



# PROXIES IN SPACE

DILUTED ASSETS, AGILE STRATEGIES

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## OPENING REMARKS

Drawing on the observation of the current phenomenon of “proxisation” of space activities, the following paper proposes insights to analysing the mechanism supporting this deep change in space economies, strategies, and operations. Thus, it does not pretend to stand as a definitive and exhaustive treaty defining Space strategies forever. Furthermore, a specialist may find it not as accurate as it should be. However, it should be read as a tool for space-faring nations to identify lines of inquiry and paths for future action. Recommendations are listed to help space actors think about their current orientations, question their operating principles, and build their modern space strategies.

This paper tries to be as objective as possible. The organisations and companies highlighted should only be seen as examples illustrating a fact or strategy, in order to help understanding the theories presented. No judgements, criticisms, or approvals should be inferred from these examples, nor in the associations made. It should be mentioned here that data are quite easy to find when speaking of companies like *SpaceX*, but much harder for other organisations, particular those Russian and Chinese. Furthermore, the three authors do not belong to the Space Command, nor to the Air Force, or even to the Navy. They have, therefore, tried to share a vision “from the outside”, with a different background and with as little bias as possible. This outsider vision is interred to complement an insider’s view.

On behalf of the *Royal United Service Institute*, the team from the French War College (*Ecole de Guerre*) carried out research from September 2020 to March 2021. The first documents studied were the space-faring nations’ official Space strategies, and Space-related studies of think-tanks such as the RAND Corporation and CGSR. Works on the terrestrial proxy wars were also taken into account in order to investigate the proxisation mechanisms which could be transposed in Space. Interviews with researchers and Space organisations officials were also conducted. In any event, the arguments developed in this memoire are only those of the authors and do not represent the opinions of the *Ecole de Guerre*, the *RUSI*, or the specialists interviewed and quoted.

The team expresses its most sincere gratitude to all the people who helped writing this paper and designing the theories developed inside. We would like to thank in particular the British language Department of the *Ecole de Guerre*, notably Mrs Nicole Santiago, the supporting team of the *RUSI*, and M. Timothy Tawney from the NASA.

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The following code applies for the memoire:

- Grey boxes: intermediate sub-parts conclusions, what should be kept in mind to understand the argumentation;
- Red boxes: main parts conclusions, the core ideas, to be also found in the abstract;
- Diagrams: examples to illustrate the theories, or explanations of the mechanisms.

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After eight years in Tarbes, in 2015 he was posted to the Rapid Reaction Corp - France (a multinational NATO HQ) in Lille as Military Assistant to the Deputy to Chief of Staff for Operations. During his four years in Lille, he participated in several NATO exercises in France, Norway, Poland, and Bulgaria. Promoted to major in 2016, he was deployed six months in Brussels in the EU Military Staff in 2018.

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## ABSTRACT

Space activities have quickly evolved in the last decade. As a result, the rules of the Space game have been disrupted. The rising use of different types of proxies by States is one of the game changers.

Such a “proxisation” process will lead to a normalisation of Space as a strategic domain: an open field of confrontation where the level of violence will rise, but without risking a major escalation to a global conflict. A side effect is that a diluted proxied Space requires to accept uncertainty and an actual higher level of risks.

In this context, sponsor States need to handle carefully the relationships with proxies to keep it fruitful. Furthermore, they can rely on shadow proxies as well as on official proxies. Sponsor States need to balance the use of each of these proxies to adapt their strategies to the goals pursued.

Using shadow proxies is a way to reintroduce surprise and deception inside Space operations. Relying on official proxies allow the Beneficiary to improve the resilience of its systems. Thus, the different combinations of official and shadow proxies allow a wide array of strategies and courses of action.

In a fast-moving environment, space proxies can be considered as conditions to overcome adversaries in order to gain space supremacy, or at least space autonomy.

## EXECUTIVE SUMMARY

Since the beginning of the Space conquest, Space has always been a very singular place for strategic confrontations. First, Space is a viscous environment, from both a physical and strategic point of view. As a result, it has always been, and it is still, tricky to operate in and to implement efficient plans. In addition, Space services have been increasingly vital for the normal functioning of earth activities and even for the survival of many actors, including societies. Finally, it is a vicious domain of confrontation, as Space competitors with opposing interests, capabilities and ambitions are racing, in a race with very loose rules. Besides, we shall mention that the “fog of war” is also particularly dense in Space. Therefore, from a strategic point of view, **all the components to trigger a conflict in Space are present.**

Space activities have been quickly evolving for the last decade. As new actors emerge, new capacities are developed, and new objectives are identified, the rules of the Space game have been disrupted. **The rising use of different types of proxies in Space is one of the game changers.** Whereas Space was once the sole domain of States, space-faring States are increasingly relying on third parties to implement all or part of their Space strategies.

**This “proxisation” of Space is linked with the principle of “dilution”,** a multi-level course of action consisting in spreading one’s capabilities and structures in the different layers composing the “useful Space”. Dilution can be described as a permanent stance allowing the protection of capabilities, as a solution increasing the unpredictability of actions, and as a course of action allowing the concentration of efforts without physically concentrate the effectors. A dilution strategy can be more or less deep: from the upstream dilution (strategic level) mainly consisting in sharing risks and responsibilities with partners to conduct a space project, to the different types of downstream dilutions (operational level) consisting in hiding key capabilities in Space, inside dual platforms or in space communications and services.

**Such a process will lead to a normalisation of Space as a strategic domain:** an open field of confrontation where the general level of violence will definitively rise, but without risking a major escalation to a global conflict. A diluted proxied Space allow more agile, robust, and performing strategies but requires to accept uncertainty and a higher level of risks.

One of the major remaining difficulties will be to align both trajectories of the Beneficiary and of the Proxy long enough to reach the desired goals (as it is for the terrestrial proxy wars). The management of the proxy relationship should lead to a constructive synergy between both actors, and not to a sub-competition. To do so, and reach maximum performance, Beneficiaries will have to tailor their partnerships to meet their specific needs, while keeping a long-term perspective. **Beneficiaries shall also structure their Space strategy on two main pillars.** First, using shadow proxies is a way to counter the improvement of SSA and reintroduce surprise and deception inside space operations. Second, relying on official proxies allow the Beneficiary to share risks, and consequently to dare more, as well as to improve the resilience of its systems through the disaggregation of capabilities. Thus, a combination of official and shadow

proxies can allow a wide array of strategies and operational moves, more resiliency and more efficiency at the same time, in order to overtake space adversaries.

**Such a change will have side effects.** Of course, States relying on third parties must be prepared to accept that they must share, and perhaps lose, a part of their autonomy and sovereignty, and must mortgage their ability to reinternalize these capabilities later. The general rise of level of violence in Space may also generate higher functioning costs for Beneficiaries and Proxies, to fix or replace damaged assets. On the other hand, Beneficiaries and Proxies will create a synergy leading to a general rise of innovation and audacity for Space activities. In addition, relying on proxies for daily-life tasks may allow Beneficiaries (ie space agencies) to focus on great long-term projects for the sake of all humankind and nations' pride.

As a conclusion, it reveals interesting to model three main types of proxied Space strategies. A traditional one relies on national agencies and state-owned companies. It is a careful approach, with low risks, but also a limited effectiveness. Another one, from now on classic, relies on new-Space actors belonging to the same ecosystem. As it creates a real synergy between the Beneficiary State and its contractors, this strategy is far more agile and efficient. It is on the contrary limited by the “pressure” of the shared environment and rules, and could lead to a competition between the proxy and the Beneficiary on the long-term. Hence, an alternative “misleading” strategy, masking goals and mixing different types of proxies from different ecosystems, would reveal very efficient for space operations. Such a strategy requires to accept higher risks, reputational ones in particular.





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## 1. INTRODUCTION

According to Nicolas Baverez, from the French think tank *Institut Montaigne*, at least three threats have been underestimated during the elaboration of the French *Strategic Review of Defence and National Security 2017*<sup>1</sup>: “the Turkish aggressivity, the weaponization of space and the speed of the disintegration of the world order.”<sup>2</sup> Alongside important changes in international relationships, we can indeed observe that space is becoming a major issue; not a day goes by without a news about space exploration, space economy, space militarisation or any kind of other space-related issue.

Actually, space is now considered as a warfighting domain by western countries, and not just as a support for terrestrial operations, as it had been since the mid-fifties. The *US Space force* was created in December 2019, and French Air Force was been renamed *Armée de l’Air et de l’Espace* (Air and Space Force) in September 2020. However, despite some hostile, or seemingly hostile acts, and whereas space-based technologies are involved in every kind of conflicts on the ground, there has been, for now, no open conflict in Space. Maybe is it, as thinks Dr. Kestutis Paulauskas, former lead officer in charge of the development of NATO Space Policy, because “*a war in space is effectively unwinnable. Unless an irrational actor with anti-space capabilities would feel very disadvantaged and desperate, and would consider making space inoperable a victory*”<sup>3</sup>. This leads to wonder what is a space conflict.

In this document, we will deal with the phenomenon of “proxisation” of space activities, in the framework of a “space confrontation”. **We define space confrontation any kind of activity conducted in space or for space, by at least two actors having opposing interests and trying to impose its will to the other actor.** These opposing activities include warring activities (kinetic or non-kinetic actions), economic and diplomatic activities, influence and mediatization, shows of force etc. To reach a maximum performance, these activities need to be organised in space strategies (strategic level) and implemented in space operations (operational level). Taking into account the nature of space and space assets, we will consider that the operational and the tactical levels are currently merged in space.

If for States, space has been both an instrument of hard and soft power, since the beginning of space conquest, for the last two decades, we could also observe that private companies are more and more involved in this domain, in an autonomous manner. They have gone on being contractors for space powers as they used to be since the end of World War 2, but, in addition, they have developed their own agenda. For instance, Elon Musk, *SpaceX*’s CEO, plan to send people on Mars by 2026<sup>4</sup>, on his own. As a result,

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<sup>1</sup> <https://www.defense.gouv.fr/content/download/514686/8664672/file/2017-RS-PointsClesEN.pdf>

<sup>2</sup> <https://www.lesechos.fr/industrie-services/air-defense/defense-linstitut-montaigne-pointe-les-failles-des-armees-francaises-1288504>

<sup>3</sup> Dr Kestutis Paulauskas, *Space : NATO’s latest frontier*, March 2020

<sup>4</sup> <https://www.businessinsider.fr/us/musk-highly-confident-spacex-will-send-humans-to-mars-2026-2020-12>

private and public projects are increasingly intertwined, in the civil field as for Defence matters.

On the ground, States can rely on other States or private company to carry on all or part of their warring activities. It is what is called a “proxy warfare”. In space, private companies and sovereign space powers share space activities. They have interests, objectives, and sometimes assets in common. Thus, is it possible to establish some links between this situation and the proxy warfare on the ground? What would be the consequences of a “proxisation” of space activities?

**We argue that such a process will lead to a normalisation of space: an open field of confrontation where the general level of violence will definitively rise, but without risking a major escalation to a global conflict.**

As we will see, Space is not as transparent and fluid as we can imagine at first sight. Nowadays, States have no choice to rely on proxies for many aspects of space activities. Proxies should have a growing importance in the coming years, including in the military domain. This phenomenon would bring advantages and drawbacks, as it is for ground proxy warfare. However, as space is very specific, the proxy courses of actions, at strategic and operational level would also be specific: Proxies can be used openly, or secretly. A relevant combination of these uses benefits to space actors trying to reach maximum performance, at strategic and operational level.





## 2. SPACE IS VITAL, VISCOUS, AND VICIOUS.

As a first step, it is crucial to understand that space is a very specific place. Waging a war there requires to take into account important constraints and risks and to dispose of real technological capabilities. As a result, even if space is democratising, it is still a very selective place, with its own rules of the game.

All the elements presented hereafter shape the actors' perception of space, and, in particular, the way proxies can be used there.

### **2.a Space is vital to our modern societies.**

Almost all kind of services, essential to citizens and societies, states and companies, and any kind of organisations, are progressively relying on space-based systems. Maintaining operations of these systems is therefore critical. As a result, space is a very sensitive environment. What is at stake there justifies any type of strategy and course of action.

#### *2.a.1 Space-based services have become the backbone of civilian systems.*

Gradually, many applications found in space are more effective and innovative. First, positioning system brought a radical change to navigation-related domains, including transport, tracking, search and rescue, and agriculture. Synchronisation of time, necessary for GPS, also serves as reference for other applications, such as banking and electricity. Second, space-based assets allowed for the development of new ways of information communication technologies, resulting in an exponential increase of capabilities. Applications for environmental mapping, remote sensing, weather forecasting, and spatial sciences (e.g., earth/sun interactions, solar system exploration, astronomy, geodesy, and microgravity) have been developed simultaneously with space services. Of course, we must add spatial research (launching, Autonomous Rendezvous Technology, or comeback on earth) in order to make it possible. These domains are now partially covered by private actors.

**Space is everywhere in our societies** – an individual in western countries uses an average of 47 satellites daily<sup>5</sup> - and all these applications are to be multiplied in the future, especially with the advent of 5G. Indeed, 5G satellites permit a better security, a larger coverage and better capabilities, so much argument with the advent of Internet of Things (IoT) and Internet of Industrial Objects (IIoT) for example<sup>6</sup>.

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<sup>5</sup> Hearing of General Jean-Daniel Testé, French Joint Chief of space by the National Security commission and Armed Forces of the French National Assembly, report n°48, May 2016

<sup>6</sup> Illustrated by type of constellation such as the one to be deployed by Omnispace (first launch planned in 2021).

