Contents

Spacecraft Charging Technology Conference, P78-2

Douglas F. Shane, Lt/Col USAF
LA Air Force Stotion
Los Angeles, Calitomia

1. OVERVIEW

The SAMSO Space Test Program (P78-2 Space Flight) is a vital portion of the NASA/USAF Charging Investigation. As shown in Figure 1, various tasks are the responsibility of a diversified collection of government and civilian agencies. The materials portion of this program is to be accomplished by the USAF Materials Laboratory and the testing of space vehicle models and experiment packages is a venture of NASA Lewis and the experiment Principal Investigators. Environmental work is being done by both the USAF Geophysics Laboratory and NASA. Other agencies such as the USAF Weapons Lab are assisting in the evaluation of suitable componehts to survive the natural radiatton environment. There are some dozen experiments which will be flying on the P78-2 space vehicle attemptting to charac-tertze the natural environment and measure the buildup and bi eakdown of charge on the various components of the space vehicle.

The Space and Missile Systems Organization itself is prtmartly concerned with this phenomenon as a measure of the survivability of eatellitee. Although military sporsored satelllites are our main concern, the problem is common to all satellites, especially those in the near-synchronous region. The P78-2 SCATHA

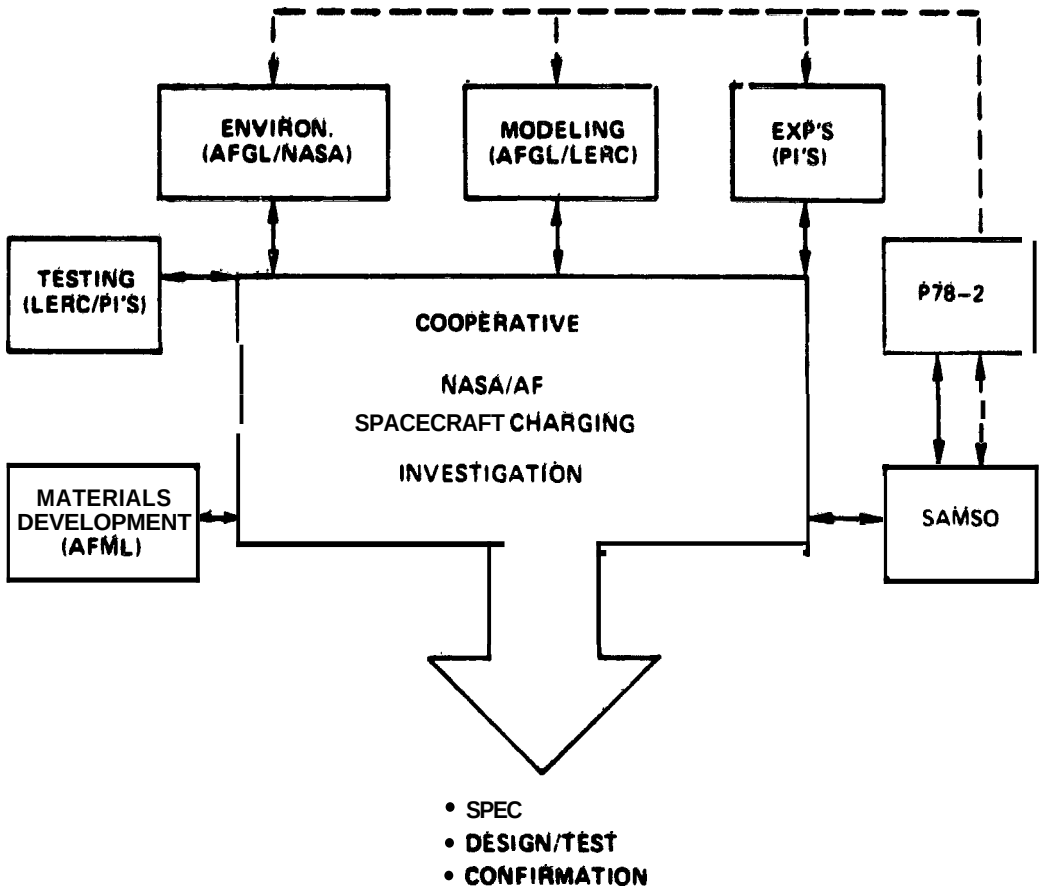


Figure 1. Program Plan

spaceflight itself is a validation of the modeling activities and a source of new on-orbit data. The final product is a specification to be followed when designing spacecraft so as to negate or minimize the effects of spacecraft charging, that is, a way to design and test satellites, and a confirmation that a spacecraft is built such that it does not experience charge-induced anomalies.

