RSS MECB PROPULSION SUBSYSTEM

C. Bressan
Combustion and Propulsion Laboratory
Instituto de Pesquisas Espaciais (INPE)
Cachoeira Paulista, SP, Brasil

INTRODUCTION

The Institute for Space Research (INPE) develops the propulsion subsystem for two satellites of remote sensing, which belong to the Brazilian Space Complete Mission (MECB), planned to be launched in 1993.

These satellites have sun-synchronous and circular orbits at an altitude of about 640km. They are of three-axis stabilized type with estimated mass of 170kg and lifetime of two years.

Preliminary satellite conception review indicated a parallelepiped shape with basic dimensions about 0.90x0.40x0.90m

PROPULSION SUBSYSTEM MISSION

The Propulsion Subsystem (PS) constitutes part of the attitude and orbit control system (AOCS). It has to provide impulse and torque to:

- attitude acquisition phase
  - Sun acquisition sub-phase
  - Earth acquisition sub-phase
  - nominal attitude acquisition sub-phase
- maneuver phase: to transfer and circularize the orbit and correct up to 0.5 degree the orbit inclination. This phase assumes a required velocity increment of about 205m/s supposing Hohmann transfer.

It shall correct the orbit semi-major axis during the lifetime.

No binary torques are foreseen.

In terms of reaction control torques for attitude control, considering a minimum thrust actuation period of 50ms around the satellite axis with minimum moment of inertia ($16kgm^2$), the maximum torque of about 1.7Nm is necessary to keep the required angular velocity below 0.3deg/s.

A compromise between the thrust required for orbit acquisition a attitude control can be met with 2N thrusters. For orbit acquisition man 2 or 4 thrusters can be used. For attitude control the maximum allowable can be met by restricting the moment arm to a value less than 0.8m.

PROPULSION SUBSYSTEM DESCRIPTION

The (PS) uses hydrazine as a monopropellant for catalytic decompo Two redundant branches of six thrusters each are fed by hydrazine pressur with nitrogen. The blow-down ratio is4:1(22 to 5.5bar).

The satellite thruster locations are shown in Figure 1.

The circuit functions and their respective components (see Figure

- storage and pressurization of hydrazine in two tanks with a to load of 20kg;
- interconnection/isolation of thruster branchs by two latching va
- hydrazine filtration with one filter before each latch valve;
- pressure verification with one pressure transducer in the gas pressurization line;
- hydrazine fill and drain: one valve;
- pressurization/depressurization: two valves;
- tubing for hydrazine feeding.
- heaters for thermal control.

ASSEMBLING - INTERFACES

The PS is mounted integrated with the satellite structure. The mem tanks are located inside the satellite central cilinder which is in the sam launcher axis (launching configuration).

Due to transfer maneuvers, two pairs of thrusters are directed opposite to the velocity vector, perpendicular to the central cilinder axis. Ea pair may be used for pitch control.

A set of four pairs is located at the Sun face side. They will be u for roll and yaw control.

Line and components have heaters for thermal control

246

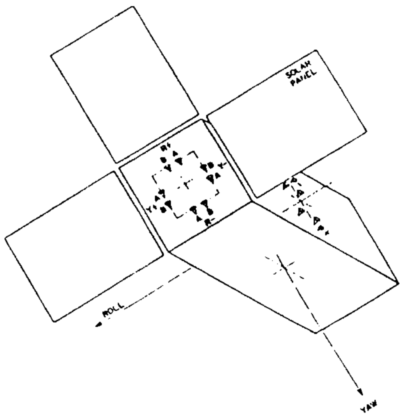

Figure 1. Sattelite thruster locations.
R - roll, P - pitch, Y - yaw,
OC - orbit control,
A - branch A, B - branch B.

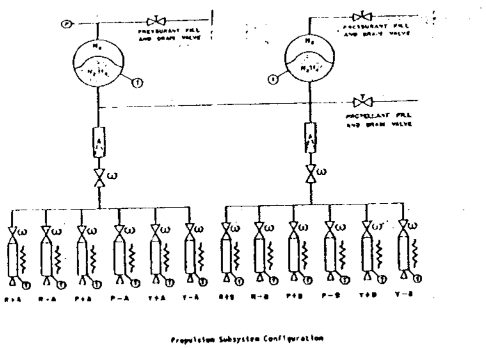

Figure 2. Schematic propulsion subsystem.

The thrusters have heaters for heating the catalytic bed before a maneuver.

The electrical wiring are connected to the Thruster Control Electronics which controls all valve actuations, pressure and temperature measurements and

heating operation.

The tube connections shall be minimized for decreasing mass and a leakage.

ESTIMATED DATA OF MASS, ELECTRIC POWER AND VOLUME

According to the components described here, the following table mass, electric power and volume of the Propulsion Subsystem is shown.

COMPONENT	QTY	MASS (kg)	VOLUME (ℓ)
Tank	2	5.6	26.6
Thrusters	12	4.8	2.16
Latch valve	2	0.6	0.26
Fill & drain valve	2	0.2	0.06
Tubing & connections	4,5m	0.7	0.126
Filter	2	0.28	0.03
Heaters	-	0.05	-
Pressure transducer	1	0.15	0.05
Hydrazine	-	20 (inside the tanks)	-
Total		32.4	29.31

COMPONENT	POWER/UNIT (W)
Thruster valve	6
Thruster heater	1
Valve heater	0.2
Latch valve	50W/50ms
Latch valve heater	0.2
Filter heater	0.1
Pressure transducer	0.5
Tubing heaters (0.4W/m)	1.8

Considerations about the attitude and orbit acquisition phases led to a maximum power of 24W consumed by the propulsion subsystem.

BIBLIOGRAPHY

MECB - Remote Sensing Satellite Concept Review. Volume II - Satellite, INPE, São José dos Campos, 1988.

CORAI, J.C. - Ensemble Propulsif de La Plateforme Spot, IAF 82-357, SEP, 1982.

BRESSAN, C.; ABRÃO, R.B. - Projeto Conceitual do Sistema de Propulsão para os Satélites de Observação da Terra- Relatório II, INPE, S.J.Campos, 1987.

THRUST BALANCE FOR A MICRO THRUSTER TEST STAND

A.L.S. Guimarães

Combustion and Propulsion Laboratory

Instituto de Pesquisas Espaciais , (INPE)

Cachoeira Paulista, SP, Brazil

INTRODUCTION

The impulse is an important parameter for the design and oper satellite orbit and attitude control systems that use reaction jets. I controlling the motion of the satellite, it is necessary to know what given jet will deliver before beginning any maneuver so that it can be accomplished with a minimum consumption of fuel: fuel being the critic that determines the useful life of the satellite.

One of the manners used to determine the impulse of a thruste experimentally measure the thrust and integrate it over a certain time However, in satellite control systems the jets develop a low thrust on of 0.5 to 20.0N and commonly operate in a pulsed mode with cycle times 50ms. This low thrust and short cycle time complicates the measurement interference from the mechanical dynamic response characteristics of t balance.

Here, this problem is discussed by presenting a dynamic anal actual performance of a thrust balance intended for use in the range c 100N and with pulse cycle times of 50ms. In what follows, the balance described, a mathematical analysis of its dynamic behavior is complet results are compared with some experimental measurements

THE BALANCE

Figure 1 shows the general features of the thrust balance. T thruster under test is attached to a table which [illegible]