### 2.a.2 No military operations, or great superpower, without space services.

From the strategic to the tactical domain, and in peacetime as during war, space capabilities have a major role for the military. In the international framework of deterrence as it has gradually developed over the past 50 years, space assets have played a crucial role<sup>7</sup>. Supporters of nuclear power, disarmament advocates, and actors of Ballistic Missile Defense (BMD) systems have dealt with deterrence in space. However, this strategic aspect is supplemented by an important role in the informing decision-making. For instance, space-imagery has influenced NATO's decision-making in eastern Ukraine, and missiles launches can be detected. Mission planning also is concerned, for instance in terms of weather forecast. Then, **space is a crucial enabler** for command and control, in two dimensions: operational awareness (positioning, movement, targeting, tracking friendly forces) and communications. In addition, space capabilities are tremendous assets in operations. As early as *Operation Desert Storm* in 1991 – “the first space war”<sup>8</sup> – some researchers affirm that without a space capability to support the terrestrial warfighter, Iraq could change the course of history<sup>9</sup>. After that, air warfare in Kosovo revealed that GPS used for guided bombs was a decisive capability.

Many argue that space capabilities will be the first target in case of a future major conflict, further illustrating that assets in space are crucial. Frank A. Rose, senior fellow at the Brookings Institution, believes that “If NATO ever comes into a major conflict with Russia, one of Russia's first targets would be the alliance's space assets”<sup>10</sup>. In *Ghost Fleet: A Novel of the Next World War*, the authors speculate that the first act of an escalation between China and the United States will take place in space, in order to blind the enemy<sup>11</sup>. Recognising these realistic concerns, regarding its own vulnerabilities in the last operational domain, NATO focuses today on gaining resilience and sustainability of space capabilities.

From both a civilian and a military perspective, space services are vital for our domestic life and to our strategic policy. Being in space, directly or via third parties, and controlling assets there, is crucial for societies, states, companies and any kind of ambitious groups.

### **2.b The physics of space: a viscous environment from a technical point of view**

According to Lieutenant General John E. Shaw, deputy commander of US Space Force, “understanding the fundamental physics of the space environment is essential for

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<sup>7</sup> *Conquête spatiales et relations internationales*, Mme Isabelle SOURBES-VERGER, AFRI, Volume IX, 2008.

<sup>8</sup> Following the Persian Gulf War, U.S. Air Force Chief of Staff Merrill A. « Tony » McPeak declared that it has been « the first space war ». Craig Covault, « DesertStorm Reinforces Military Space Direction », *Aviation Week and Space Technology*, 8 April 1991, p.42

<sup>9</sup> *Not Ready for the First Space War What about the Second?*, Lieutenant Colonel J.Briger, U.S. Air Force.

<sup>10</sup> *NATO and outer space: Now what?* April, 22, 2020.

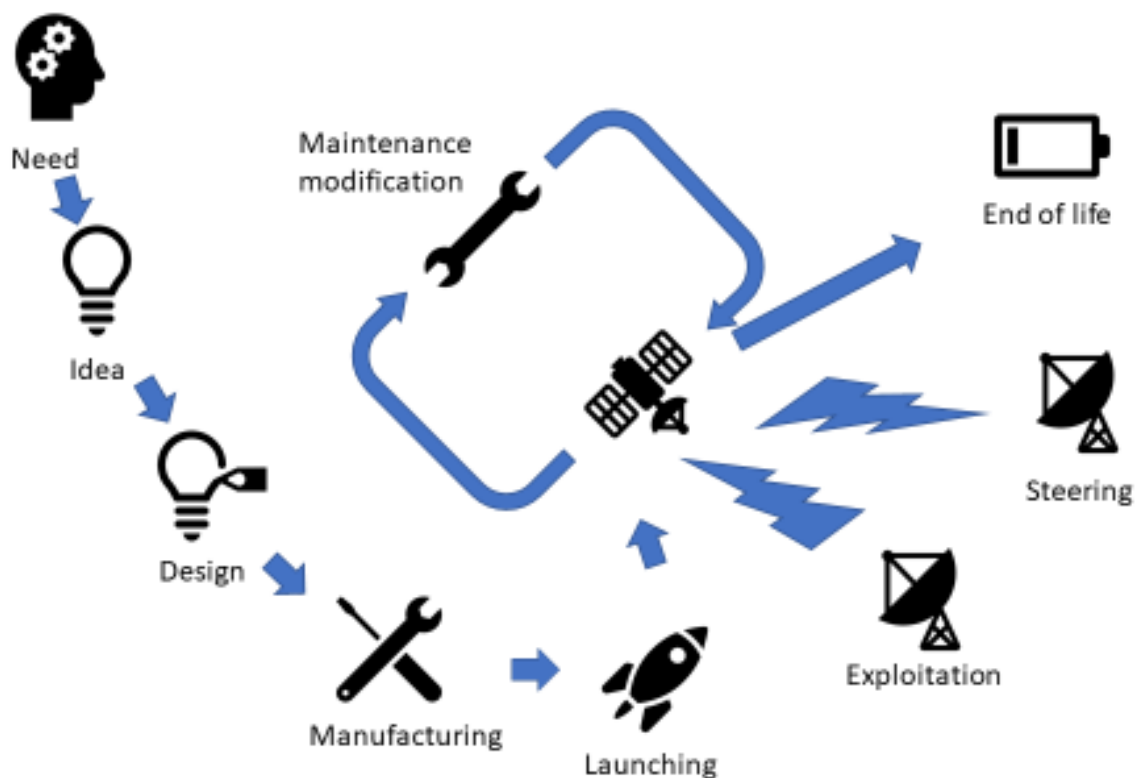
<sup>11</sup> *Ghost Fleet: a Novel of the Next World War*, P.W. Singer and August Cole, Ed. Mariner, 2016.

anyone who would seek to also understand how to properly use and control space”<sup>12</sup>. The physics of space imposes its rules on all space actors, narrowing the choices of courses of actions and strategies. As a result, relying on proxies becomes an option relevant faster than on terrestrial conflicts. Therefore, the following paragraphs will introduce some basic concepts and notions.

Artificial objects in space can be divided in two categories: satellites and spatial ships. **Satellites** are **submitted to physical laws** and follow an orbital trajectory around other celestial bodies (e.g., planets, asteroids, and stars). **Spatial ships** (e.g., rockets and probes) have to travel in space. **These objects need to escape gravity**.

In order to guarantee safety and efficiency of space missions, it is necessary to have a proper view of both natural and artificial celestial bodies. This global view is called the **space situation awareness (SSA)**.

#### The life of a satellite.



#### *2.b.1 Physics of orbits: severely narrowing the terrain.*

An orbit is the trajectory followed by a celestial object or a satellite gravitating around the sun or a planet<sup>13</sup>. Simply put, an orbital trajectory is due to the compensation of

<sup>12</sup> *Whither space power*, p73.

<sup>13</sup> Definition from [www.universalis-edu.com](http://www.universalis-edu.com).

centrifugal forces, linked to the speed of the considered object, by the force of gravity. Other forces exist, but a full knowledge is not required to understand our point. Most of the artificial objects follows *Keplerian orbits*<sup>14</sup>, which are elliptic or circular.

Depending on the purpose of the satellites, three main parameters have to be considered. First, a satellite speed depends on its **altitudes** and **eccentricity** (circular or elliptic). In addition, the **inclination** of the trajectory (difference of the satellite's trajectory plane with the equatorial plane). The combination of these parameters will determine the ground trace of the satellite. The ground trace is the projection of the satellite's orbit onto the surface of the Earth (or other celestial body), and therefore, define the part of the earth covered by the satellite.



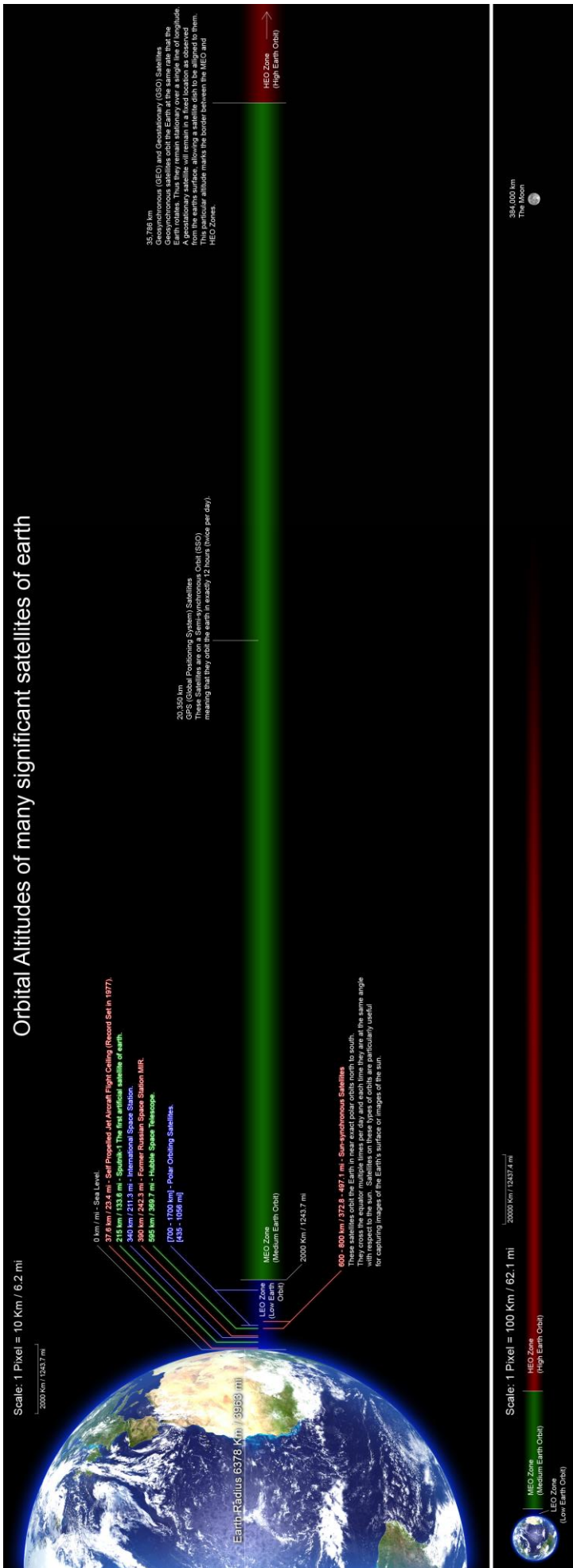
Representation of a *Molniya* orbit and its ground trace, used by Russian communication satellites.

The nearer the satellite is to Earth, the faster it goes. This means that the satellite spent a very short time in the south hemisphere, and an important part of its revolution (Hour 4 to 8) where it is useful. At least 3 satellites are required to cover permanently the appropriate location. Launching a satellite in *Molniya* orbit is cheaper and easier than a geostationary satellite, but it requires much more control during its exploitation.

Following page: representation of the different satellites' orbits.

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<sup>14</sup> Orbit of a spatial object in gravitational interaction with one other object, each object considered as a point. Orbits of planets and artificial satellites could be considered as keplerian by neglecting small forces.



### *2.b.2 Fighting against gravity: an adversary before the adversary.*

There are two main steps to put a payload in orbit. First, it must be raised above the earth's atmosphere using a vessel. Then, once it reaches the expected altitude, the payload must acquire proper angle and speed in order to start its revolution around Earth (or other celestial object). After that, the satellite will need to correct regularly its trajectory, affected by external forces. Energy is mandatory to conduct all this steps.

Once again, details are very technical, but **a lot of energy is required to launch satellite**. For instance, in order to launch four *Galileo* satellites (payload: 2952kg, altitude: 22900km), the rocket *Ariane 5* weighed 760 tons at launch. Of that, 423 tons were propellants!<sup>15</sup> Of course, the weight of the payload depends on the target altitude.

Furthermore, **the whole rocket is disposable**, consequently causing space pollution. Even if alternative solutions are currently explored, such as Space X reusable launch system or air launch to orbit system, it is easy to understand that launching a satellite is both very expensive and energy consuming. Therefore, some space actors have no choice but rely on other actors, proxies, to launch a satellite, since they do not master this skill.

Finally, it is important to stress that only **a small part of the satellite is dedicated to its purpose** (such as camera for earth observation). Solar panel, infrastructure and, once again, propellants used to correct trajectory, are the biggest parts of the satellite.

### *2.b.3 A very harsh place: the first stage of attrition.*

**Fighting gravity is only the first step. Once in outer space, satellites, and human activities need to face other difficulties.** One is the extreme temperatures, both cold and hot. Radiation caused by solar flares can affect long-range radio communications or cause errors in GPS. High-energy particles can also penetrate inside satellites and disrupt sensitive electronics. Of course, it is possible to reinforce satellites, but this impacts the overall weight, therefore increasing the payload, the price, and so on. These particles can be trapped in the Earth magnetic field and are concentrated in the *Van Allen* radiation belts, between 640 and 58000km above the Earth. Consequently, satellites and humans travelling through the *Van Allen* belts are exposed to potential radiations. This must be taken in account, especially if a spatial object spends a lot of time there.

Waste is not the only kinetic threat in space. Natural objects, including asteroids and other space objects, are also threats to all human activities in space. As a result, these natural phenomena have to be considered in the SSA, as we are only able to observe and predict some of them. Therefore, on a scientific and technical point of view, space presents many challenges. It is a hostile environment and it requires both very technical skills and economic capacities to operate in.