Mumerous approaches to the charging problem have been investigated already, One method is to fabricate the spacecraft entirely from conductive material. However, this method has been shown to be enormously expensive for materials that are (and remain) conducting. It is being successfully used for "one-shot" application, but in vtew of the numbers of satellites of various types flown – both military and commercial – there must be a better way.

2. OBJECTIVES

The objective (Figure 2) af this mission, in the mast general sense is to provide **data** to program offices (military and civilian) to insure that survivable space systems are designed, tested, alid flown. The **STP P78-2** mission is much more confined than that, The P78-2 objectives are to fly two types of packages, one set associated with charging and one set concerned with materials effects, by providing a space vehicle which supports the payload objectives, and by operating that spacecraft for a minimum of 1 year retrieving and distributing data as requested by the experimenters.

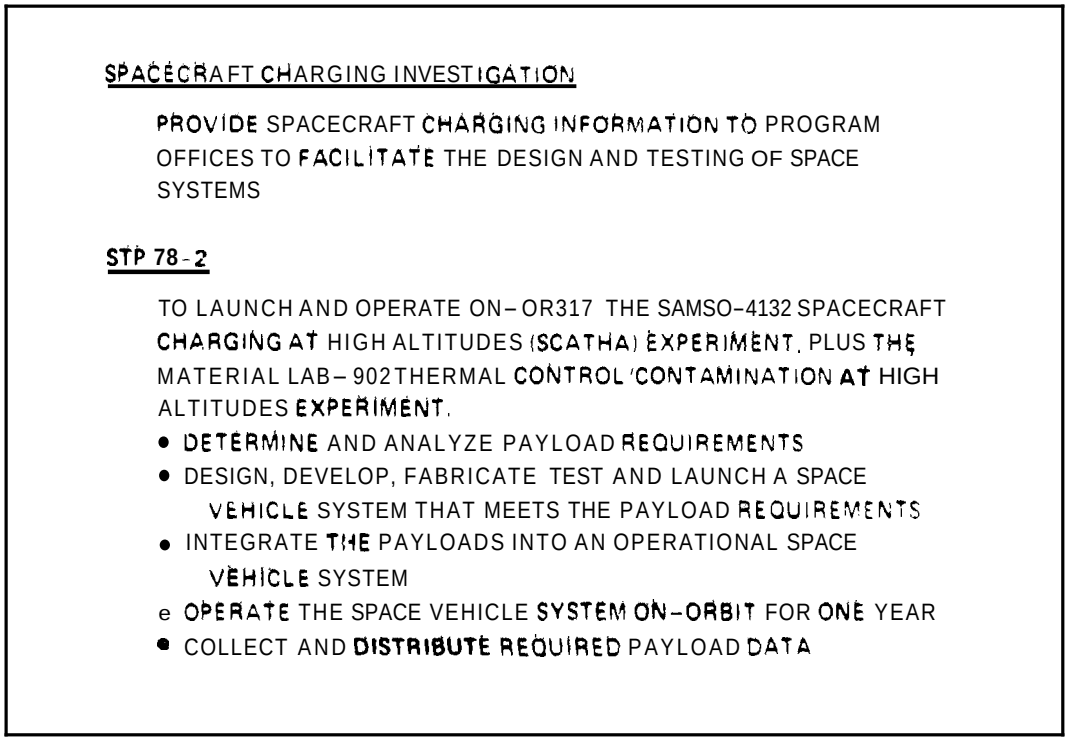


Figure 2. Mission objectives

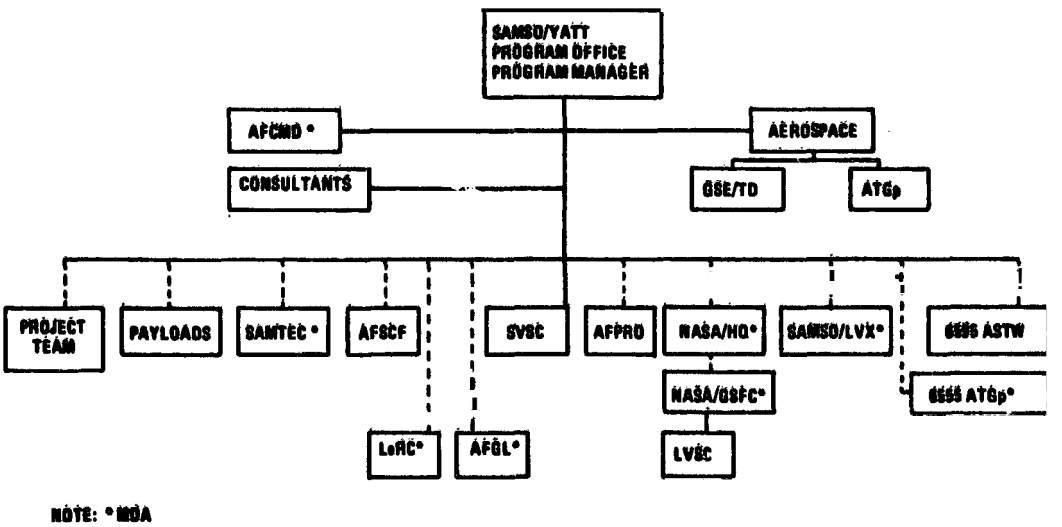
In order to properly accomplish these objectlvea, it was ftrst necessary to determine the experimenter requirements, no easy task wtth the dozen different expertments on this mission. Next came the problem of designing and building a space vehicle which supports those diversified requirements. As an aid to the accomplishment of thts task, 6 months was spent in a definition phase attempting

to optimize the mission, It is also necessary that the payloads and space vehicle operate in harmony and continue to do so for 1 year on orbit. STP will operate the vehicle during that year and collect the required data which will be processed and analyzed according to an integrated plan currently beihg developed, Eventually, each experimenter will profit from having the benefit of the combined data rather than just his own.

3. MANAGEMENT. ..... .

From a management viewpoint (see Figure 3), the SCATHA mission is quite different from previous STP missions. Although the program is currently assigned to the Space Test Prograni during the flight Demonstration Phase, it originated within the Survivability Directorate and after the Launch atid Orbital Operations Phase will return to Survivability. Td assure continuity, Survivability, personnel are currently assigned to the program full time within STP and those personnel will revert to Survivability with the end of the space mission. The overall Mission Manager function is filled by STP personnel.

