MEMORANDUM

To: Mission Critical Chemistry Team Members
CC:
From: Director of Mission Critical Chemistry
Date: October 16, 2003
Re: Mission Profile

Thank you for joining the Mission Critical Chemistry Project. I think we have assembled an excellent team, and I'm looking forward to working with all of you over the next few days. In addition to creating an important new fuel technology for our Mars program, we will be establishing an important international collaboration with the Mexican firm IMP that should lead to many long-term benefits. IMP, a research subdivision of PEMEX, is the largest chemical company in Mexico.

This team's expertise in redox and thermochemisty will allow us to research the optimum combination for our next-generation fuel system. As you are well aware, NASA has a variety of powerful reductants and IMP will be providing an impressive array of oxidants. With our combined resources, we will be able to create and test a revolutionary, cost-effective fuel system that will bring us one step closer to a manned mission to Mars.

Mission Objectives

Your objective is to research and propose the parameters needed for an unmanned satellite launch to Mars. Your research will involve many intermediate states.

- **Energy Characteristics**
  You will determine the energy characteristics of the fuel needed to boost the rocket to Mars. To this end, the Physics group has prepared a Launch simulator which will help you resolve the following unknowns:
  - Energy given off by fuel reaction (in kJ/sec)
  - Loss in mass of rocket due to fuel burning (in kg/sec)
  - Total initial mass of fuel in rocket (in kg)

- **Fuel Mixture**
  Determining the proper mixture of an oxidizing and a reducing agent for the fuel needed to boost the rocket to Mars will be your most challenging step. While NASA researchers have developed a number of powerful new reductants for use as fuel, we have not yet found a complementary oxidant. Fortunately, IMP has a number of excellent candidates that we are interested in testing. *Due to the strict national security issues however, chemical samples may not change hands*. Instead, you will perform your own experiments in isolation from our international colleagues, and then subsequently work together to find the best mixture. You can, and should, discuss your approach with your other team members to coordinate your strategies.

Resources

The success of this mission is critical, consequently, we have made the following resources available for your use.

The first and foremost is the project website, located at http://ir.chem.cmu.edu/mars/. Here, you can view a summary of your status, and quickly view any documents and other relevant material pertaining to the project including the Virtual Lab and Trajectory Simulator simulation.

For a number of months, the physics group has been evaluating the peripheral issues surrounding this launch, such as the Energy Characteristics we've already discussed. You can find their report, along with a simple launch simulator on the project web site.

The chemistry group has synthesized a number of powerful reductants and performed some initial characterization. They have made these reductants available to you in the chemical laboratory simulation, and written a detailed report. Both the lab and report are available on the project web site.

Needless to say, your greatest resources will be your fellow teammates. As mentioned previously, you will be collaborating with researchers at IMP, and good working relationships with your international colleagues are therefore imperative. Our primary mode of interaction will be e-mail, so please refer to the guidelines from our Director of Communications, to avoid difficulties and awkwardness that can arise from this communication medium.

Flight Parameters

You must provide the following launch parameters:

Oxidant (choice of chemical)
Total volume in liters of Oxidant
Flow rate of oxidant (in cm^3/s)

Reductant (choice of chemical)
Total volume in liters of Reductant
Flow rate of reductant (in cm^3/s)

Each team member must agree on all parameters. If a parameter is changed, the rest of the team will need to sign off on the new parameters before the Launch Control group accepts them. This is a safety and quality-assurance measure, as required by NASA directive NASA-067-21B83.

You can submit results, at the end of the collaborative meeting on the 23rd of October.

If your group is at a standstill or you run into any unforeseen difficulties, please contact my office via the direct link on the mission web site. I will do everything I can to assist.

I suggest you begin by using the virtual lab to analyze your fuels to determine which would be best for this mission.

I am confident that this project will pave the way for future international collaborations. Thank you for your participation.