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<sup>15</sup> Press kit mission VA244, july 2018



#### *2.b.4 The Kessler syndrome and SSA: few courses of actions at tactical level.*

A satellite has a limited lifetime. Therefore, at end of life, a satellite needs to be disposed in order to not saturate useful orbits. Waste in space is a real problem: each object in orbit is a potential threat to satellites. In addition, each collision could create dozens more pieces of waste, inducing a chain reaction, therefore saturating an orbit, and preventing its use for commercial or military purposes. This phenomenon is called the *Kessler syndrome*. Among other reasons, **the Kessler syndrome contributed to preventing space powers from developing kinetic weapons in space to date.**

To prevent this syndrome, **SSA is vital**. The purpose of SSA is to keep tracks of objects in orbit and to predict their trajectories. It allows the scheduled launching of satellites, but also modification of trajectories in order to avoid collision. SSA is harder and harder since the satellites number is rocketing, and space objects can now modify their trajectory. Furthermore, even a small object can have tremendous effect. Following objects require specific assets, such as ground radar or satellites dedicated to this task. It also requires specific capabilities to deal with the huge amount of data generated by SSA. With SSA improvement, we also can expect it will be harder and harder to hide an object or an activity. If a space actor wants to act discreetly, he will have to develop new tactics and procedures, which will be described later.

As a physical environment, space is very constraining. Despite the seeming lack of natural obstacles and despite its apparent homogeneity, space is a very viscous place to operate in, as the law of physics cannot be overlooked. Before overcoming an adversary, artificial objects belonging to any actor, have to overcome the environment. For space actors, it means to be able to access high technologies, to master a wide range of skills, and to spend large amounts of money in conducting space activities. Proxies are a performing way to do so.

#### **2.c. The weight of the initial purpose of space as a strategic environment: nuclear deterrence.**

Space, as a field of activities and confrontations, is also defined by its specific history. The current strategic perception of space is still largely influenced by the origins of space strategies. Apart from industrial subcontractors working for the “old space”, proxies were not used in space in the 20<sup>th</sup> century. This section shows therefore how new a proxy war in space is.

##### *2.c.1 The first space age dedicated to nuclear deterrence<sup>16</sup>.*

During what is called the “first space age”<sup>17</sup>, from the first orbit of the Sputnik-I in 1957 until the fall of the Soviet Union in 1990, only the two great superpowers, the USA and

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<sup>16</sup> *Conquête spatiale et relations internationales*, Isabelle Sourbès-Verger. AFRI, Volume IX, 2008.

<sup>17</sup> *Escalation and Deterrence in the Second Space Age*, Center for Strategic and International Studies, October 2017.

the USSR, competed for space and in space. For both of them, it was not only a matter of fame and pride, but also of survival. Both space powers focused almost exclusively on the military use of space. As a matter of fact, the major part of space assets were deployed either to directly build nuclear deterrence capabilities, such as pre-conflict intelligence, early warning of ICBM launches, continuity of nuclear Command and Control, or to test new dual technologies participating indirectly or in a second time in improving nuclear capabilities. Hence, we could say that the first space age was a period of equilibrium and clarity: as almost every satellite had a role in the nuclear deterrence, **the principles of deterrence applied for all activities in space.**<sup>18</sup>

### *2.c.2 No armed confrontation in space to date.*

Despite the role of space in deterrence, no warring activities were conducted in space during this period. The two superpowers developed a range of counterspace capabilities, namely: nuclear weapons to destroy all satellites in the line of sights (for example, the *Starfish* prime nuclear test in 1962); ground-based or co-orbital anti-satellite (ASAT) systems able to target a specific satellite in low-earth orbit (LEO); and manoeuvrable space vehicles with offensive capabilities, as the *Project SAINT* in 1959, or the *Air-Launched Miniature Vehicle* (ALMV) project in the early eighties.

However, all these trials were part of the greater competition game, which had implicitly-agreed upon informal rules between the two nuclear superpowers. Both of them were acting beyond an identified threshold, but within acknowledged boundaries and according to predictable patterns. In the end, competition activities in space were not attempts to gain superiority, but proofs of a limited superiority already acquired in the nuclear field of confrontation. Thus, **space strategies were simple, sequential, and immovable**, limited to the support of a terrestrial weaponisation<sup>19</sup> (a first phase dedicated to the hidden development of capabilities, then to a show-off phase demonstrating the level reached, and finally to the implementation of the new capacities in space) and to retaliation strategies based on an “all-or-none” principle and formal or informal thresholds.

### *2.c.3 Space strategies deeply influenced by the static vision of space.*

This first period deeply influenced space strategists’ minds. Throughout the decades, together with the implementation of a large variety of powerful assets aiming at increasing State’s power on earth, a kind of strategic paralysis dampened the development of innovative and dynamic courses of action in space. Some theorists<sup>20</sup> say that “the taboos of nuclear war have had a spillover effect into a taboo on space”<sup>21</sup>. **As closer space (orbits around earth, if not Lagrange points) was inextricably**

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<sup>18</sup> This rule does not apply for some nuclear States such as France. See reference no. 1.

<sup>19</sup> *La militarisation de l’espace, quels enjeux pour aujourd’hui et demain ?*

<sup>20</sup> *Deterrence and First Strike Stability in Space*, Forest Morgan, RAND Corp., 2010.

<sup>21</sup> *Deterring Space war, An Exploratory Analysis Incorporating Prospect Theory Into a Game Theoretic Model of Space Warfare*, RAND Corp, 2017.

**associated to space nuclear assets, it turned to be considered as a sanctuary, a no-action zone**, especially in the United States.

In the nineties and the early 21<sup>st</sup> century, during the beginning of “the second space age”<sup>22</sup>, this perception of space as the last sanctuary was maintained and even reinforced by the common understanding of the importance, vulnerability, price (development and launching), and reduced number of every kind of space assets (civil or military).

The historic trajectory of space as the keystone of nuclear deterrence played an important role in narrowing the range of possibilities concerning recent available space strategic options. As a strategic domain and environment, space appears again as a foggy place. Space actors have to start from scratch in defining their operational strategies in space; no guideline is currently available. This is particularly true for strategies and courses of actions relying on proxies.

## **2.d. The space players: an evolving landscape making space a vicious place.**

If nuclear deterrence had a structural impact on the strategic perception of space, so did the status of forces between the actors having access to space. In the current space era, not only space faring States access space: middle powers can directly or indirectly go in space and use it for developing and protecting their interests while independent private actors are sometimes able to master all the segments of space activities. This phenomenon makes possible many combinations between actors, opening the road to “proxisation” processes.

### *2.d.1 The second space age: renewed accessibility to space for a wider array of actors.*

Since 1960, many actors gained access to space. First, an increased number of States have progressively become able to place assets in orbit, alongside with the United States, Russia or China. We could name the United-Kingdom, France or India of course, as well as Japan, Israel or the UAE. Not all these States master the full range of space capabilities (from the building of rockets to the day-to-day exploitation of specialized satellites), but **a growing number of state actors are present in space through their national space agencies** or via regional space organisations such as the European Space Agency.

**In addition to the national space agencies, some States, like China, rely on state-owned enterprises (SOE)** to carry on their space activities, while others sign contracts with private companies (like SpaceX and its *Falcon 9* rockets and *Dragon* ships to send cargo to the ISS, and then its *Dragon crew* to send humans in orbits). In any case, many independent actors, in addition to states, are now present in space.

Moreover, some countries see the exploration and exploitation of space as an opportunity. For instance, Luxembourg has no intent to join the physical actors in space.

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<sup>22</sup> See reference n°2.

However, he tries to make the most of the new projects of other actors, such as Space Act, for his economy. Indeed, Luxembourg has published a law regarding space activities and exploitation of space, and has attracted numerous companies linked with space, on its national soil. Others countries joined a program in order to develop their R&D and knowledge. Obviously, whatever the case, it is a win-win situation: the leader will take the opportunity to pull the cover in terms of legislation for example<sup>23</sup>.

**There are several consequences of such a diversification of the actors present in space.** First, in most cases, States remain the masters of space activities, in particular those who developed a “vision” for space, like China or the USA. However, they can act indirectly through different types of proxies. In addition, “commercial firms developed space capabilities in areas that were once dominated by government such as high resolution satellite imagery, signal intelligence or SSA”<sup>24</sup>. In some cases, these commercial firms developed their own goals and strategies, as independents gamers. So could do other non-governmental organizations, of any kind.

#### *2.d.2 The unquestionable supremacy of the United States in space.*

At present, **the only country that could claim a global space dominance<sup>25</sup> are the United States.** Seeking power and pride through space<sup>26</sup> since the end of the Second World War, the American nation has been carrying out irregular but massive efforts to gain and retain its *hegemon* in space, from the competition with USSR to the current international multiple rivalry between states. This space leadership has meant to be the first to set a capability up, and to remain the strongest in all the segments of activities and fields of confrontations.

There is no doubt the United States is has unequalled investments<sup>27</sup> (for 2021, the NASA is supposed to receive more than \$25Mds<sup>28</sup>), an unrivalled fleet (more than 1,300 American satellites are orbiting), real prestige (e.g., NASA is known all over the world and used as a brand for a whole range of derived products), and both civil and military capabilities (almost \$40Mds are dedicated to the military space sector each year, or 7% of the Defence budget<sup>29</sup>). The United States implements long-term, symbolic, stargazing, and pride-related programs (like *Project Artemis and Perseverance Mission*), while developing commercial, short-term, earth-dedicated, and money-led actions (such as SpaceX deploying the *Starlink constellation* for commercial purpose),

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<sup>23</sup> Artemis accords for instance.

<sup>24</sup> *Escalation and Deterrence in the Second Space Age*, CSIS, 2017.

<sup>25</sup> *Stratégie spatiale, continuité et évolutions du programme spatial militaire français*, Groupe de Recherche et d'Information sur la paix et la sécurité (GRIP), 2020.

<sup>26</sup> *Le leadership américain et l'espace : la recherche de la puissance et de la gloire*, John Logsdon, Hermès La revue, 2002.

<sup>27</sup> *L'Evolution du contexte spatial américain*, Xavier Pasco, Défense et Industries, Juin 2019.

<sup>28</sup> *Le spatial, grand gagnant du budget fédéral américain ?*, Pierre-François Mouriaux for Air et Cosmos, Feb 2020.

<sup>29</sup> *La puissance spatiale américaine*, Diplomatie magazine, page 55, 2020.

as well as a full-range, consistent and powerful military space force, to support operation on earth and to carry out operations in space (see the *X-37B* project).

**The United States can rely on a robust space industry, both from “old space” and “new space”:** the traditional ex-monopolistic giant companies such as Boeing or Lockheed Martin<sup>30</sup>, which are very resilient and reliable, and what is called the “New Space” start-ups such as SpaceX, Orbital ATK, or Blue Origins. The New Space should speed USA’s capabilities and strategies up, through reduced costs (launching SpaceX’s *Falcon Heavy* rocket would cost \$150M whereas a single launch of Boeing’s *SLS* would cost \$1500M), disruptive technologies (SpaceX’s reusable launchers for example) and new ways of thinking. The structure of American space industries offers the USA the possibility to react very quickly to a sudden evolution of the strategic situation and are therefore a power asset.

#### *2.d.3 Outsider states’ growing ambitions.*

In the second space age, thanks to the diffusion of technologies and declining prices, many countries want to use space as a support to their international ambitions. They design their space strategies to acquire or regain international status and fame (soft space power strategy), and/or to back a global power strategy up (hard space power strategy).

**China has shown great ambitions and achieved much in space in the last 50 years:** human in orbit in the *Shenzhou* vehicle in 2003, *Tiangong-1* orbiting laboratory in 2011, deorbiting of *Tiangong-2* in 2019, *Tianwen-1* mission to Mars *Chang’e-5* mission to the Moon in 2020, as well as mastery of Autonomous Rendezvous Technology (ART) and permanent laboratory orbiting in LEO planned for 2022. It recently made great progresses in its heavy launching technologies, in addition to its expertise in microelectronics. Space is line of its strategy for global supremacy in 2049, mirroring and challenging the USA’s domination strategy. It is important to stress that China is looking at the moon, mars and other celestial objects the same way it is looking on the Sea of China. To this day, its foreseen pre-eminence in space has been centrally built through state agencies like the *China National Space Agency* (CNSA) and the *State Administration for Science, Technology and Industry* (SATSIND), and SOEs<sup>31</sup> like the *China Aerospace Science and Technology Corporation* (CASC) and the *China Aerospace Science and Industry Corporation* (CASIC)<sup>32</sup>. The *People’s Liberation Army* (PLA) also plays a major role in the implementation of space activities, mainly through the *Department for Space Systems* (DSS). However, the Chinese government tries to develop a real private commercial space sector to enhance innovation and economic growth<sup>33</sup> (to this day, only 78 private space companies have been listed).

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<sup>30</sup> Associated in 2006 in the ULA (United Launch Alliance) joint-venture.

<sup>31</sup> *Evaluation of China’s commercial space sector*, IDA science and technology policy institute, 2019.

<sup>32</sup> *Chine, puissance dominante de l’espace*, Marc Julienne for Diplomatie magazine, 2020.

<sup>33</sup> *Document 60, Guided Opinion of the State Council on Innovating the Investment and Financing Mechanism in Key Areas and Encouraging social Investment*, Chinese government, 2014.