Consulting agencies and the Aerospace Corporation provide suppbrt for the overall mission, The General System Engineering and Technical Direction role is performed by the Aerospace Corporation for the Space Vehicle fabrication and



Ftgure 3. Organizational Chart

testing. An Application Task Group composed of representhttves from Aerospace and consultants provide similar support for the scientific aspects of the mission. A Project Team has also been formed to coordinate the requirements of the individual experimenters. The composition of these vartous teams fluctuate according to the particular mission phase. The Project Team has proven absolutely invaluable duping the spacecraft definition phase. Requirements have been modified in a spirit of cooperation to optimize the mission from an overall scientific approach. Data is the real output of any space mission arid the P78-2 Integrated Data Analysis Plan Will mesh the efforts of SAMTEC, AFGL, and the individual experiment Principal Investigators to furnish the Maximum of data with a miliimum of processing and analysis expense. Control of the vehicle on orbit is through the USAF Satellite Control Facility,

NASA Lewis Research Center and the USAF Geophysics Laboratory support the mission in terms of the overall modeling effort.

The Space Vehicle System Contractor is the. Martin Marietta Corporatidh in Denver, Colorado. Technical support at the contractor facility is the responsibility of the AFPRO.

The laulich vehicle is a NASA belta 2914 under the responsibility of NASA Goddard Space Flight Center.

The mission will be supported by SAMSO/Launch Vehicles and the 6595th Aerospace Test Wing and SAMTEC at Vahdsnberg AFB, CA. The 6585th Aerospace Test Group is the USAF orgmnization which will oversee the preparation for launch at the Eastern Test Range at Cape Canaveral.

4. SPONSORS

See Figure 4. The USAF Systems Command is sponsoring 6 experiments. SC 1 and 2 are being built by the Aerospace Corporation at SAMSO. AFML 12 is also being built by Aerospace. The USAF Geophysics Laboratory is providing SC 4, 5 and 6. Three experiments are being spohsored by Office of Naval Research. SC 9 is being supplied by the Untversity of San Diego. Lockheed Palo Alto Research Laboratory is providing SC 3 arid 8. NASA Coddard is sponsoring SC 10 and 11. NASA Marshall Space Flight Center is Sponsoring SC 7.

