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Reverse Engineering of Juno Mission
Homework 5

Course of Space Systems Engineering & Operations
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Group 5

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Contents

Notation

TCS	Thermal Control System	**S/C**	SpaceCraft
SYM	to remove this cite[1]	**SPM**	Sun Pointing Mode
TP	Thermal Phase	**EPM**	Earth Pointing Mode
LEOP	Launch and Early Orbit Phase	**HGA**	High Gain Antenna
IC	Inner Cruise		

1 Introduction of TCS

The Thermal Control System of Juno adopts various strategies in order to maintain the instrumentation within operative ranges of temperature. This is done through both active and passive systems, which will be analyzed in section 3. First thing first, an analysis of the mission will be conducted to enlighten the thermal conditions the satellite is exposed to, which range from really hot environment nearby the Sun to extremely cold environment nearby Jupiter. A selection of the two most extreme situations will be done through a preliminary evaluation of the heat fluxes in these phases. In the light of this, the architecture of the Juno's TCS will be studied and justified through a brief rationale analysis. Finally, a reverse sizing will be carried out imposing some simplifying assumptions in order to find the temperatures on Juno and to verify the compliance with its mission.

2 Analysis of thermal conditions along the mission

Different thermal conditions have been encountered by Juno during its cruise. In previous chapters, the mission was divided into phases by different attitude and communication constraints. These phases will be now grouped by the means of thermal constraints to better analyze their evolution during the mission time.

- **TP-1**: in this first phase, which comprehends both LEOP and IC 1, the S/C is in SPM due to thermal and power requirements. In particular, since the trajectory is relatively close to the Sun, Juno has to protect the vault with the HGA (as already explained in the previous chapter). It is a hot phase but not the most critical one and so it will not be considered in the following analysis.
- **TP-2**:
- **TP-3**:
- **TP-4**:
- **TP-5**:
- **TP-6**:

3 Architecture and rationale of TCS

4 Reverse sizing of TCS

Bibliography

[1] Richard Grammier. *Overview of the Juno Mission to Jupiter*. Site: `https://www.jpl.nasa.gov/missions/juno`. 2006.