Up to now, Russia, mostly thanks to its space agencies, has been capitalising on its historical expertise to stay in the race, mainly through its launching capabilities used by other countries<sup>34</sup> (from *Star city* for the training of astronauts, to the *Proton* rocket and *Soyouz* vehicle, via *Baikonur* and *Plestetsk* launching facilities). However, **Russia, as a state actor, is losing its central role in space conquest.** In addition to a harsh international competition, this evolution stems from its limited budget (around \$2.5Mds) and the dependency on foreign customers to augment its budget (\$80M to be paid by other nations to send one astronaut in orbit), a lack of national ambition, few national needs (only 170 Russian satellites orbiting) and a loss of skills (manufacturing defects recently observed on the *Proton* launcher)<sup>35</sup>. Nevertheless, Russia developed a large range of military courses of actions in space, including shadow hacking of adversaries' orbiting satellites and orbital manoeuvres. For Russia, space is a field of confrontation, where it can show it is still part of the game, even if it is via independent groups. In the space domain, this country may seek punctual victories, with limited implications. Russia is now a "poor (space) power"<sup>36</sup> which will focus on military space to set partnerships with allies like China.

Some interesting changes should finally be noticed here. First, in India, the 2019 ASAT shooting and the creation of a Defence Space Agency are a turning point for this country, as it shows a brand new interest for military space. Second, the United Arab Emirates launched in 2020 a space probe to Mars, as a sign of its accelerated development in space<sup>37</sup>.

It is reasonable to say that **States are currently racing for space.** Some of them, like China or Russia, want not only to show their strength but also to gain a unilateral advantage in some segments to contest the USA its global supremacy in space. Others, like France or Europe, just want not to be left behind and be part of the game. Thanks to a strong space tradition and expertise, these countries mimic the USA and try to develop smaller-scaled capabilities in every segments.

#### *2.d.4 New technologies toward a further democratisation of space.*

Development of private capacities and new technologies, such as the Space X reusable rockets or air launch to orbit systems, and also artificial intelligence, will **provide agilities to space powers, but will also allow new actors to operate in space.** In addition, satellite constellations are also a way to develop new or alternative capabilities. For instance, three geostationary satellites are required to cover the earth, or hundreds of micro-satellites, easier and cheaper to produce and to launch.

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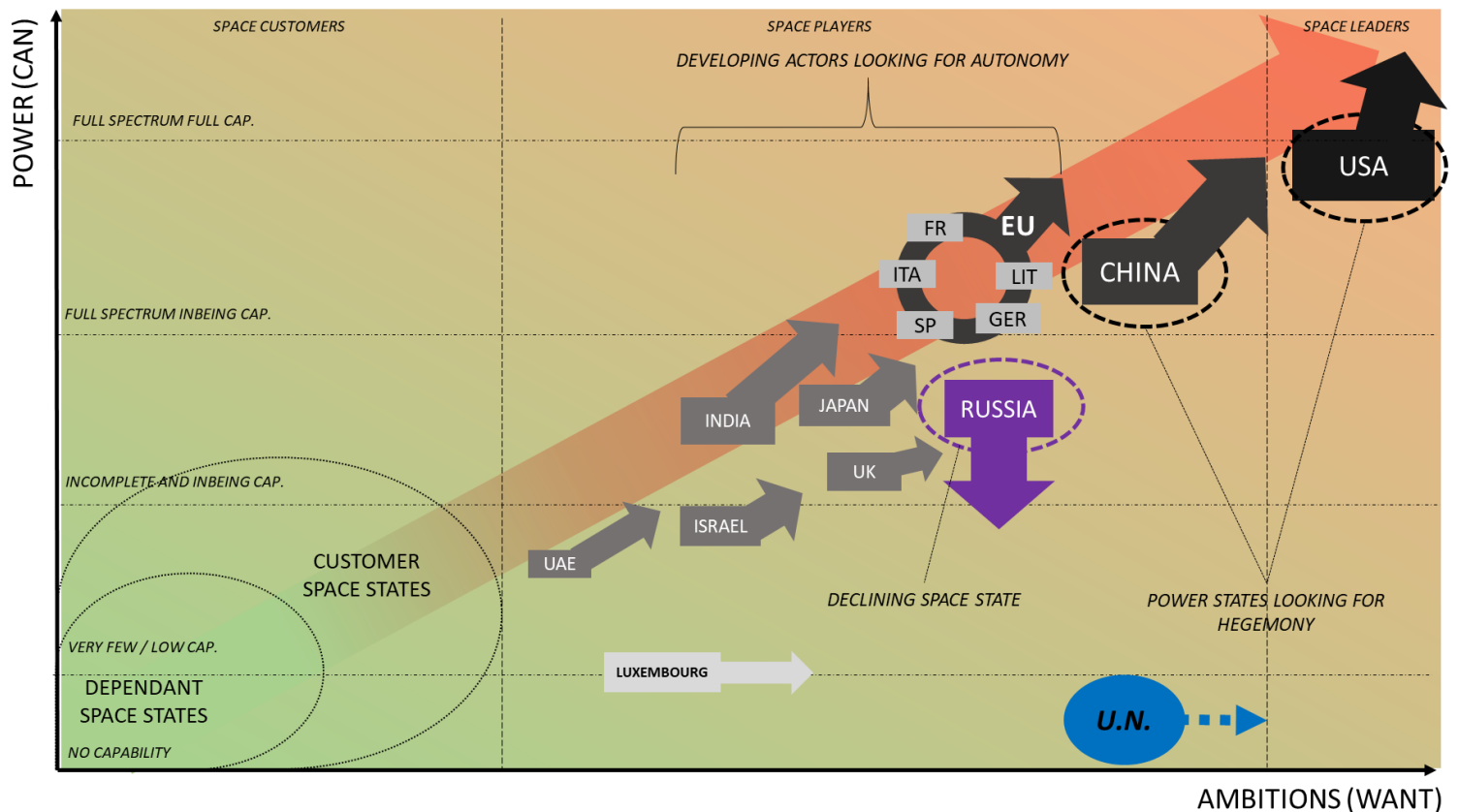
<sup>34</sup> *La Russie en quête d'une politique spatiale*, Diplomatie magazine 2020, Isabelle Sourbès-Verger.

<sup>35</sup> Ibid.

<sup>36</sup> Id.

<sup>37</sup> *Les Emirats Arabes Unis et l'Espace : un développement accéléré pour une stratégie aux objectifs multiples*, Florence Gaillard-Sborowsky for Diplomatie magazine, 2020.

## Space States : a quickly-evolving landscape.



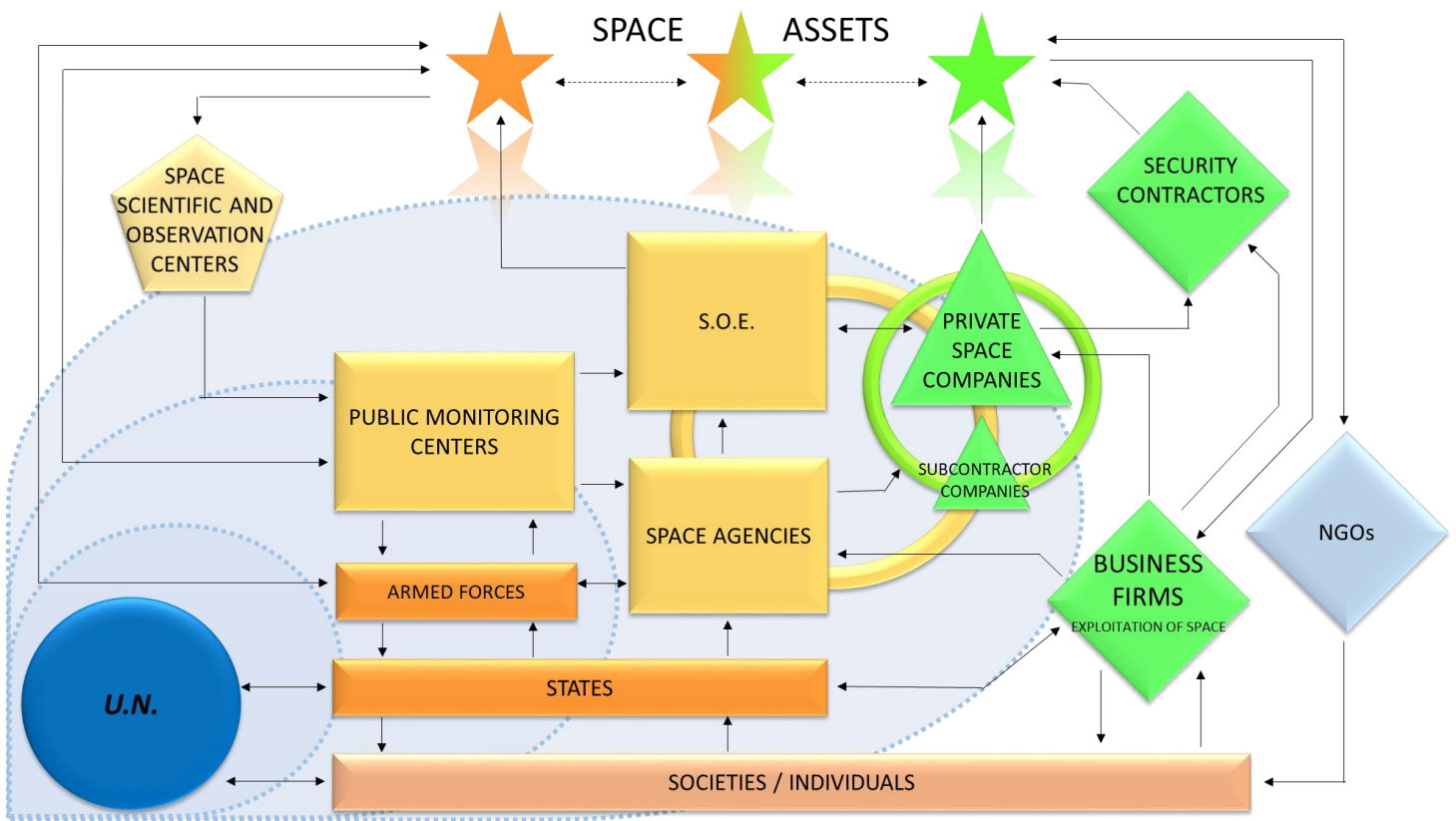
Within the EU, there are various ambitions: some countries, such as France, Italy, Germany, are pushing for national capabilities.

To rank space powers two main criteria have been used:

- the ability to be truly autonomous regarding space activities. On a true autonomous prospective, space States need to master the following segments of activities:
  - to be able to fully build and test satellites;
  - to be able to launch assets in space;
  - to control its own navigation system;
  - to dispose of an own communication network;
  - to be able to observe earth and space (SSA).
- the development of scientific or ambitious pride-related programs such as space exploration or human space program.



### Space actors: a complex eco-system.



Space is getting more diverse and disordered because of the proliferation of space capabilities to very different types of actors: States, amongst which the untouchable dominator, the ambitious outsiders, the cash-strapped experts, Companies, either SOE or private companies, either steady solid firms or dynamic start-ups, and Organizations of different types. Multiple agendas are therefore confronting in space, making it a vicious place. These multiple agendas are currently under pressure, as space is polarized by the USA's power. Besides, depending on the merging or diverging interest of space actors, they can combine their actions in very different ways, opening the door to proxy relationships.

### **2.e. A very loose legal framework, making space an even more vicious place**

In order to avoid an escalation in space, concerned countries tried to build a common framework of what is forbidden. That said, we are unlikely to face a kinetic escalation in space. Indeed, Chinese and Russian investment in space capabilities should make them also increasingly dependent on space, and this domain could be considered as a mutually-assured destruction (see the *Kessler syndrome* in 2b3). As a result, the Law of Armed Conflict would not be relevant. But others new challenges and opportunities enforce diplomacy to think about defining more precisely what is the legal context for space activities.

### 2.e.1 From the Outer-Space Treaty (OST)...

During the Cold War, Russia and the United States signed the Outer Space Treaty (OST) to avoid an escalation in space. The Treaty limited the arms race, excluding a prepositioning of weapons of mass destruction in space, and arguing for a pacific use of space. However, **without a clear definition of a weapon, this Treaty is no longer up to date**. Indeed, the pacific use of space does not imply no weapon in space: even a debris could be considered as a weapon. Another aspect of this Treaty is the non-national ownership of space. Nevertheless, space resources can be considered as celestial body, or not like in the Space Act of 2015. It is obviously a questionable notion.

Several tries to reach a new international treaty (e.g., *Moon Treaty* in 1979, several *PAROS* documents since 1978), have been rejected by one or more big actors in space or does not have a binding character. Only treaties regarding secondary questions have been issued successfully, such as satellites' registration in 1975 and telecommunications in 1986.

### 2.e.2 ... to a mix of hard and soft law, representing the first confrontation field in space.

**Since 1978, and since 1985 officially inside the Conference of Disarmament, countries have not managed to reach an agreement** inside the *PAROS* Committee. The last draft submitted by Russia and China in 2008, the *Prevention of the Placement of Weapons in Outer Space Treaty* (PPWT) did not succeed because of two main factors: there was no definition of weapon and the situation was not favorable: shadow and foggy programs were developed, but also visible actions such as the Chinese ASAT launch in 2007. France, for example, advocates a prohibition of ASAT systems, whereas China and Russia put forward a prohibition of stationing weapons in space. Since 2010, the impact of the *PAROS* Committee has decreased in the face of these obstacles, but national legislations are gradually emerging with this state of affairs.

Given the divergent legal starting points of view of the countries, and the need due for civilian capabilities, **the soft law covers de facto the gap**. Last year, China submitted set of guidelines for the development of launch vehicles in the growing commercial sector<sup>38</sup>. EEAS attempts to start over with 3SOS (*Safety, Security and Sustainability in Outer Space*), ESA is in the same way with his Clean Space initiative. Moreover, this year NASA finalized with the nation states in the *Artemis program* the *Artemis Agreements*. We can see that **there are many initiatives in different domains**: commercial aerospace enterprises, sustainability, resources, arsenalisation, and so on. However, there is no consensus, even if the *United Nations Committee on the Peaceful Uses of Outer Space* (UNCOPUOS) work on it.