The development of the Space Vehicle Transient Pulse Monitor wtll be managed from our program office.

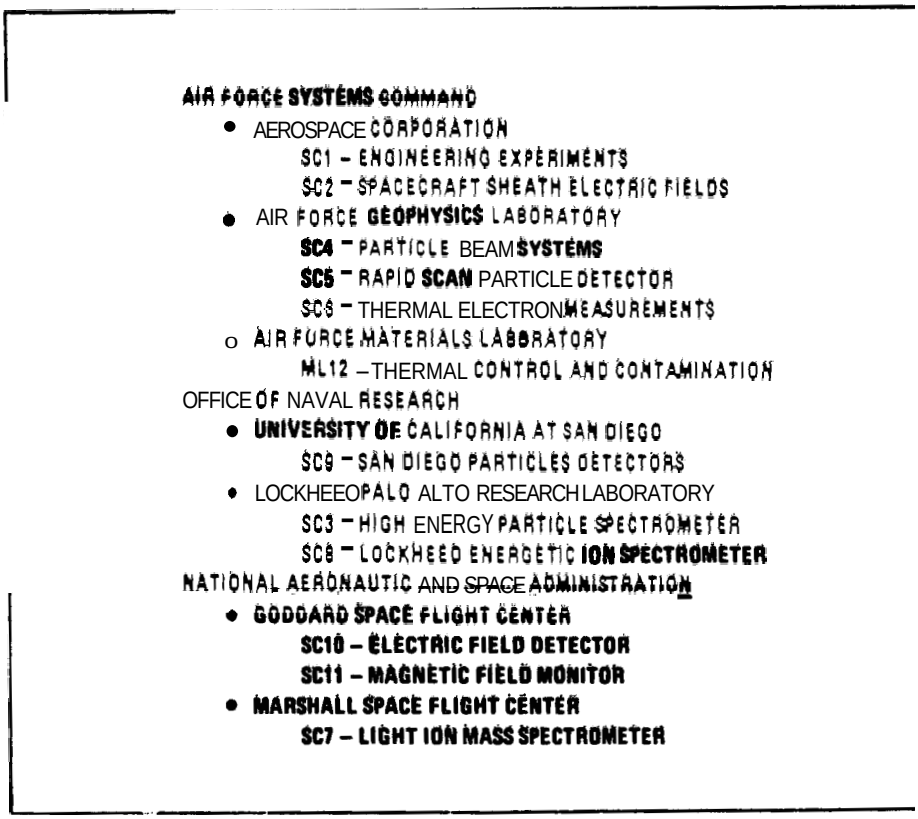


Figure 4. Sponsoring Agencies

5. PAYLOADS

Figurss 5 and 6 portray the engineering payloads and the energy range of the various particle detectors along with the Principal Investigators, It should be evident that a complimentary group of experiments has been selected which cover the energy spectrum. The mission should provide a means of complete investigation of the environment.

• SURFACE POTENTIAL OF SELECTED MATERIALS TRANSIENT SHAPE IDENTIFIER I COUNTER PULSE SHAPE LOW FREQUENCY ELECTROMAGNETIC SIGNALS	SC1	H. KOONS
• TRANSIENT PULSE MONITOR	SPACE VEHICLE	SRI
• POTENTIAL NEAR SPACECRAFT	SC2	J. FENNELL
• THERMAL PROPERTY CHANGES OF MATERIALS CONTAMINATION RATE MEASUREMENTS	ML12	D PRINCE D. HALL
• ELECTRIC FIELDS	SC10	T. AGGSON
• MAGNETIC FIELDS	SC11	B. LEDLEY

