation of scientific day-to-day operations at ISAS as well as much detailed technical information on the SXT. Finally, I've just this year published a long paper in Solar Physics about the on-orbit performance and calibration of the SXT.