N75 20359

KEYNOTE ADDRESS

MR. DANIEL HERMAN - NASA HEADQUARTERS

MR. HERMAN: I am not really going to give a keynote address in the formal sense of the word. Rather, what I thought I would do is to tell you what the current status within NASA is for an outer planets probe program.

I will begin with this first picture (Figure 1-1) of the so-called official NASA mission model as of last October. These are the missions Dr. Fletcher presented to the Congress in his testimony in October and have been carried on the books as the official NASA plan. Currently, this plan is in the process of being changed because our thinking with respect to the outer planet probe missions has changed. I will indicate the changes from this so-called official NASA mission model of last October to our current thinking.

Originally, the outer planet probe missions in our plan were those stipulated by the Outer Planet Science Advisory Group, headed by Jim Van Allen. The so-called "three to make two" concept where in three opportunities dedicated Pioneer probe missions are launched to Saturn and Uranus, with the last one to either Saturn, Uranus or Titan as a function of the success or failure of the two predecessors. This strategy of the "October plan" is shown on the second schedule (Figure 1-2).

In 1979, we would send a dedicated Uranus probe mission to fly by Jupiter and be deflected to Uranus. The arrival at Uranus would be 1984. Then, in the 1980 opportunity, we would send a probe to Saturn directly and that probe would reach Saturn in 1984. Then in 1981, we would launch a probe mission, the Saturn-Uranus swing-by opportunity, which would reach Saturn in 1985 after both earlier probes had encountered Saturn and Uranus. If both earlier

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Editor's Note: Mr. Herman's remarks accurately reflect the programmatic and fiscal situation at the time of the workshop. Subsequent changes in available resources and other programmatic considerations may alter the mission schedule described in his remarks.

PLANETARY EXPLORATION PROGRAM (PL)

October 1973

Payload Code	Payload	CY	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	Total
	Approved Programs																					
PL-1	Mariner Venus/Mercury		①△																			1
PL-2	Pioneer Jupiter Flyby																					0
PL-3	Helios			①		①																2
PL-4	Viking 75				②																	2
PL-5	Mariner Jup/Sat 77						②															2
	Inner Planets																					
PL-6	Viking Orbiter/Lander 79								1													1
PL-7	Surface Sample Return													2								2
PL-8	Satellite Sample Return																			1	1	2
PL-9	Pioneer Venus							2														2
PL-10	Inner Pl. Follow-On									1	2		1			1						5
PL-11	Venus Radar Mapper												2									2
PL-12	Venus Buoyant Station														2							2
PL-13	Mercury Orbiter																2					2
PL-14	Venus Large Lander																		2			2
	Outer Planets																					
PL-15	Mariner Jup/Uranus Flyby								2													2
PL-16	Pioneer Jup/Uranus Flyby (Uranus Probe)								1													1
PL-17	Pioneer Saturn Probe									1												1
PL-18	Pioneer Sat/Uranus Flyby (U Probe)										1											1
PL-19	Mariner Jupiter Orbiter										2											2
PL-20	Pioneer Jupiter Probe													2								2
PL-21	Mariner Saturn Orbiter														2							2
PL-22	Mariner Uranus/Nep Flyby															2						2
PL-23	Jupiter Sat. Orb/Lander																			1	1	2
	Comets & Asteroids																					
PL-24	Dual Comet Flyby					1																1
PL-25	Encke Slow Flyby								1													1
PL-26	Encke Rendezvous										2											2
PL-27	Halley Flyby														1							1
PL-28	Asteroid Rendezvous															2						2
	Total		1	1	2	2	2	2	5	2	7	0	3	4	5	5	2	0	2	2	2	49