Figure 5. Engineering Payloads

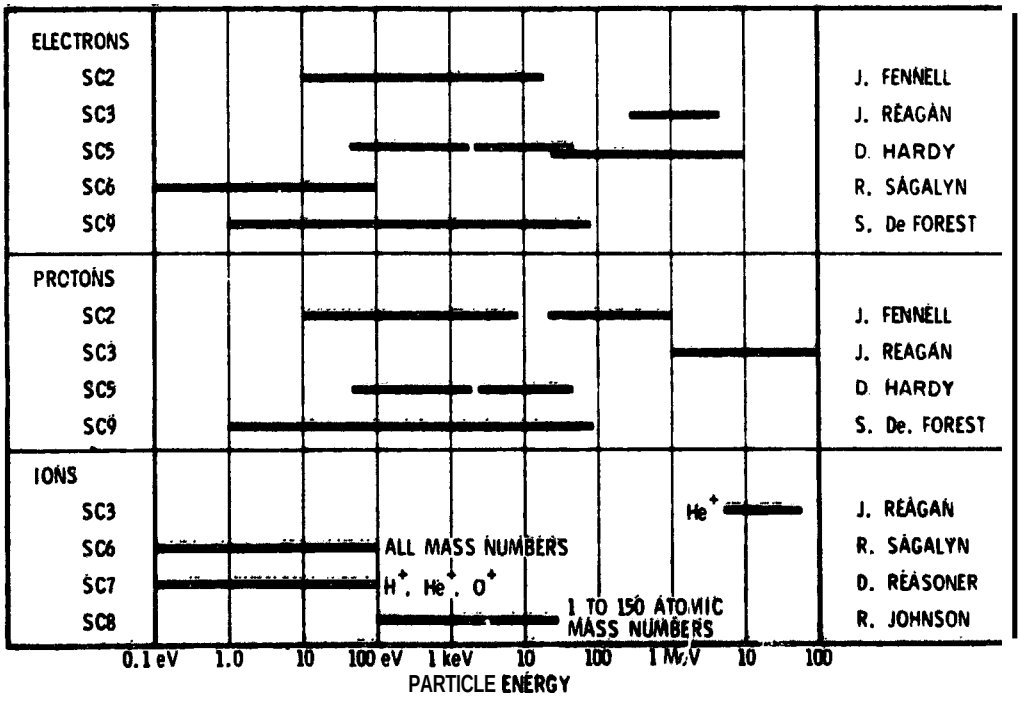


Figure 6, Energy Range of Particle Detectors

6. ORBITAL PARAMETERS

The final orbit parameters are currently as follows:

Apogee	23,100 nm
Perigee	15,030
Inclination	2.5°
Ascending Mode	0°
Drift	6°/day nominal

Figure 7 depicts the orbital parameters graphically but fails to portray the desire to have apogee at local midnight during the eclipse season. The period is 23.54 hr and approximately 12.62 hr of each revolution are spent above synchronous altitude.

An Orbital Requirements Document and Operations Plan will be available in January of 1978 which will provide the detailed mission timeline.

