NASA's Deep Impact Mission: Decision Making

John Marriott

APPENDIX D: INTERVIEW SHEET

Question: Please tell us about your involvement with the Deep Impact mission and your thoughts about optimizing the data being received during the impact of Comet 9P/Tempel 1 in July of 2005.

Interview of: John Marriott
Job Title: Ball Aerospace, Deep Impact Program Manager
Institution: Ball Aerospace
Interviewer: John Ristvey
Date: July 5, 2001
Conducted by phone at Ball Aerospace in Boulder, Colorado

John Marriott
Ball Aerospace, Deep Impact, Program Manager

Ball Aerospace is responsible for the design and building of the Deep Impact flyby spacecraft, the impactor spacecraft and three science instruments: a high-resolution imager; a medium- resolution imager; and the impact target sensor. The first two of these instruments are onboard the flyby spacecraft, and the last one is part of the impactor. As program manager, I oversee the development of this hardware and work with the Jet Propulsion Laboratory (JPL) and the University of Maryland to develop the mission operations and critical sequences of the Deep Impact mission.

The Deep Impact mission is the most exciting thing I have done in my career simply because of the sheer size of it, and the fact that it is a deep space mission. I have been interested in a career in aerospace ever since I was in high school. This inspired me to go to college, get my education and learn while working in different engineering jobs at Ball. I have been able to work my way up the ranks to become a program manager. I have personally been involved in building an instrument for the NASA/ESA Solar and Heliospheric Observatory (SOHO) spacecraft. I have most recently been involved with the Space InfraRed Telescope Facility (SIRTF), involving an infrared spectrograph for Cornell University. The most exciting part of working on a deep space mission is working with the principal investigators who are responsible for dreaming up these missions. My team and I try to help implement their dreams by developing spacecraft and instrumentation that meet their needs. Through this, we get caught up in the excitement.

Ball Aerospace is responsible for three science instruments for the Deep Impact mission. The high-resolution imager and the medium-resolution imager will view the formation of the crater and take data on the chemical and physical composition of the comet to establish a model for Comet 9P/Tempel 1. On Deep Impact, all three instruments are crucial to achieving these science goals.

The high-resolution imager includes two channels. There is a visual channel that will allow us to get visible data (pictures), and an infrared spectrograph channel. This allows us to look at the visible and infrared spectra simultaneously, compile the data and store it redundantly in the spacecraft control unit. We can command the spacecraft to either transmit the data to the ground in near real-time as the data are being taken, or we can command it out of memory to the ground through the Deep Space Network.

The medium-resolution imager is a visible light instrument that gives us a more wide-angle approach and allows us to get data through a nine position colored filter wheel. The principal investigator and the science team choose the different wavelengths of each one of the different filters. Then the command sequence commands the filter wheel to put a particular filter in position from which the visual image is taken.

The impact target sensor is optically similar to the medium-resolution imager. The instrument that is looking at the comet and sending the data to the control system so the flight of the impactor spacecraft is controlled as it approaches the comet. This instrument is located on the impactor spacecraft and will be honing in on the bright area of the comet. The target sensor will collect data from the comet right up until the time of impact giving the science team a very close-up view of Comet 9P/Tempel 1, at which time the fly-by spacecraft will monitor the activity as the impactor hits the comet.

Another goal of the program is to involve other spacecraft and ground-based observatories and have them also gather data of the impact. It is difficult to tell at this point which facilities will be available during impact. We are looking very closely at Hubble Space Telescope (HST), and at SIRTF, as well as the Chandra X-ray facility. We are evaluating the availability of observatories based on orbit patterns of space-based facilities, as well as the positions of several ground-based facilities to determine where the best viewing is going to be. There are a lot of people right now working on exactly what the time sequence will be for the impact of the mission. Because of my former involvement with SIRTF, I would personally love to see SIRTF and Deep Impact tied together.

The Deep Space Network (DSN) is the primary means of communication for the vast majority of these facilities. The principal investigator, along with the mission planners at JPL, are the primary architects of choosing the time of impact and which facilities will be used. We will need to work the actual mission sequences based on the current impact scenario. Since no one knows a whole lot about comets, we are going to be learning right up until launch. Other missions that are looking at comets will serve to inform our mission. This could change the impact sequence of events up until shortly before the time of launch, in which case, we would have to build a new sequence. The folks at Ball and JPL would get together and lay out exactly what the sequence needs to look like and then take this information to the software engineering group. The software group develops the new sequence, which is then tested and verified. This software is uploaded to the spacecraft through the DSN causing the spacecraft to implement this new software at a particular time. This software is very complex, particularly with a spacecraft that does its own thinking. We have to be careful to develop comprehensive test programs for this software before it is uploaded to the spacecraft.

The data collection method itself is tried and true. The only thing that is different here is that we are using the latest and greatest software computers. We are using the RAD 750, which has more capability than any computer that we have flown before. The science team met recently at Ball and was delighted with the increased memory of this computer. However, the memory of the computer will fill up very quickly, as we take more and more images. These computers are real enablers of science. The only concern I have is that, as a deep space mission, Deep Impact has a rigid launch date. The comet is not going to wait for us. We have to make our deadlines. We have a lot of work to do in a short amount of time. Everything we have to do has been done before and done many times. But, we have to be there.

For more information about Ball’s role in the Deep Impact mission visit their Web site.

http://www.ball.com/aerospace/deepimpact.html