Statement of Work

Mars Express/ASPERA-3

Post-launch Phase. Mars Express is scheduled for launch in June 2003. The spacecraft will be inserted into Mars orbit six months later. The work described will be carried out during the four-year period 1 July 2003 through 30 June 2007.

The Johns Hopkins University Applied Physics Laboratory (JHU/APL) participation in the ASPERA-3 experiment includes theoretical support, data analysis, and development of techniques for image deconvolution and interpretation. The energetic neutral atom (ENA) images will be obtained by the Neutral Particle Imager (NPI) and Neutral Particle Detector (NPD) of the ASPERA-3 experiment. JHU/APL scientists will collaborate on this task closely and directly with scientists at IRF (Swedish Institute for Space Physics, Kiruna), the PI institution. Consequently, travel to IRF is required, as well as travel to report scientific results at international meetings.

The research goal is to extract scientific information from the ENA images concerning the interaction of the solar wind with the neutral atmosphere of Mars. The general approach will follow that outlined in Section 1 of Volume I of the ASPERA-3 proposal (February 1998) selected for flight by the European Space Agency. Mathematical details will be found in Section 1.9 of Volume I of that proposal. In summary, existing mathematical models for the flow of the solar wind by Mars and the density and composition of the Martian atmosphere will be incorporated into computer simulations of the emission of ENA. Estimates of the response of the NPI and NPD to the simulated ENA emission will be calculated from pre-flight calibrations performed by IRF. Comparison between the NPI/NPD data and the simulated response of the instruments will guide the modifications and improvements in the mathematical models, thus deriving the desired scientific information describing the Mars/solar wind interaction. It is expected that the PI's planned involvement in interpreting ENA images from the upcoming NASA missions IMAGE (launch, February 2000) and TWINS (first launch, Spring 2002) will contribute to the development of the techniques that will be applied to the NPI/NPD scientific data analysis.

Deliverables will be: (a) annual technical reports; (b) scientific presentations; and (c) scientific publications.

(a) By each anniversary of the beginning of the contract, a technical report will be submitted to SwRI from JHU/APL. It will summarize scientific progress to date, list all scientific presentations within the year, and list all scientific articles submitted for publication or published within the year.
(b) During each contract year, at least one scientific presentation on the research activities of that year will be reported at an international scientific meeting with a JHU/APL author and/or co-author.

(c) During each contract year, at least one scientific article involving a JHU/APL author and/or co-author will be submitted to a scientific journal or conference proceedings.

Deliverables shall be deemed accepted upon delivery.

This schedule of scientific presentations and publications is contingent upon nominal performance of the NPI/NPD instruments and their data reduction systems. If said performance is less than nominal, there will be a corresponding slippage in the schedule of the scientific presentations and publications.

The scientific work will be carried out by JHU/APL Principal Professional Staff members Dr. Edmond C. Roelof and Dr. Donald J. Williams, both designated as ASPERA-3 Investigators in the Mars Express proposal selected by ESA. They will be assisted by other JHU/APL staff in computer programming. Dr. Roelof will serve as Principal Investigator and will be the contact at JHU/APL for technical information. Mr. Barry E. Tossman may be contacted for programmatic issues information.