Fundamentals of spacecraft technology

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1 The space environment

1.1 Introduction

Talking about space, we refer to an higher altitude than 200km. Here you can enter in orbit and maintain this state for enough time, due to the low air Drag.
Secondly, there is a very high vacuum condition, that makes impossible to have a natural convective heat transfer, causing extremes temperature (must provide a proper cooling system).
Thirdly, in certain regions, we can find aggressive chemical species, such as atomic oxygen, that can cause consistent corrosion, despite the low density. Because of that, we are limited in material choice.
What is more, we are not covered by particle and electromagnetic radiation at this altitude. These radiation could represent a problem for humans and for electronic parts, which have to be properly designed (increasing costs).
Lastly, we must consider the presence of space debris, micrometeoroids, etc..
Despite of these complications, there are also advantages such as:

- Absence of water vapour (that cause corrosion)
- Absence of wind
- Clean environment
- Zero effective gravity, allowing us not caring too much about weight.

All this stuffs, makes us set some design guidelines:

- **MATERIAL CHOICE** → make use of stable materials and coatings
- **CONFIGURATION** → choose a proper geometrical shape, in order to vent outgassed materials away from sensitive surfaces (outgassing is the release of a gas that was dissolved, trapped, frozen, or absorbed in some material; in space-based equipment, released gas can condense on such materials as camera lenses, rendering them inoperative)
- **MARGIN** → allow for degradation in thermal and optical properties in orbit
- **MATERIAL PRE-TREATMENT** → consider vacuum bakeout of materials before installation (the vacuum bakeout is a process in which high temperature and vacuum are used to remove volatile compounds from materials and objects, in order to avoid, or at least to limit, the outgassing phenomenon in space)
- **FLIGHT AND GROUND OPERATION** → provide time for in-orbit bakeout during early operations

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