Note: ○△ Approved and On-going / Launched

Figure 1-1

PROBE MISSION STRATEGY

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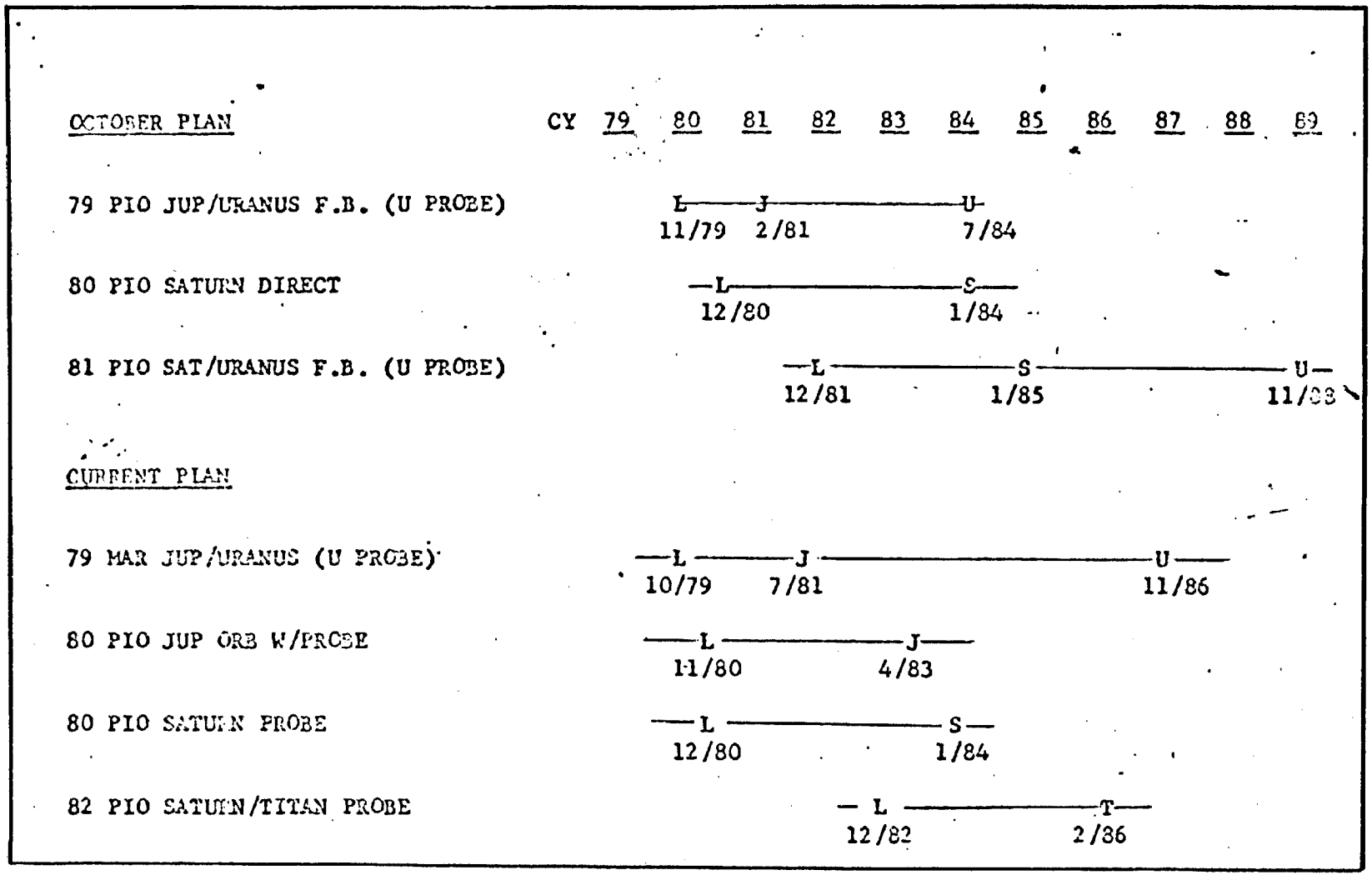

Figure 1-2

probes were successful, this probe would then go into Titan. If either the Saturn or Uranus probe was a failure, then this probe would repeat either the Saturn or the Uranus mission.

The scenario had a couple of weaknesses in it, the major one of which was exposed at the Titan workshop held here at Ames about a year or so ago. The strong advice of that workshop, which we have accepted, was we should not try to achieve commonality between a Titan probe and an outer planet high-atmosphere probe; the reasons being that the science to be performed at Titan would be different and, also, that the quarantine restraints to be imposed on a Titan probe would differ from the outer planets probe.

In this old plan (Figure 1-2) you don't see a Jupiter entry because until the Pioneer 10 encounter our entry analysis of the Jupiter probe mission, indicated that facilities would not be available until about 1980 to test an entry probe to the Jupiter entry heating conditions. Hence, we deferred a Jupiter entry probe until the mid-1980's. That thinking has changed and that is going to be a major issue of this workshop.

