NON-CONVENTIONAL PROPULSION SYSTEMS FOR SPACE SHUTTLE

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Introduction

The words "non-conventional propulsion systems" mean essentially "non-chemical systems". Thus a large class of propulsive systems are possible candidates: electrostatic, magnetohydrodynamic, nuclear fission and possibly nuclear fusion.

This lecture will first discuss, within the framework of the course objective, the various mission requirements during the next generation. Based on a reasonable extrapolation of existing technology, it will become clear that high-thrust, moderate specific impulse systems will dominate most future programs. The nuclear rocket will be shown to be the only realistic "unconventional" candidate for this role. A discussion of the two basic nuclear rocket configurations - solid core and gaseous core - will follow, emphasizing the present state of development of each type.

Timetable for Desired Missions

An overview of NASA's future space program has recently been published (Ref. 1). The dates forecast for a specific mission represent "...a program conducted at the rate permitted by technology," and budgetary constraints may well postpone or even eliminate certain target dates.

A brief tabulation of specific objectives and their respective completion dates follows:

Earth orbital

1. Saturn workshops 1971-74
2. Space station 1975-76
3. Geosynchronous station 1980
4. Space base 1981-82

Lunar

1. Extended Apollo 1971-74
2. Lunar orbit station 1975-76
3. Lunar surface base 1978-79
4. Large-scale lunar orbiter 1980-81
5. Large-scale lunar base 1983-84

Planetary

1. Mariner orbiter 1971
2. Viking 1973
3. High data rate orbiter 1977
4. Grand tour 1978
5. Manned Mars landing 1981
6. Mars temporary base 1985-86
7. Mars semi-permanent base 1988

Mission Requirements

Basically, when we ask the question, "What propulsion system is the best for a specific mission (such as one of the above)?", we are faced with a decision which requires us to consider two very distinct types: the high-thrust moderate specific-impulse system