In this context, it is crucial for the actors to reinforce their capability domain, in order to have something strong to deal with. According to *The Independant*, SpaceX plans “to

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<sup>38</sup>Spacenews, Andrew Jones, July 2, 2019.

makes his own law to Mars”<sup>39</sup>. Anyhow, US could have something to say regarding this issue. As a result, we can say that **without some strong legal policy, the space law will be tantamount to the jungle law.**

### *2.e.3 The example of space congestion.*

In 2009, the collision between two satellites caused the dispersion of thousands of debris into outer space. Every space power is aware that the preservation of orbits is mandatory in order to be able to exploit space. January, 24 2021, SpaceX launched more than 140 satellites, using a Falcon 9 rockets. It is interesting to note that a wide variety of customers used this mean, from NASA to Starlink, passing by a various number of companies, the main issue of this kind of launching is obviously the congestion of orbits.

These facts underline the necessity to legislate both satellites launching and responsibility regarding debris and risks of collision. Indeed, if a lot of countries take actions to prevent debris creation, there is no international law or agreement. USA for instance follow the *Orbital Debris Mitigation Standard Practice*<sup>40</sup>, an 8 pages document describing some mitigation good-practice. France seems to be the only country to inscribe in his law responsibility regarding space pollution.<sup>41</sup> The international concerns lead to the creation in 1993 of the *Inter-agency Space Debris Coordination Committee* (IADC).

However, even if China is an IADC member since its creation, it did not prevent them to launch an ASAT missile 13 January 2007, causing a dramatic increasing amount of space debris into outer space.

Space congestion is nothing but an example among others. If with existing structures and common objectives, good will and non-binding commitments are not enough to be efficient for space regulation, it seems very difficult to imagine that space powers will be able to agree on a set of rules and norms when it does not. The simple fact that there is no universal definition of Outer Space, even in the 1967 treaty, shows that it is quiet hard to define global norms in space. The same issue exists about the definition of an aggressive act or hostile activity in space.<sup>42</sup> What could be the criterion? Distance? Ability of a satellite to maneuver? Known capabilities of a satellite? Each country will probably answer these questions differently depending on their history and culture of war.

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<sup>39</sup> Anthony Cuthbertson in a article of october 2020 quote the governing law section “For services provided on Mars, or in transit to Mars via Starship or other colonisation spacecraft, the parties recognise Mars as a free planet and that no Earth-based government has authority or sovereignty over Martian activities... Accordingly, disputes will be settled through self-governing principles, established in good faith, at the time of Martian settlement.”

<sup>40</sup>

[https://orbitaldebris.jsc.nasa.gov/library/usg\\_orbital\\_debris\\_mitigation\\_standard\\_practices\\_november\\_2019.pdf](https://orbitaldebris.jsc.nasa.gov/library/usg_orbital_debris_mitigation_standard_practices_november_2019.pdf)

<sup>41</sup> <https://www.legifrance.gouv.fr/affichTexte.do?cidTexte=JORFTEXT000018931380>

<sup>42</sup> <https://rusieurope.eu/publication/rusi-defence-systems/catch-me-if-you-can-challenges-orbital-rendezvous-and-proximity>

On a legal point of view, space is more or less a free zone. Space treaties only offer a loose legal framework which can be interpreted in different ways by space actors, according to their own plans. The legal framework can therefore be considered as a “combustion agent” for space crisis.

## **2.f Conclusion on space: a new paradise for crisis?**

Space is a very singular place for strategic confrontations. **First, it is vital.** It means that every strategic actor will need to be in space, will try to get an advantage there on its competitors, and will take the risk of an open conflict to protect its assets. **Second, it is viscous** on a physical and strategic point of view. As a result, it is tricky to operate in and to implement efficient plans. In addition, the “fog of war” is particularly dense in space. **Finally, it is vicious** as many actors with opposing interests, capabilities and ambitions are racing under the surveillance of the American superpower, jealous to remain the game master. And this race is a race with no rules.

On a strategic point of view, space has become a strategic mix ready to burn or burst if the game rules are not changed.

In addition, all the conditions for the implementation of proxy warfare are gathered: harsh environment requiring money to act in, multiple possibilities for associating with different kinds of actors, new technologies allowing a wider range of courses of actions, and last but not least much to gain or to lose.

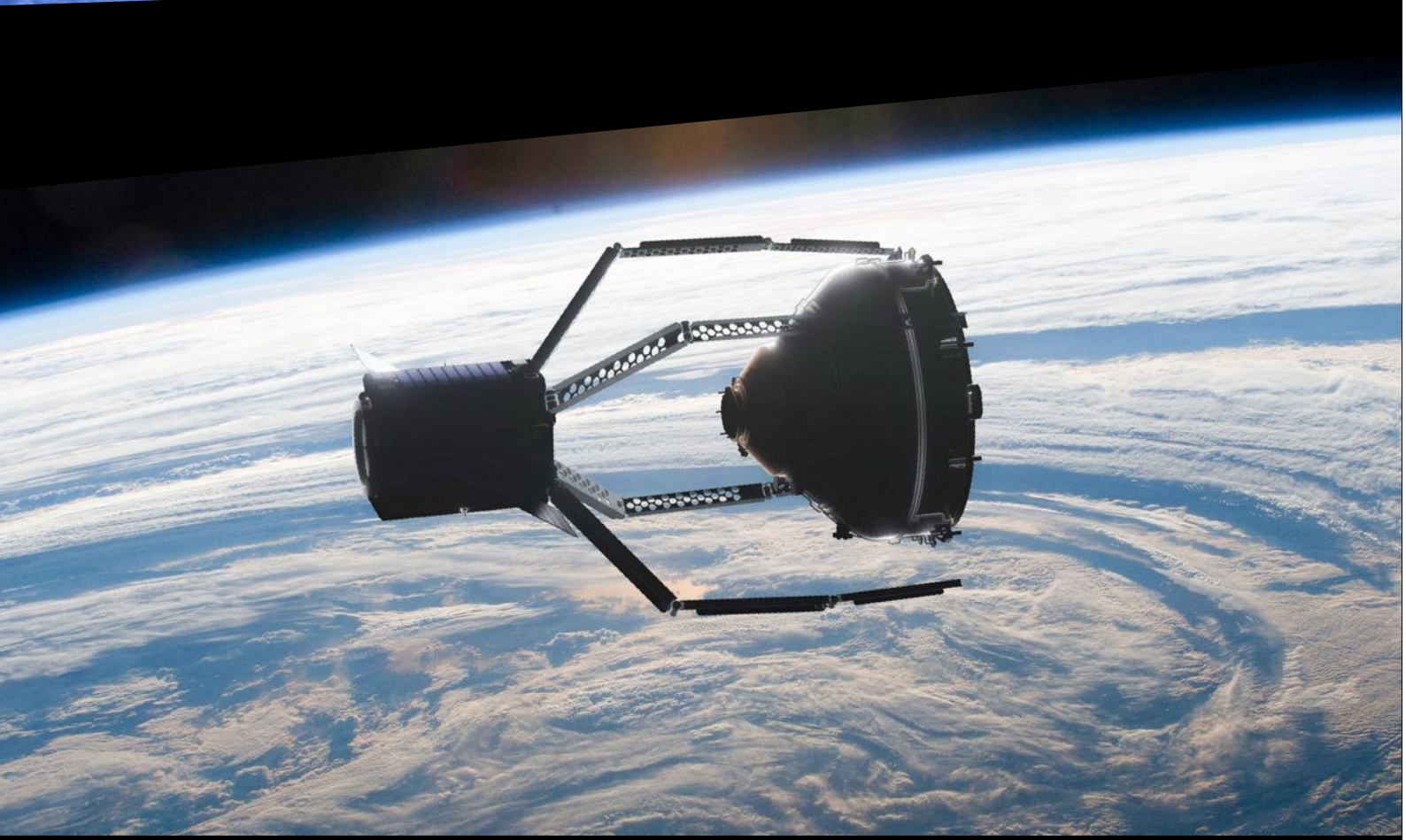
### **Nota bene :**

When speaking of space operations, we use the same semantics as when speaking of terrestrial operations. Hence, we divide space activities in three levels:

- The strategic level is a global level including all fields of activities. It is framed by a strategy: a long-term plan linking a current state to an end-state sought by top authorities (government / executive board...). A strategy converts political guidance in a series of combined operations.
- The operational level is the level of the theatre of operation. The operational level converts the strategic orientations in tactical effects to be reached on each battlefield/domain/environment of the theatre, on a mid-term perspective. It ensures therefore the convergence and combination of these tactical effects to reach operational objectives, which are a part of the global strategy.
- The tactical level is the level of the battlefield. It generates effects on the short-term, in one domain/environment and participate in reaching multi-domain operational objectives.

**The nature of Space and Space activities allow to distinguish the strategic level and the operational level. However, the tactical level and the operational level are merged, superimposed. In the following parts, we will only speak of “Space activities” framed by “Space strategies”, and “Space operations”, framed by “Space operational plans” and “Space tactics” (courses of actions).**





### 3. THE “PROXY WAR” HAS ALREADY BEGUN IN SPACE.

In such a hostile and tricky environment, with such high stakes, space powers became aware that they needed to develop new strategies not to be downgraded. It appeared that one of the best ways to maintain or increase its rank and capabilities in space was to outpace adversaries in the development of new courses of actions and technologies (both are closely linked in space, as an “emergent” field of confrontation). **Fast meant agile. For old and state-owned firms and agencies, agility was to be found outside the organisation.** Cooperation with lower-level partners was born: the proxy relationship was to enter in space.

Being agile in space means quickly finding solutions to react in front of the general upgradability of the strategic environment. In order to react fast to these changes, generated either by adversaries or by the environment, space actors need to be able to shift from a strategy to another, using a wide array of courses of action, from the most conventional one to most disruptive one. **Using proxies, with different backgrounds, with different ways of thinking, with lower risk exposure and a lot to gain from a partnership is one of the most effective way to become more agile.**

Of course, such a process comes with advantages and drawbacks. The question is: are space proxies a risk or an opportunity in the development of space activities?

#### 3.a General ideas on the proxy war and its translation into space.

##### *3.a.1 Historical overview of proxy wars.*

A proxy war could be defined as “a violent armed interaction resulting from the polarization of competing political goals between two organised parties, a beneficiary and a target, in which at least one party engages the other indirectly in sustained collective violence through a third party, the Proxy.”<sup>43</sup>

States have used third parties to fulfil their objectives for a long time. The third of the Thirty-Six Stratagems say more or less the same: “kill with a borrowed knife”.<sup>44</sup> For instance, during the first century, half of the manpower of the Roman empire was composed by the Auxilia. Composed of non-Roman citizens, organised and lead by Roman officers, these troops were supposed to support the Imperial Roman army, even if in fact, they were conducting almost the same missions. However, the Auxilia defended part of the *limes*, where no Roman troops was deployed. Thereby, Roman legion was able to focus on strategic operations or areas.<sup>45</sup> Mercenaries could be considered as proxies as well. Corsairs are also a kind of proxies, but analogy with naval strategies will be developed in a coming paragraph.

More recently, during the Cold War, the USA and Russia were often opposed either directly or, more frequently, through proxies. Each actor was trying to extend its

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<sup>43</sup>Vladimir Rauta, ‘A Structural-Relational Analysis of Party Dynamics in Proxy Wars’, p. 457.

<sup>44</sup> <https://chinesereferenceshelf.brillonline.com/grand-ricci/files/36-stratagemes.pdf>

<sup>45</sup> [https://www.penseemiliterre.fr/la-guerre-par-procuration-1-2\\_560\\_1013077.html](https://www.penseemiliterre.fr/la-guerre-par-procuration-1-2_560_1013077.html)

influence in the world, and was supporting third parties, by providing money, weapons, training, direct military support, or whatever their need. Each war in Afghanistan could illustrate this concept.

We can expect various effects from proxies. According to Vladimir Rauta, **proxy wars are “waged for both maximalist, coercive goals as well as for discrete, conservative goals such as the management of (parts of) complex issues.”**<sup>46</sup> Nowadays, proxies are used by many states, in every warfighting domain. Armies use private military companies, such as the US company Academy, the British Aegis Defences Service, or the Russian company Wagner. Cyber-attacks also can be conducted either by governmental or civilian groups on behalf of a state. Even the “train and equip” doctrine could be assimilated to proxy warfare. Indeed, by training and equipping some armies, Western countries can achieve strategical objectives. In this case, the trained army is the proxy.

Of course, due to the utmost importance of space and its applications in civilian, commercial and military domains, there is no reason to not expect the presence of proxies in space. In fact, we believe that, thanks to the whole range of advantages they offer, it is arguably a perfect place for them to be deployed and used.

Proxies have always been used, at different level, and for various objectives, in every warfighting domains. With space becoming more and more accessible (a warfighting domain like others, but also a place of economic warfare), there is no wonder to see the multiplication of proxies in this area.

### *3.a.2 Definition of a space proxy.*

**There are three categories of proxies: covert, overt and ‘grey’.** The first type, called *shadow proxies*, are “underground” and hidden. It is generally the case in cyberspace domain for instance. On the contrary, a state can use a proxy in an open way. Finally, in some case, proxies can evolve in a “grey zone”: everybody know who is behind, but the beneficiary don’t acknowledge this use (annexation of Crimea in 2014 for instance).