Let me go to this next schedule (Figure 1-3), and show you our current thinking. For the October mission model we were given a fiscal constraint by the Administrator to formulate all of the new programs we hoped to implement for the next five years. The original mission model was in consonance with that fiscal constraint. However, late last year several things happened, one of which was a forecast overrun in the Viking program.

Since our overall budget does not increase, funds for planning for new missions is from the same funding that has to accommodate overruns. We, therefore, had to alter our thinking and decide which missions we wanted to do as scheduled and which missions would have to be deferred. Since the outer planet probe missions could be done almost in any year - the opportunities to the outer planets occur in about a twelve-or fifteen-month period - these were more easily deferrable than some of our other missions.

PLANETARY EXPLORATION PROGRAMS

April 1974

PAYLOAD	CY 73 74 75	76 77 78 79	80 81 82 83	84 85 86 87	88 89 90 91
APPROVED PROGRAMS					
MARINER VENUS/MERCURY	1				
PIONEER JUPITER FLYBY	1				
HELIOS	1	1			
VIKING '75	2				
MARINER JUP/SAT '77		2			
INNER PLANETS					
VIKING ORBITER/LANDER		1			
VIKING ORBITER/LANDER (W/ROVER)			1		
SURFACE SAMPLE RETURN				2	
SATELLITE SAMPLE RETURN					1 1
PIONEER VENUS		2			
INNER PLANET FOLLOW-ON			1 2 1	1	
VENUS RADAR MAPPER			2		
VENUS BUOYANT STATION				2	
MERCURY ORBITER				2	
VENUS LARGE LANDER					2
OUTER PLANETS					
MARINER JUP/URANUS FLYBY (U PROBE)		2			
PIONEER JUPITER ORBITER (ESRO)			1		
PIONEER SATURN PROBE			2		
PIONEER SATURN/TITAN PROBE			2		
MARINER JUPITER ORBITER			2		
PIONEER JUPITER PROBE				2	
MARINER SATURN ORBITER				2	
MARINER URANUS/NEPTUNE FLYBY				2	
JUPITER SATELLITE ORB/LANDER					1 1
COMETS AND ASTEROIDS					
ENCKE SLOW FLYBY		1			
ENCKE RENDEZVOUS			2		
HALLEY FLYBY				1	
ASTEROID RENDEZVOUS				2	

Figure 1-3

Consequently, when we formulated that mission model, the dedicated Pioneer outer planet probe missions were deferred. As I indicated before, our thinking changed about commonality between an outer planet entry probe and the Titan entry probe and, also with Pioneer 10 encounter and Arv Kliore's data about the possibility that the probe design for Saturn and Uranus would also have Jupiter capability. Since ephemeris uncertainty of Jupiter has been decreased which allows a shallow entry angle, and if the atmosphere is more toward the so-called "warm expanded" or "nominal" atmosphere, it may be possible to enter Jupiter with the same entry technology that we will use for Saturn and Uranus.

So, for several reasons, our thinking has changed. We have given up the dedicated Pioneer-Uranus entry probe. Instead, our current thinking is to incorporate a Uranus probe in a Mariner Jupiter-Uranus mission which we want to launch in 1979. As far as a Jupiter entry probe is concerned, we are discussing a cooperative program with ESRO at the present time, using Pioneer H to do an orbiter mission in the 1980 opportunity and we are going to discuss the possibility and the advisability of incorporating a Jupiter entry probe in that mission.

Our dedicated Pioneer-Saturn probes are still intact. That thinking has not changed but now you see Pioneer-Saturn-Titan probes. These would be a different kind of a probe. They would be dedicated Titan entry missions. The Pioneer-Jupiter probes is still kept on the books at the old date in case we cannot incorporate the probe into the Pioneer Jupiter orbiter mission with ESRO.

