

An idea to create a satellite with the capability to rescue

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Until now, satellite is considered by many to be an untouchable system once launched into space. That means we are unable to physically expand, repair or replace any component or sub-system, etc... once a satellite is operating in orbit. That is why satellites have been developed under very stringent design & production process using high-reliability hardware and qualification test to ensure them being able to work smoothly in harsh space environment for a long time without failure. The thing is, people can't manage all risks in space.

This paper suggests a solution which may help to repair a part of hardware problems or fulfil a request for system expansion after launching.

Any satellite is proposed to simply be equipped with a wireless connection port which supports inter-satellite link once requested. The main idea is how to apply it and design the satellite orbit. With this configuration, once this satellite needs:

to add more functions (networking, relay communication...) or increase capacity (adding more memory, data exchange with other satellites...); or

to replace the failed hardware such as data storage; downlink system (for example: space debris damaging the downlink antenna, or problem with the transmitter)...

We will launch a "rescue" satellite for instance a micro-satellite which is able to support the request system or the faulty system. This "rescue" satellite will connect to the "request" satellite via the inter-satellite link.

Here are some technical supports for this solution:

The "rescue" satellite will be launched into the same orbit, maybe as close as possible with the "request" satellite in order to reduce as much as possible the power of transmission of both satellites. That also means a simple and small antenna system is required (we can even use omnidirectional antenna). By the way, the distance and pointing direction between the two satellites is almost unchanged therefore the Doppler's effect is removed and the satellite pointing is easy. It also allows any wireless transmission technology such as that from Ka, Ku band and even optical communication to be easily applied, too.

Nowadays, many satellites have applied the SpaceWire standard due to its advantage of standardized interface, network protocol, link management..., as well as plug and play function. That means no new, expensive technology is required and standard system can be applied easily. It may just request some add-in protocols for this standard.

With this solution, my dream is that one day, satellites will be equipped with a small sub-system just like a PC equipped with a Wi-Fi or USB ports. Such inexpensive investment may create huge advantages to help the mission adapt to unforeseen requirements from a dynamic economy or increase the opportunity to recover from some serious satellite failures.

Keywords: micro satellite, repair and service in space, novel/pioneering mission