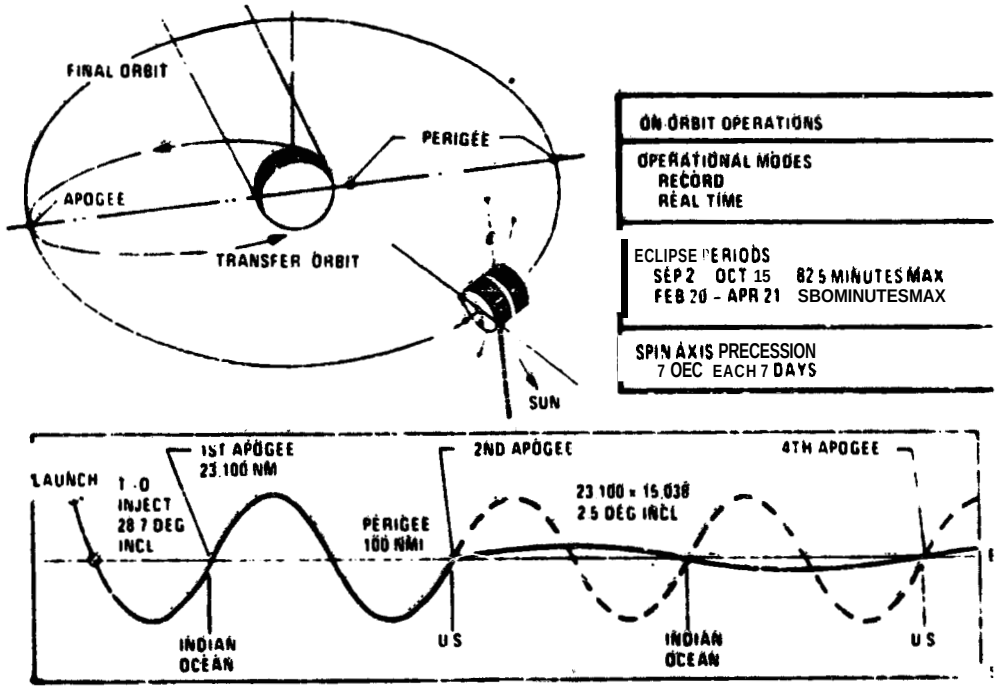
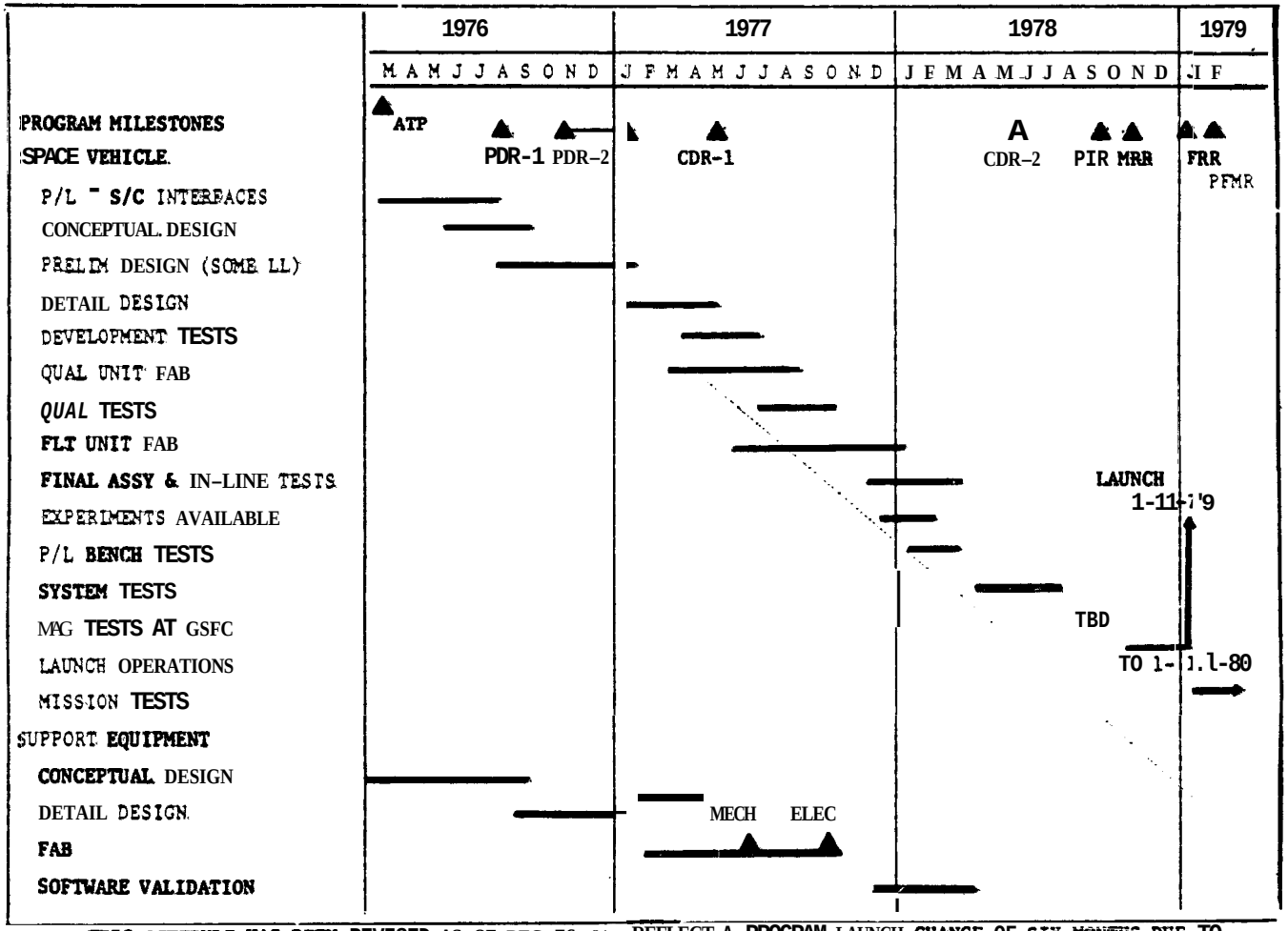


Figure 7. Orbital Parameters

7. SCHEDULE

Figure 8 portrays the program master schedule.



NOTE: THIS SCHEDULE HAS BEEN REVISED AS OF DEC 76 AND REFLECT A PROGRAM LAUNCH CHANGE OF SIX MONTHS DUE TO DIRECTED FUNDING LIMITATIONS.

Figure 8. P78-2 Milestone Schedule