These are some concepts and some of the things that we are considering. The only way the concept of a probe on the MJU flyby is feasible is to first aim the spacecraft so that it would impact Uranus and then release the probe. The probe then need not have an attitude control system or delta-V propulsion, and after the probe is released, the spacecraft is deflected to achieve

the flyby. This mode permits use of a simple, "dumb," probe that can be developed within reasonable cost and weight constraints. However, the spacecraft deflection mode requires a new NASA policy position on the quarantine requirements for outer planet entry probes. This is being considered by the Space Science Board. This issue must be addressed since this is the only practical mode to incorporate a probe on a Mariner spacecraft to Uranus.

Figure 1-4 presents a concept of a dedicated Pioneer probe mission into Saturn. Again, the concept for probe release would be the same. The spacecraft, of course, serves as a communications relay for the probe during the entry of the probe into the atmosphere. One of the things that is being studied is the feasibility of designing one probe system which can be completely common, including science for both Saturn and Uranus.

A cooperative Jupiter mission with ESRO that I mentioned, and the possibility of a probe in that is shown here on Figure 1-5. The probe would be released before orbit capture and the spacecraft would serve as a relay for the probe during entry. Then the spacecraft would be captured and would achieve a highly elliptical orbit about the planet. The first formal meeting with ESRO on this mission is here at Ames on June 17 and 18.

Now, let me tell you one announcement that I think will be of interest to some people here. The Mariner Jupiter-Uranus Science Group that has been meeting is coming up with a strong position that an atmospheric entry probe will materially enhance the value of that mission. On the basis of a meeting last week, we at NASA decided that we would go out with an RFP to industry for a Phase B Study in fiscal year 1976 for an entry probe that can be used for Uranus, Saturn and, if possible, Jupiter. The RFP will be entitled, "Outer Planet Probes." The RFP will also state that the first mission for this outer planet probe family will be the MJU mission in 1979. Preceding the release of that RFP, Dr. Rasool is going to form a small science group to evaluate