There is no universal definition for proxy, as the definition is related to the context. But simply put, a proxy is an actor involved in another’s actor project. The proxy can have a direct interest (money, fame...) or a hidden agenda, but its implication is not free.

Until now, there has been no war nor open military conflict in space. Therefore, the proxy war definition given by Rauta cannot be applied to space *in extenso*. However, space is more and more considered as a warfighting domain. Every space power is working on ASAT capabilities, either kinetic or non-kinetic. In addition, it is a fact that a lot of military capabilities are space-related. There is a militarisation of space.<sup>47</sup>

But space is also a theatre of economic and information war, between states, but also between states and private corporations, and obviously, between private corporations. For instance, launching a satellite is no longer a sovereign capability. Each launcher

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<sup>46</sup> Vladimir Rauta (2020) Proxy Warfare and the Future of Conflict: Take Two, The RUSI Journal, 165:2, 1-10, DOI: 10.1080/03071847.2020.1736437

<sup>47</sup> [https://swfound.org/media/206970/swf\\_counterspace2020\\_electronic\\_final.pdf](https://swfound.org/media/206970/swf_counterspace2020_electronic_final.pdf)



tries to be attractive in order to make a profit. As a result, the less competitive launchers could disappear in a near future. Mega constellations of satellites illustrate commercial war between big corporation, with some winners (e.g., SpaceX's Starlink), some losers (e.g., Oneweb), and challengers (e.g., Amazon's Kuiper).

Because of that, a very broad definition seems required in order to speak about proxies in space. That's why in this paper, the following definition will be adopted:

**A space proxy is an external state or non-state actor, conducting at least one task of a space related operation, on behalf of another state or non-state actor, the "beneficiary". The task conducted aims at reaching a specific objective (end-state, audience...), named the "target".**

Example of a proxiation of space activities:



Mars Hope is a mission set up by the UAE space agency. The Jaxa was used as a proxy, since the probe was launched by a H-2A Japanese rocket. The target is the international scientific community since all results and information collected will be available.

### 3.a.3 The extreme specialisation of space actors: a global reliance on proxies.

With this definition in mind, every space actor could, at one point, be considered as a space proxy. **There are, indeed, very few actors fully autonomous regarding space operations**, and it is becoming truer and truer.

Before the "new space", each space power was able to think, plan, and launch space operations by itself. Most of the companies involved in manufacturing were state-owned. For instance, *Asterix*, the first French satellite was built by *Matra* and launched by *Diamant*, a rocket built by *Nord et Sud aviation*. All these companies were public. The mission was planned and conducted by the CNES<sup>48</sup>. French government had every actor involved in this mission under its command.

Nowadays, the only space actor fully autonomous regarding space operation is probably *SpaceX*. Indeed, this corporation master the whole range of capacities required to design, plan and conduct a space operation.

<sup>48</sup> Centre National des Etudes Spatiales, French National Center for Space Studies.

French *Pleiades* Satellite is a perfect example of how proxies are nowadays mandatory in space operations. Pleiades is a “2 satellites constellation” used for earth observation. It is a dual system, which meets the space imagery requirements of European countries defence but also civil and commercial need. First it is a French-italian project, launched in 2003 with the CNES as the overall system prime contractor, and *EADS Astrium* as the prime contractor for the space segment. The two satellites were launched by Russian rocket *Soyouz* from the French spatial centre of Kourou, in French Guyana. There are four ground receiving station, two for defence in France and Spain, and two for civilian purposes, in Toulouse (France) and Kiruna (Sweden). Imagery produced by Pleiades satellites are used for military purposes and exploited by different European countries (France, Spain, Italy) but also a wide range of civilian activities such as land planning, agriculture, maritime and littoral surveillance, ... Finally, *Pleiades* satellites was bought by United Arabic Emirates and Morocco.<sup>49</sup>

If *Pleiades* is a perfect illustration of how a lot of actor can be intertwined when it comes to space operations, and therefore to proxies use in space, it is obviously far from an isolated case.

Since there is almost no space actor who master the whole range of space operations, the call for proxies is mandatory, even when it comes to defence issues.

### **3.b The principle of “dilution”: the key part of the proxy war in space.**

The features of the environment shape the conflicts that take place inside: these features offer a limited array of possibilities to the warring parties. In other words, they design opportunities and restraints at the tactical, the operational and the strategic levels. Space is a very constraining place, but it is constraining for all the actors operating there. **The objective of the space proxy war is to turn the constraints in opportunities in order to overcome an adversary. To reach this goal, a proxy war in space will be based on the general principle of “dilution”.**

We have to mention that there is a double causal chain between the proxy, the effector, and the dilution, the process, or course of action. To be effective, a proxisation strategy of space activities relies on dilution, while dilution requires to use proxies to be possible. Effectors and course of action are therefore tightly intertwined: both of them are making the other possible. As it is not possible to analyses the proxisation process without analysis the dilution process, it is mandatory to start explaining first what dilution is.

#### *3.b.1 What is the principle of dilution?*

Usually, the “dilution” is literally the “process or action of making something less strong or valuable”<sup>50</sup>, or the “progressive depletion of strength by dispersion or erasement”<sup>51</sup>. If we only consider these rough definitions describing the physical phenomenon of a

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<sup>49</sup> <https://pleiades.cnes.fr/fr>

<sup>50</sup> Definition from the Cambridge dictionary.

<sup>51</sup> Definition translated from the Larousse dictionary.

material diluting inside a liquid, it could seem counterintuitive to apply it to a strategic choice in a conflict. A warring party would not deliberately choose to “weaken” its capabilities in order to reach its goals in space, against other actors. Such a choice would apparently be absurd: usually, warring means trying to get stronger than the adversary does, either globally or at chosen place and time.

However, in this specific case, to understand the meaning of the concept of *dilution*, we should consider it as the opposite of the concept of *concentration*. As an operational concept, *concentration* means temporarily gathering a large amount of strength to outpace an adversary at specific place and time, and consequently defeat him either tactically or operationally. On the contrary, *dilution* means dispersing strength in a space as wide as possible, before any hostile action. Thus, the *dilution* it is not a matter of depleting the global size of the strength, but is related to the way **you split your strength, in order to permanently inactivate an adversary’s concentration of strength. In a way, dilution is mirroring concentration.**

As a warfare concept, *dilution* is:

- a **permanent stance** allowing the **protection** of capabilities, by weakening the effects of an opponents’ concentration of efforts;
- a **solution** to increase the fog of war to one’s benefit through the **unpredictability** of assets’ positions and actions, and the **uncertainty** of the Beneficiary’s goals;
- and a **course of action** allowing **concentration** of efforts (and fires) without physically concentrate.

“*Space dilution*” is a multi-level course of action consisting in spreading one’s capabilities in space, using the structure of the environment/domain to protect and hide before, during and after an offensive action. It is made possible by the original structure of space, the specifications of space services and the capacities of space assets.

### *3.b.2 A Russian doll called Space Dilution.*

Space is both a domain and an environment. To understand the “useful space”, we shall see it as composed of multiple layers interconnected with each other. **Four main layers structure the “useful space”.**

First, **the different useful orbits and places on which the assets are located can be considered as the areal and geographical layer.** Space, considered as an operating environment, is not homogeneous: it is like a sea with multiple surfaces: the orbiting trajectories (LEO, MEO, GEO), and inter-surfaces depths between these exploited orbits. In addition, some specific points are regarded as strategical, like the Lagrange points. They are like heights overhanging the sea. Besides, the American strategist John M. Collins explains that “*who rules closer space commands earth; who rules the moon commands closer space; who rule L4 and L5 (Lagrange points) commands the earth-moon system*”. Finally, farther, outer space is an infinite ocean depth, with no real bed: other celestial bodies’ orbits could be considered as punctual beds.

Acting in the first layer means physically moving from a place to another.

**A second layer consists in the deployed hardware** (e.g., satellites, ships, shuttles, vehicles). These assets are at the same time operational units moving and acting in the first layer and the medium for the third layer, the space services. The smallest unbreakable operational permanent unit in space is the satellite. Strength in space relies therefore on a physical net of satellites. This net can be dense or sparse, though delivering the same level of services.

Acting in the second layer means playing on the platforms (e.g. shifting, duplicating, sharing).

**Space services are the third layer:** they include space to space capabilities and space to earth ones. Through the perception of States, companies and societies, space is only seen as a service supplier. Its only existence is linked with these services. Maintaining, disrupting or modifying these services is enough to win in space.

Basically, these services are transported by waves (in and out signals). Acting in the third layer is acting on the signals received and sent by satellites.

In addition to these three layers located in space, **a fourth layer is to be considered: all the entities and activities acting on earth for space.** The useful space is completely dependent on earth for the development of capacities and their permanent support, once deployed in space. This terrestrial part of the useful space is, at the same time, a vulnerability as it is easier to strike, and an asset for resilience as it is easier to protect. The usual terrestrial rules apply in the fourth layer.

There are many ways, mainly organisational, of acting in the fourth layer.

Consequently, on a theoretical point of view, **you can apply the principle of dilution in the four layers.** The roles of proxies in the dilution process will be developed in another further section.

It is possible to **dilute your assets in the geographical layer**, hiding assets in the depth of the space-ocean. For this purpose, it is possible to take advantage of less monitored areas, to use artificial space objects to screen an asset, or to conceal behind natural space masks (celestial bodies such as the moon). The implementation of stealth and dormant assets is also one course of action.

This is the *downstream positioning dilution (DPD)*. Proxies are one actor among others to be able to implement this type of dilution. The DPD mainly requires technological skills as it relies on the gap between its own hiding capabilities and the adversaries' SSA capabilities. These skills can be acquired thanks to proxies, or on a beneficiary's own.

It is also possible to **dilute your capabilities in the second layer.** To that end, you can shift from a sparse net of massive assets to a dense one with smaller satellites, or you can design a multilevel dilution strategy with redundant assets deployed simultaneously in suborbital areas, LEO, MEO and GEO (or through light launches to suborbital altitude, or balloons, on very short notice). Diluting in the second layer can also be achieved by hiding specific capabilities inside a satellite conducting another mission,

and relying on dual technologies and assets, or through sharing assets with other Nations.

This is the *downstream hard dilution (DHD)*. Proxies should be considered as DHD enablers, as it will be much easier to implement such a dilution through proxies than on a beneficiary's own.

