

SPACE SYSTEMS SYMPOSIUM (D1)
Innovative and Visionary Space Systems Concepts (1)

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IMPORTANCE OF TRANSPORTATION COST FOR ON-ORBIT SERVICING

Abstract

Today, many business plans which use satellites are hindered by expensive launch cost. But, there have been few cases that inspect the relationship between the reduction of launch cost and the commercial profit of business before. So, to set the aim of launch cost which makes business true improves the motivation to reduce the transportation cost.

I select On-Orbit Servicing (OOS) as the example in this paper. OOS is the future business that supplies services such as repair, refill of propellant and exchange of modules to the satellite. But, we must launch extra mass for OOS. So, reduction of launch cost may enable the OOS.

Purpose of this research is follows

- Build the OOS model which use Satellite and service satellite which are designed to implement OOS.
- Estimate the relationship between the reduction of transportation cost and the commercial profit of business.

In this research We suppose the OOS business for Comsat as a theme of this research. The reason is that, there conditions of Comsat are suitable for OOS such as long operation time, structural resemblance, and so on.

Doing OOS, we suppose unmanned service satellite that has remote manipulator arm. Using it, we exchange the modular units of Comsat. Service satellite waits in GEO when first OOS is over and is used to multiple OOS missions. So, when doing following OOS, we need spare parts only.

In this model, total revenue is calculated by consideration of satellite development and manufacturing cost, launch cost, Comsat income and so on. These models are mainly based on the data of satellites developed before.

Using these data, we calculate the OOS method which gives the maximum total revenue. To optimize the revenue, we use Genetic Algorithm. In calculation parameters such as Comsat design life, Comsat's reliability, distance of OOS, OOS method (refuel, repair, extension) and etc. are optimized. Additionally, environmental factors such as launch cost, the number of Comsat, service cost, and etc. are considered.

Results are follows

- Using large number of Comsat, the mass of revenue increase and the cost of infrastructure such as service satellite manufacturing is eased.
- Using 200 Comsat, if transportation cost become 1/10, OOS get 10 B\$ revenue compare to existing method that renounce Comsat when its broken.
- Additional revenue comes from the increase of transponder and the cost reduction of additional launch.