



Private space exploration: A new way for starting a spacefaring society?

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ABSTRACT

Since the beginning space was an exclusive domain of public organizations, the role of privates is becoming more and more important, and not only in commercial activities. However, the main international treaties dealing with this subject are still based on the assumption that space activities are mostly reserved to states. In the last decade the idea that the role of privates could include the management of space infrastructures and launch vehicles gained support and now private launch services are a reality. An even wider role of privates is now advocated and private exploration and exploitation missions are discussed. This requires that space activity in general can generate an attractive return and those business models are identified.

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1. Introduction

The model for space exploration, that prevailed since its beginning at the end of the 1950s, was based on a direct involvement of governments, through the military and, in most cases, through specifically created space agencies. There were many reasons for this, but the main one can be identified in the general climate of cold war in those years, the programmatic non-existence of a private sector in one of the two main actors (the Soviet Union) and perhaps also in the utter novelty of this enterprise, that led to forecast that the costs of exploring space were beyond the possibilities of any private organization. In addition, the technologies required for those early space missions were directly derived from military technologies and were mostly mastered by the armed forces (army, aeronautics and even navy) of the two main actors of the cold war [1].

In the beginning only the two superpowers, the US and the Soviet Union, could participate to what was called a 'space race' and for decades these were the only countries that had the capability of sending humans into space. Other

countries acquired the ability of sending payloads into orbit, like Italy, Great Britain and France, usually through agreements with the superpower 'of reference'. In the meantime other countries acquired this ability, like Indonesia, India, Japan and China, some of them developing their own launch systems, others using rockets manufactured abroad.

The space industry grew, with many actors entering into play, both for spacecraft and launcher construction and for the ability to perform all the complex operations needed to launch and operate satellites, by developing their own ground sector.

Space exploration beyond LEO (and GEO) remained mostly in the hands of the two main spacefaring countries, with later some contributions by Europe, through the European Space Agency. As a result, the main international treaties dealing with space activities were heavily influenced by the belief that states were the only actors in space and that exploration could be peaceful only if states refrained from claiming 'things' that exist beyond the Earth as their own, and from taking any sort of weapons in space. Everything of value existing there was to be considered as belonging to humankind in general, and should be exploited, if at all, in the interest of all humans.

The 1967 Outer Space Treaty, signed by all the then spacefaring countries, states significantly that the States

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shall bear international responsibility for national activities in outer space, whether such activities are carried on by governmental agencies or by non-governmental entities. The states must thus authorize and supervise those activities when they are performed by privates [2].

However, some governments did not sign the subsequent treaties, and there was no clear statement about who, or how, was in charge of enforcing them. The USA, for instance, did not ratify the so-called Moon Treaty of 1979 [3].

Actually, in the beginning this worked: none of the actors was interested in exploiting anything that was in space: the return of the huge investments was in terms of prestige and national pride and in the propaganda of the main actors the accent was laid on peace, advantages for all humans, etc. This did not prevent all of them from running many classified military missions and even trying to develop weapons that could destroy enemy satellites.

Space activity allowed the development of a space industry that, at least in the West, was private, but the governmental agencies (and the military) designed and managed directly the missions. Private companies built the hardware (launchers, spacecraft, ground equipment, etc.) at their specifications, with an autonomy mostly limited to strictly technical choices, and under strict control. When the Soviet Union collapsed, also the countries that were generated from it adopted the same model.

Slowly a new model started emerging. The idea was forwarded that space agencies were not to deal with all kinds of space activities, leaving industrial ones, like telecommunication satellites, but also meteorological and Earth resources satellites, to private companies, concentrating on their main business, namely science and exploration. The infrastructures and the launch vehicles remained however under strict control of the agencies.

In the 1990s the total budget of the private activities in space became greater than the total budget of space agencies. But these activities were confined to LEO and GEO.

2. The semi-private approach

The companies that performed commercial activities in space proved to have mastered the technology required not only to build and to operate satellites, but also to operate the required launch vehicles.

In general, the cost of launching a payload into orbit and of operating space systems was lower than the cost for performing the same activities in the 'old' public way and space commercial activities in Earth orbit proved to be profitable enough for a market to develop.

Later, starting with year 2000, the idea that also in science and exploration missions the space agencies should buy launch services from private companies emerged: transportation from the Earth surface to LEO should be operated by privates, with agencies 'buying tickets' from an 'orbital transportation company'. Launchers required for scientific and exploration missions are thus not only built, but also studied, designed and operated by privates.

NASA awarded Commercial Orbital Transportation Services (COTS) contracts to private companies, like Orbital Science Corp. and Space X, to demonstrate delivery of cargo to the International Space Station. In this way also science and exploration activities could benefit from the cost reduction due to the increase of commercial activities and to the better efficiency of private models in managing the access to space [4,5].

One of the reasons for this approach, that is at present gaining momentum, was the failure of the Space Shuttle in achieving the economical goals for which it was initially designed [6]. The idea behind the Shuttle was that a reusable spacecraft, managed by a space agency, could allow a substantial reduction in the cost of access to space, while increasing the overall launch capability. Both these goals could not be achieved, and the ageing fleet of space shuttles had to be retired, also because they proved to be less safe than it was hoped.

The return to the use of expendable rocket and the need of reducing the cost of satellization in spite of this, forced the American government to change its policy and to give incentives to privates to develop launch systems that could be operated outside the space agencies. At present this has proved to be feasible for unmanned missions, including carrying cargo to the ISS. The plans to qualify private launchers to carry humans are there and it is likely that this will follow in few years.

It is also likely that a similar way will be undertaken by other countries, at least those in which the private space sector is strong enough to allow to follow this path.

3. The private approach

There is, however, another approach that is suggested by many: exploration missions should be completely run by private enterprises, that decide their goals, recruit the crew (if any), build the equipment, operate the mission and finally own the outcome, of whichever nature it is.

This private way to exploration is possible only if the outcome of the mission is lucrative enough to justify the investments and the risks. This was, for instance, the case of the sea exploration journeys of the sixteenth century: the value of the spices brought back by the only ship of the Magellan's expedition that came back, for instance, did pay for all the money that was invested in the journey. But, in the near term, there are no resources equivalent to spices to bring back from space and so this way looked not viable for a long time. The advantages of this approach are at least two: a decrease in the cost of space exploration and, above all, the possibility of maintaining longer term engagements, without the frequent changes of objectives and priorities imposed by politics.

To make this approach to exploration possible two conditions are required: a decrease of the overall cost of space travel and the identification of business models with the related markets. These two conditions are however not sufficient: private exploration requires a legislative background and possibly a set of incentives, without which no private can invest in this business.

As already stated, the reduction of the cost of space travel is both a pre-requisite and an outcome of the

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