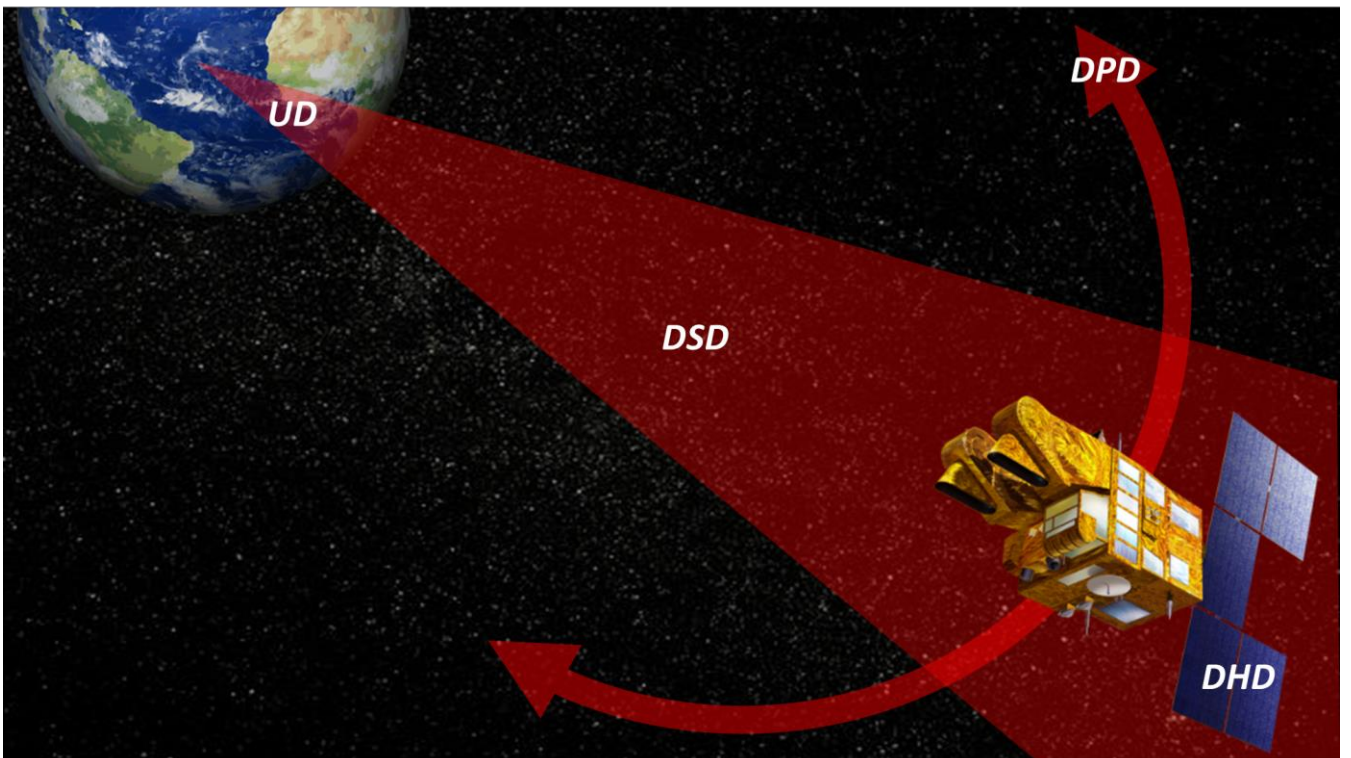
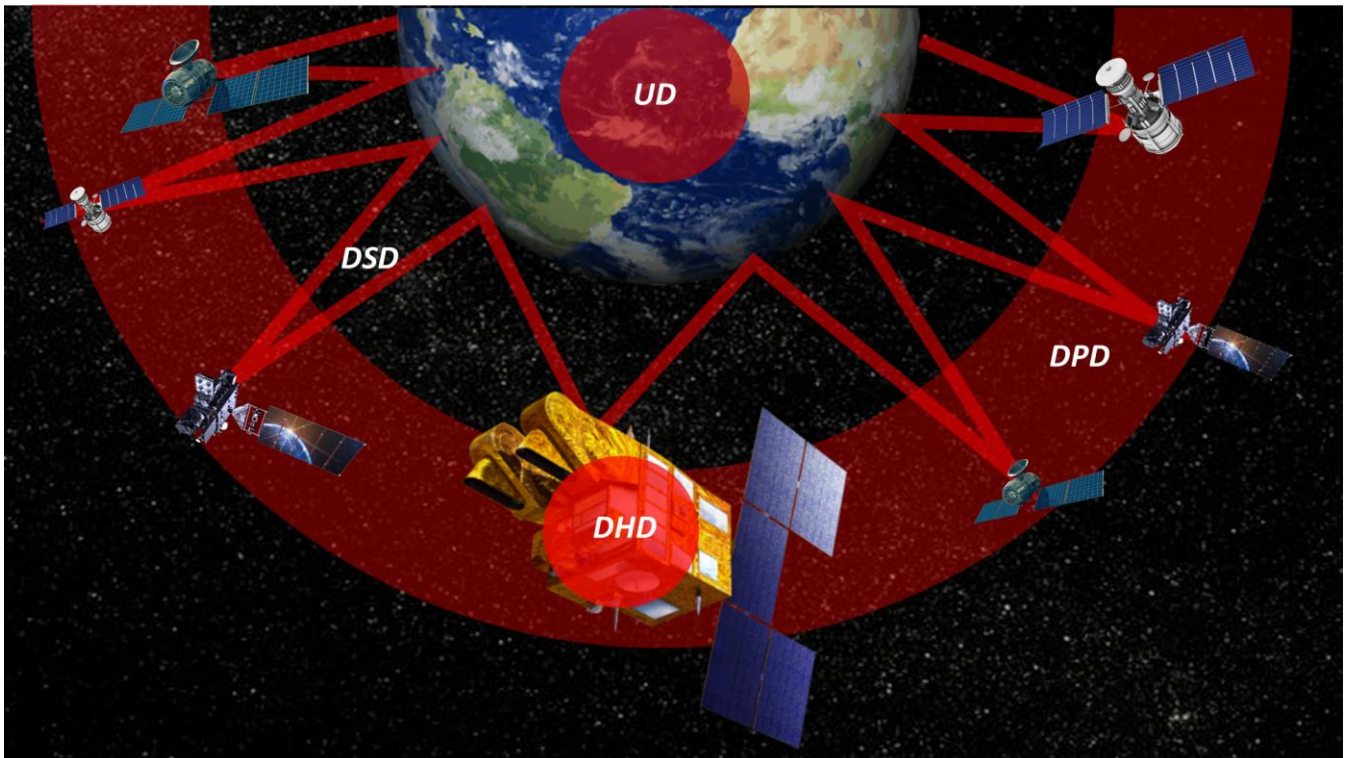
You can **dilute your action in the third layer**, by temporarily redirecting a service thanks to multi-purpose satellites (native dilution of assets' specificities), or to use a wide net of receptors on the ground. It is also possible to consider the hacking of these services as a dilution, as it is a way to overtake an adversary remotely, hiding one's attack in the usual data flow.

This is the *downstream soft dilution (DSD)*. Proxies are a major asset allowing the DSD: they should be considered as the main executor for this kind of dilution.

Finally, **you can dilute your organisation in the fourth layer**. This kind of dilution is closely linked with the need to balance the risks associated with space activities. You can dilute the financial risks of a space project by sharing responsibilities with "associated" actors, such as R&D projects, relying on externalisation of some fields of activities... You can also dilute the direct retaliation risks by using contractors ("front" companies, shadow organisations...).

This is the *upstream dilution (UD)*. Proxies are at the heart of the UD. Without Proxies, no UD.

Following page: the deep dilution in the four layers (two different views).



When considering space proxy strategies, we can imagine several forms of dilution in each layer “usable space” is composed of: an upstream dilution before sending the assets and three types of downstream dilutions on the field. Of course, a multilayer dilution strategy is possible, and suitable. It would allow a deeper dilution and maximise its effects.

### 3.b.3 Analogy to maritime strategy

Though limited, the analogy with strategies at the sea enlightens the specifications of space strategies in general and of the principle of dilution in particular. As it was observed in the 18<sup>th</sup> century for naval warfare, three types of space wars can be theorized<sup>52</sup>. The “war for space supremacy”, evolution of the “*guerre d’escadre*” (military ships attacking military ships), would aim at gaining the control of space. The “war from space against earth” would reinvent the “*guerre de côte*” (military ships attacking an opponent’s land and harbours) and would mainly result in an arsenalisation of space. The “war for space communications”, a new “*guerre de course*” (corsairs attacking merchant ships) would mean focusing on the “celestial communication lines”<sup>53</sup> as a major stake. These types of war were linked with specific naval strategies: offensive conventional direct strategies (OCDS) for the “*guerre d’escadre*”, offensive conventional indirect strategies (OCIS) for the “*guerre de côte*” and offensive unconventional indirect strategies (OUIS) for the “*guerre de course*”.

Of course, it has already been proven that the analogy with naval strategies is not absolutely relevant to understand space strategies, as it cannot embrace the breadth of space strategies<sup>54</sup>. As a matter of fact, naval strategies only focus on offensive “means and methods of employing force at sea to achieve national goals while increasing national power and prestige”<sup>55</sup>.

However, the **maritime strategy**<sup>56</sup> - a wider approach than the naval strategy - offers some interesting keys to think on space. In his book, Julian Corbett explains that the value of the sea is the means of communication it offers, which are vital for Nations. For space, it means that **the main target of space strategies will be the up and down data flows**, as they are at the same time the way to control satellites and the power source of space actors, on earth. In this context, dispersing “cruisers” in distant operating areas allows a maritime power to control the routes of communications without being physically present on it, since they are hidden and therefore unpredictable (an adversary would consider the cruisers can be everywhere). When needed, these cruisers would

<sup>52</sup> *La mesure de la force, traité de stratégie de l’Ecole de Guerre*, M. Motte, J.O. Soutou, O. Zajac, J. de Lespinois, chapter on space strategies.

<sup>53</sup> *Space warfare*, John Klein, 2006.

<sup>54</sup> *Corbett in Orbit, a Maritime Model for Strategic Space Theory*, Naval War college review, 2004.

<sup>55</sup> *Id.*

<sup>56</sup> *Some Principles of Maritime Strategy*, Julian Corbett, 1918.



deliver limited battles, or converge and be concentrated for a major battle. This phenomenon is even greater in space as **the dispersion of assets will ensure their physical protection while keeping the capability to concentrate firepower or other destructive effects without physically concentrate.**

The comparison with submarine strategies is also interesting. When leaving for its patrol, a SSBN (nuclear powered - ballistic missile submersible ship) will “dilute” in the ocean as fast as possible. It means that as time goes by since the moment the SSBN dived, the possible locations where it could be found are exponentially increasing and the possibility for an adversary to find it is exponentially decreasing. Meanwhile, the SSBN can strike any target on earth at any time. The SSBN strategy can be compared to the “*downstream positional dilution*” in space. There indeed, a satellite can stay hidden for a very long time in the geographical layer as explained in para. 3.b.2 and strike when needed any target in space, either remotely (non-kinetic physical attack, electronic attack, cyber attack) or closely (any type of attack).

For classic naval strategies, proxies were only used for the “*guerre de course*”, as a convenient way for States to share costs and risks with corsairs (improvement of the advantages/risks balance). However, the principle of dilution was already applying to all the strategies at the sea, as Corbett theorized it and as the dilution strategy of the SSBN embodies it. Modern space strategies will borrow to these maritime strategies the principle of dilution. Nevertheless, it will associate more closely this course of action with the proxies. Thanks to a deep dilution, space proxies could be used not only for the “*guerre de course*” but also for the “*guerre d’escadre*”, the “*guerre de côte*” and other types of space warfare, in every layers.

### **3.c Risks and drawbacks of using proxies in space: a general rise of the level of violence.**

#### *3.c.1 The difficulty to make both (Beneficiary/Proxy) objectives match on the long-term.*

If the relationship between a Proxy and his principal-agent seems to be win-win in the first steps, this relation can evolve. Worse, the roles played could be reversed, with a beneficiary becoming dependant of his Proxy. Indeed, as explained in the 3.a.3, the Proxy in space is rarely a third party, making the link between a Beneficiary and a Target. The objectives of the two entities can evolve, and could lead to a rivalry between each other. Let’s have a look at some examples to dig in that direction.

First, **when the partnership begins to be less effective, the two actors could distance themselves.** For example, facing some difficulties in the *Ariane 6* development in 2016, France preferred to hand in her part of *Arianespace*, 34% owned by CNES, in order to give back the lead to industrials<sup>57</sup>. Another example is the *Artemis Agreements*. The US

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<sup>57</sup> *Le Monde*, Dominique Gallois, 10 June 2015.



(the beneficiary) try to take advantage of their technological capabilities to impose their vision to other countries (proxies) about exploration and exploitation of resources in outer space<sup>58</sup>. These accords are a prerequisite for participation to *Artemis lunar program* and tensions can raise if some countries will not accept a legal framework they finally disagree.

Then, **one could try to look out for itself**. This risk is not specific to space and we have a mass of examples regarding the Defence industry who sometimes develop their own project, not so closed to the user problematic and so similar to the contract they took. However, this could translate into other ways. A proxy can think he has to shift a little bit their activities at the expense of the beneficiary, in order to be stronger economically or to be more influent. It may result in distance between the two actors. *SpaceX* is working hard to impose his optimistic timeline, but the actual statement of M. Steve Jurczyk, actual administrator of the NASA, regarding the timelines of *SpaceX* illustrates this possibility of tensions<sup>59</sup>. Even the *Federal Aviation Administration* (FAA) seems to become shyer after the recent investigation following the *Starship SN8* crash in January 2021<sup>60</sup>. As a result, the *SN9* has been pushed to the right, interfering with the plans of *SpaceX*<sup>61</sup>.

**In a long-term perspective, it seems therefore very hard for the Beneficiary and the Proxy to keep up their relationship at the same level of cooperation.**

Space operations require a synergy on the long-term between a Beneficiary and a proxy, because the technologies are long to develop, the assets are very complex to design and build (the launching capabilities in particular), and because it is very expensive to finance, on public or private money. As a result, the management of the relationship between the Beneficiary and the Proxy is a key issue to succeed in conducting space operations. It is a prerequisite to maintain this relationship long enough to reach the intermediate common goal.

A proxy is never only a proxy: this is why it is so hard to maintain the relationship. As it has its own goals, a proxy should be considered at the same time as a contractor working for, or on behalf of, the Beneficiary, as a partner of the Beneficiary regarding R&D, and as a competitor<sup>62</sup>. As long as the contractualised part of the Proxy activities meets the requirements of the contract, the activities competing with the Beneficiary's activities are tolerated. The partnership on R&D can be an element strengthening the contractualised relationship if it is jeopardized by the competition. **To preserve the**

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<sup>58</sup> There is a conflict in the interpretation of the OST regarding space mining. *Sciences*, 09 October 2020, vol. 370, Issue 6513, pp. 174-175, by Aaron Boley and Michael Byers.

<sup>59</sup> Interview of Steve Jurczyk for *Futurism*, published 1<sup>st</sup> of February 2021.

<sup>60</sup> According to a CNET news on the 2<sup>nd</sup> of February 2021, it appears that SN8 has took off without the FAA authorization.

<sup>61</sup> Tweet of Elon Musk, 28 January 2021: "Unlike its aircraft division, which is fine, the FAA space division has a fundamentally broken regulatory structure. Their rules are meant for a handful of expendable launches per year from a few government facilities. Under those rules, humanity will never get to Mars."

<sup>62</sup> Interview with Timothy Tawney, NASA representative in Europe. January 2021, French War College.

relationship, a positioning balance has to be found between those three states (contractor / partner / competitor), at least until the common goal is reached.

The following diagrams propose a modelling of the proxy relationship.