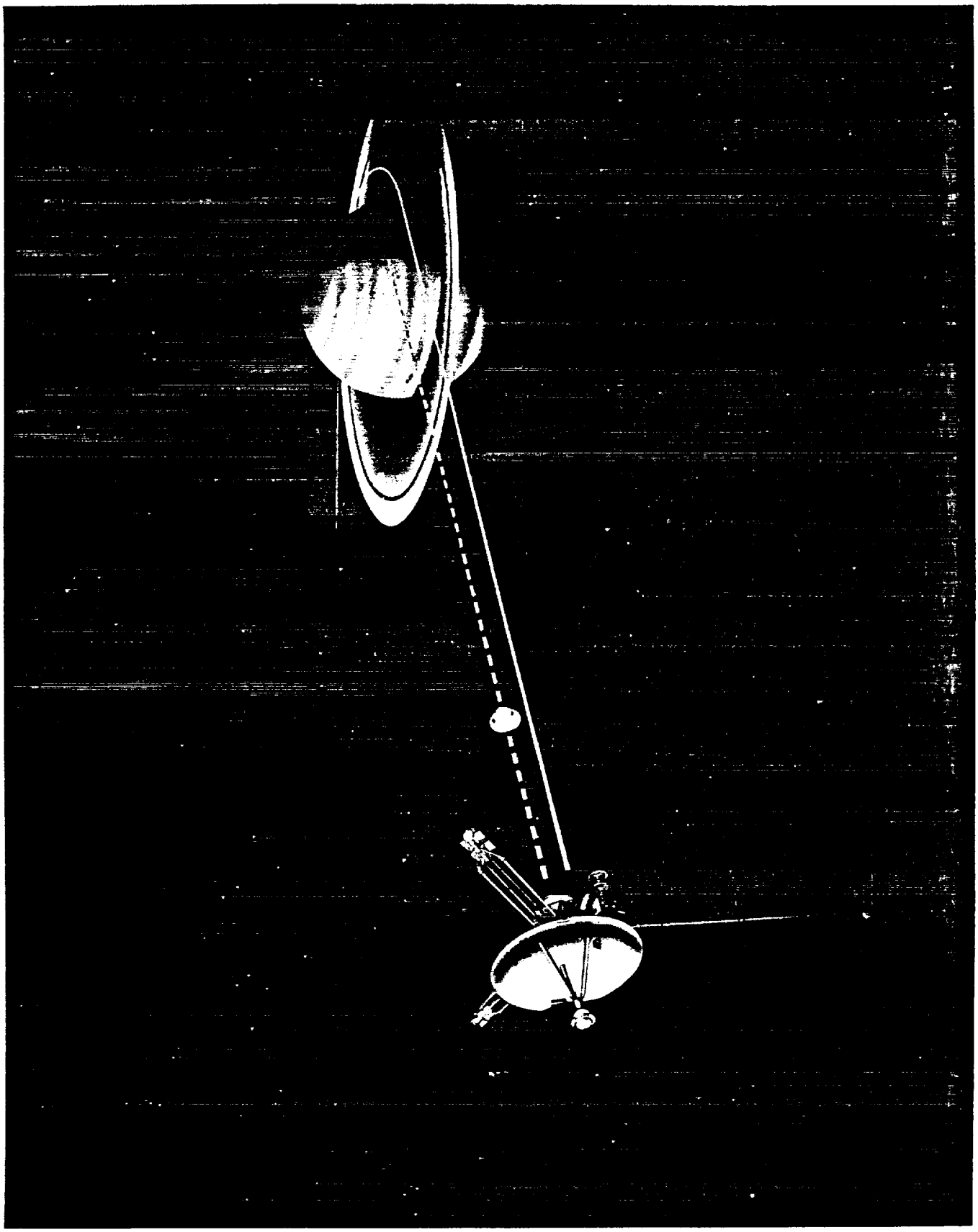

Figure 1-4. Pioneer Saturn Probe Mission

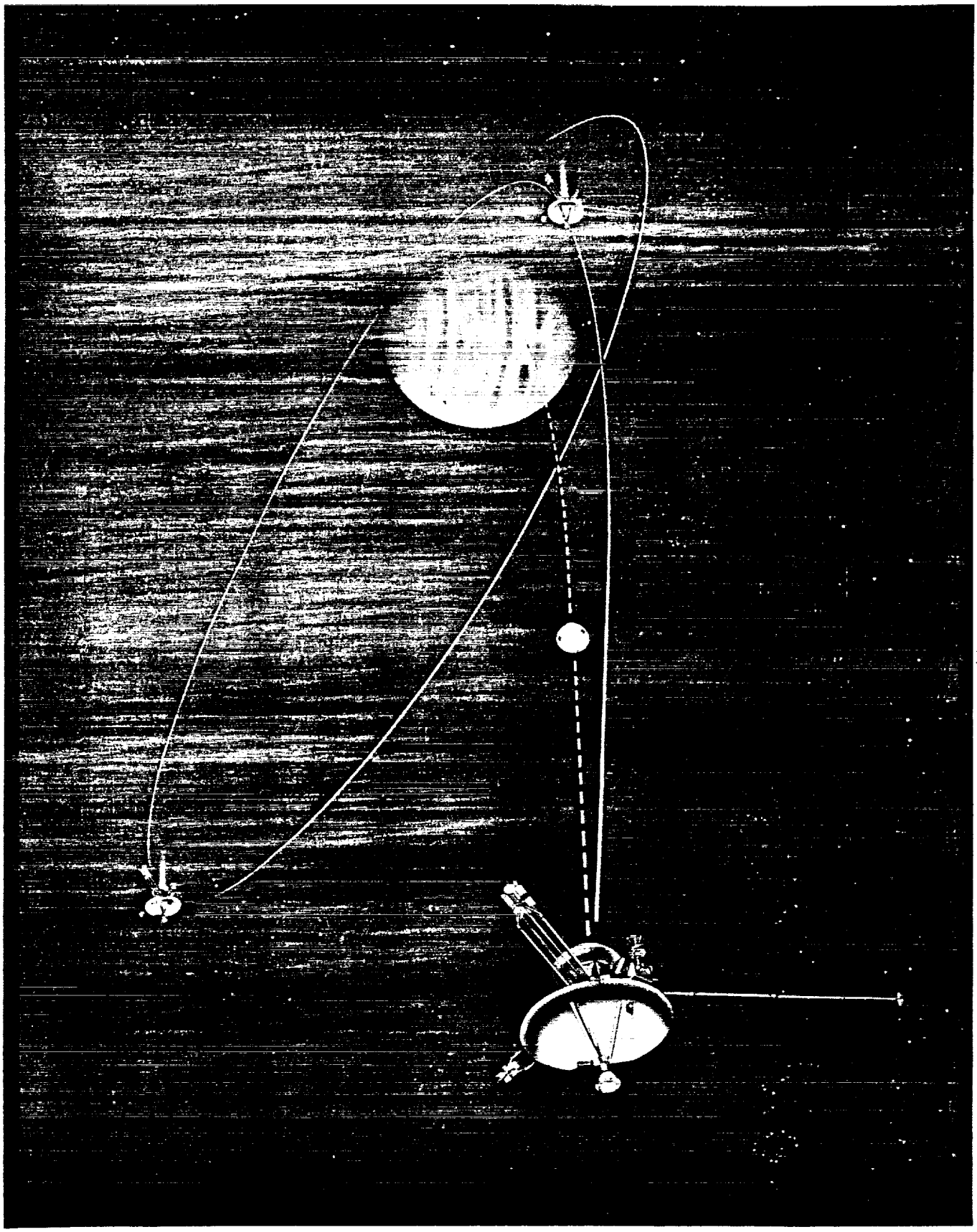

Figure 1-5. Pioneer Jupiter Orbiter with Probe

the payload that should be incorporated in the probe and this will serve as a guideline for the Phase B contractors.

Our current thinking is that this RFP, which would be competitive, would be released about July of next year and the procurement procedure would be similar to Pioneer-Venus. It would be open competition with two contractors selected to conduct a competitive Phase B and only the winners of the Phase B allowed to compete for the execution phase.

SESSION II. SCIENCE RATIONALE AND OBJECTIVES

Dr. Ichtiaque Rasool, Chairman

MR. SEIFF: I think everybody knows Ichtiaque Rasool who is the Deputy Director in the Planetary Programs Office in OSS. Prior to that he was working at Goddard and at the Goddard Institute for Space Studies. He has been of great service to the planetary programs at some professional sacrifice to himself because he has had to give up some of his scientific work in order to help advance the programmatic aspects of these projects. Dr. Rasool has kindly agreed to serve as chairman of this session.

DR. ICHTIAQUE RASOOL: Thank you

Now we come to the most important part of the session. As you know, the planetary program is having great success at the moment; technology wise and science wise, we have done very well.

Last week I was asked by my boss, John Naugle, "Why?" Why are we having such great success? It is very interesting that when we have a failure, we have an inquiry; and when we are having success, we still have an inquiry. But it is an interesting question, why our program, compared to many other programs in other countries, has had great success in the ten years NASA has been in the planetary business.

I have reflected on that quite a bit in the last few days and I think very firmly that the main reason has been the strong base of supporting planetary technology and advance planning. We go through a great deal of research and technology development and we do very careful planning. We go through a great amount of technical development and technical studies. A very important thing is that we have conducted science and technology studies together. I think this mix is extremely important. We design our missions to answer specific questions. This, in the next ten or fifteen years, is going to be very important because now we are entering the second generation of planetary

