LASER INVESTIGATIONS FOR PAYLOAD G-652 PRIOR TO FILING PRE-FLIGHT ACCOMMODATION REQUIREMENTS

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ABSTRACT

In anticipation of presenting the pre-flight accommodations requirements to NASA for approval, we are investigating the physics, biology, electronic and chemistry aspects of laser experiments which are most advantageous to our flight.

Preliminary laboratory evaluation has been targeted with the realization that future flights of the shuttle may begin in 1988. It is our consensus that during the holding time before the resumption of flights, there is an extra margin of perfection which is possible and that the period prior to flight is working to our advantage technologically.

The problems that can be encountered in space flown laser systems are addressed and the analysis of data is offered as a model for pre-flight accommodation requirement filing.

Scientific investigation and invention are closely related and dependent upon each other. The age old saying that necessity is the mother of invention is often true. However, the inventions of today are also dependent upon many of the scientific building blocks of the past.

When working on the cutting edge of technology there are almost always constraints in developing new inventions. When working in space the constraints are often greater due to the harshness of the environment.

In great measure we are dependent upon those who have gone before us when it comes to experimentation and the development of new devices.

Because of new developments in the field of science which occur continually, it is essential to investigate the finest options before producing a system for space flight. In reviewing the latest technology and inventions we have arrived at the conclusion that, although get away special experimentation on board the Space Shuttle has been delayed during the past year, we have indeed had time to re-think our experiments and also apply the most recent concepts which can make our experiments more meaningful.

Before submitting our pre-flight accommodation requirements (PAR) package to NASA we have found it necessary to review by experiment the feasibility of the research.

To get the greatest advantage from the financial investment it is essential to select members for the payload team that have the necessary background.

In our particular payload GAS-652 we have addressed the needs of the scientific and administrative segments by selecting payload members that can optimize both disciplines. Figure I is a photo of our payload group.

FIG I
Payload Team
From left to right seated: Michael Petry, Mary McClutchy
From left to right standing: Reginald Sprecher, Rich Sportiello, Darrel Seeley, Mark Theiler.

Because so much depends upon proper scientific and administrative decisions in making the payload a success we have given the team a hands on responsibility from the beginning, and have addressed the many parameters essential in orientation around the experimenters handbook and the safety manual. Because our payload must also address the laser safety issue we have spent considerable time stressing the latter.

We have attempted ionization related experiments relative to concepts involving the Free electron laser and investigated magnetic field attenuation in plasmas.

Tests of high peak power neodymium laser have been orientated around the concept of producing the well known laser generated electrical breakdown for implementation in an environment for the production of amino acids. Stanley Miller conducted experiments using electrodes and electric sparks[1]. Our experiments will be conducted in microgravity using the spark from laser generated breakdown.