exploration. The first generation was to go and find out what is there and now we know a little bit of what is there on the terrestrial planets, and through very powerful telescopes we have been looking at the outer planets.

Once we know what is there, then the question is why is it there and what does it mean in terms of the history of the solar system? So our major objective is that we would like to understand the processes which took place in the early history of the solar system, what is the history of the Earth and what may we estimate to be the future of the Earth. Those are the specific questions and it is to those questions that our spacecraft design and mission design should be geared to answer. That is the interaction of science and technology. That is what we have been doing and in my opinion that is why our program has been scientifically very productive.

It's very appropriate then that our first session be a definition of science. We have six or seven speakers who will start with a general discussion of what we know about the outer planets. In this last ten or fifteen years we have concentrated on the inner planets and we have used flybys and orbiters. The next decade will be the outer-planet era, hopefully, and there the emphasis will be on flybys, orbiters and probes. As you know, the structure of the outer planets is very different from the inner planets and, therefore, it is very important that we begin this historic meeting - which I think is a very good way to kickoff the 1980's at which time probe technology will be the word of the day - by trying to find out what is there, why are we going there, what do we expect to learn, and what measurements do we need to make.

The first paper is a general review of what we know about the outer planets by Toby Owen. I have asked him to include Titan in his paper because he has become very interested in Titan in the past few months.