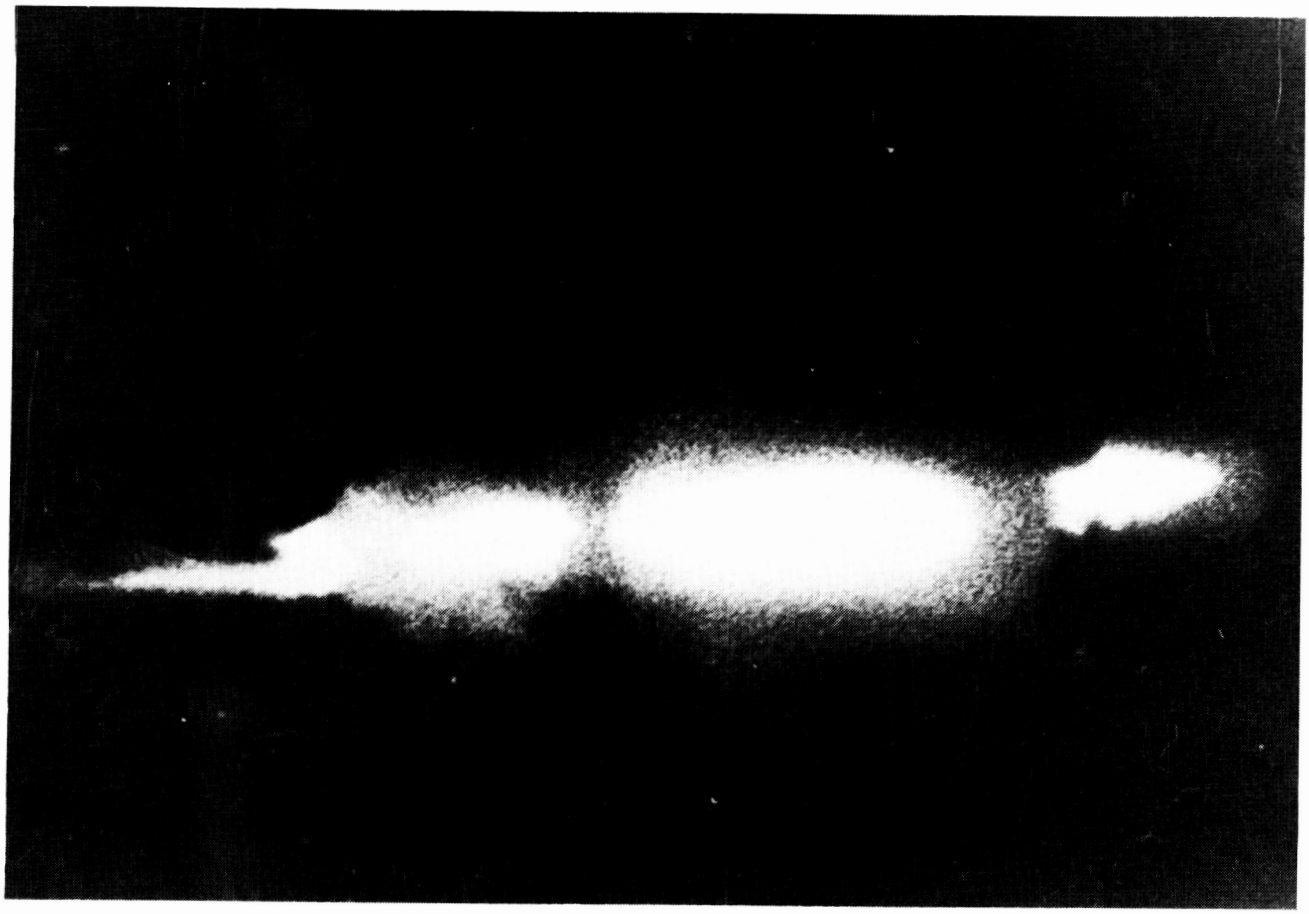

Figure II
Laser generated air breakdown for application in producing organic compounds (amino acids) from chemicals believed to have been present in early earth atmosphere.

Investigation of Free electron laser operation using the ram glow concepts[2-8] of the space shuttle included a search of the literature and magnetic attenuation of plasma in the laboratory.

Combinations of DNA and RNA in the focus of the neodymium laser are being investigated and relationships that may be essential in the combinants are being attempted before arriving at a distinct methodology for implementation in our PAR.

The problems that can be encountered in space flown laser systems are many. The problems we are mainly concerned with regard optics, temperature, vibration (lift off and landing), electrical supply, timing of on/off sequences, Q-switching techniques, and electronic noise rejection and safety.

The selection of an adequate laser system and electronics that do not easily lend themselves to latch up are being investigated. Hardening of the circuits and a review of previous information supplied in past GAS experiment symposiums offers a large amount of data for pre PAR development.

Our main emphasis in flying GAS-652 is on exploring the possibility of flying an orbital system although the methodology has not been determined.

Our payload concepts are embodied in our preliminary logo (Figure 3) and are graphically self-evident.

SUMMARY

We wish to address the following:

1. Investigation of physics, biology, electronic, and chemical aspects of the laser experiments. Before we arrive at a model we consider to be optimal for our payload we are doing proof of principle investigations.
2. Evaluation of scientific data is possible in this period of down time for flying in the GAS program and gives us the added option of learning more about past payloads and arriving at proper conclusions.
3. Our team is dependent upon many sources of information and continues to work energetically in developing an optimal PAR.
4. Our laser data analysis tends to lead us in the direction of using existing laser systems that have been space tested or innovations around new concepts such as those involving Free Electron Laser wigglers .
5. Our PAR will be based upon criteria which meet the latest safety specifications of NASA, with enough room for flexibility, so that adjustments can be made for operational capabilities.

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Figure III
Preliminary logo for project

We believe that the logo (FIG III) we are presently considering does indeed portray our greatest hopes for the flight of payload G-652.

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