General ideas on the proxisation possibilities:

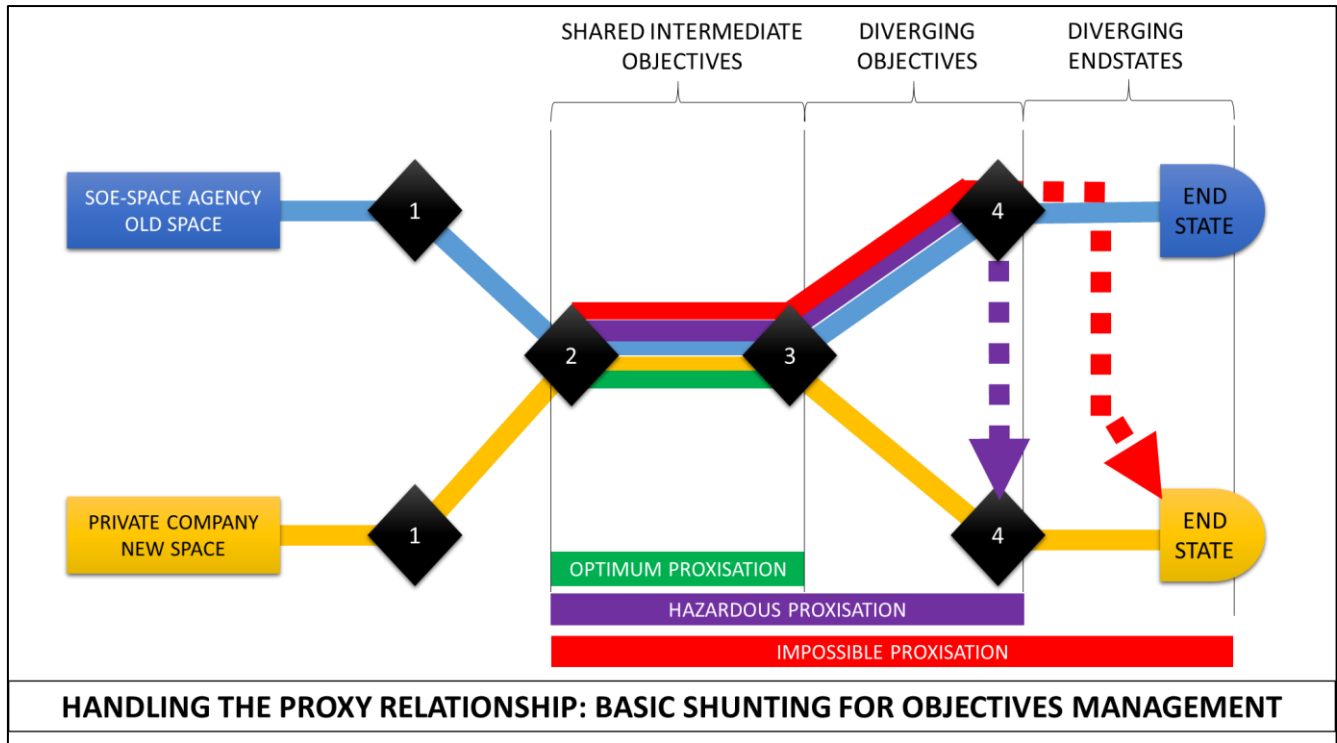
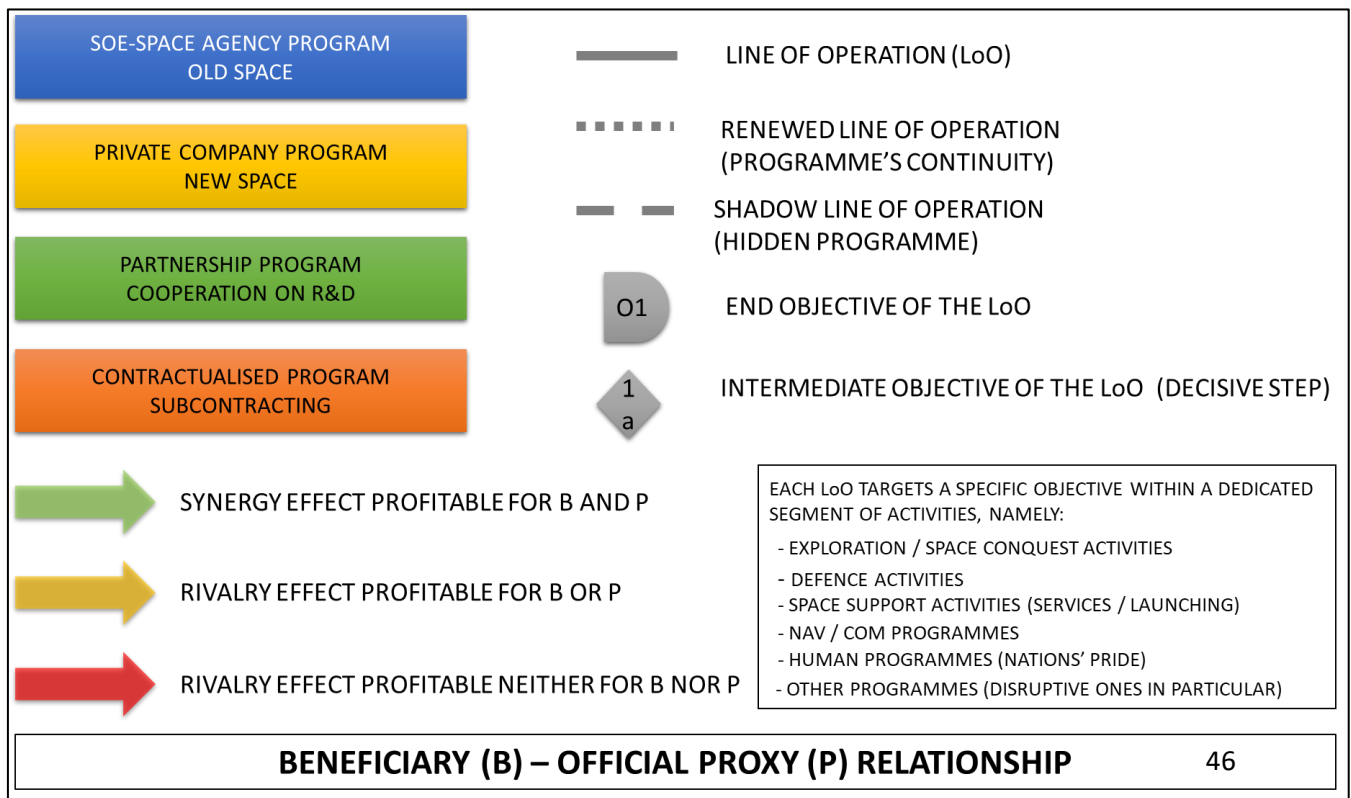


Diagram keys for the following views:



Modelling the Beneficiary-Proxy relationship. Diagram of reference, no proxisation:

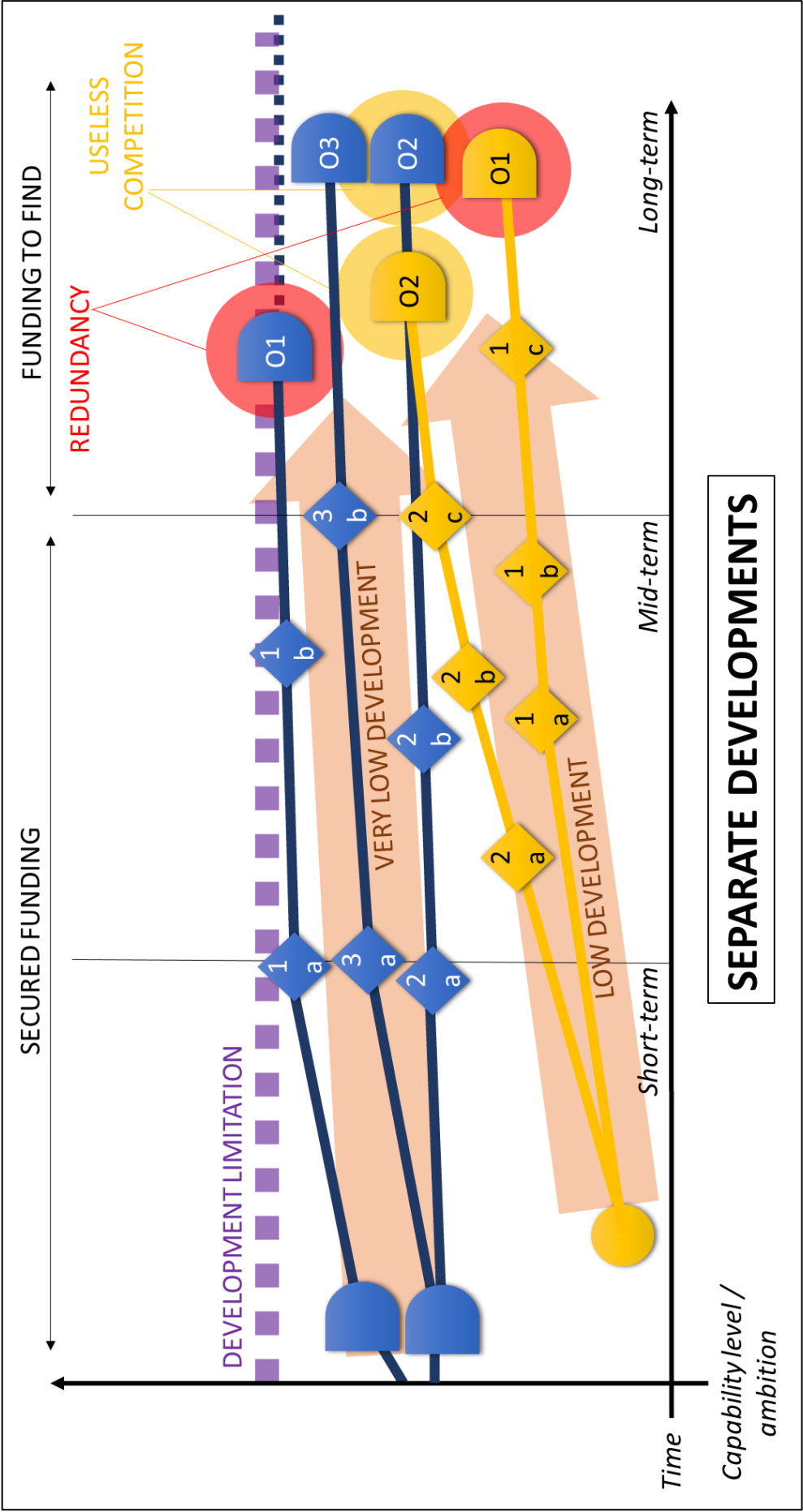


Diagram of optimum relationships:

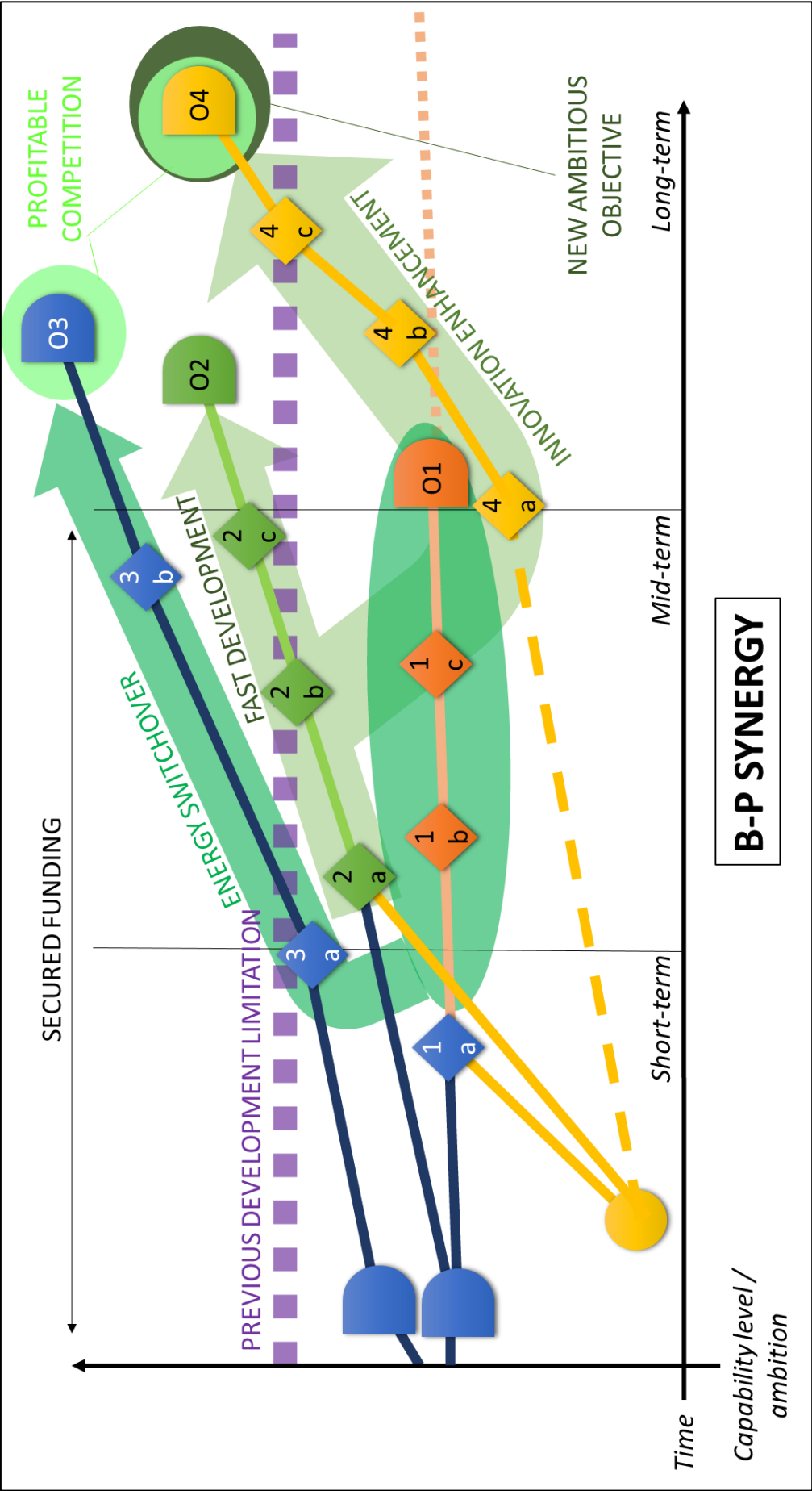
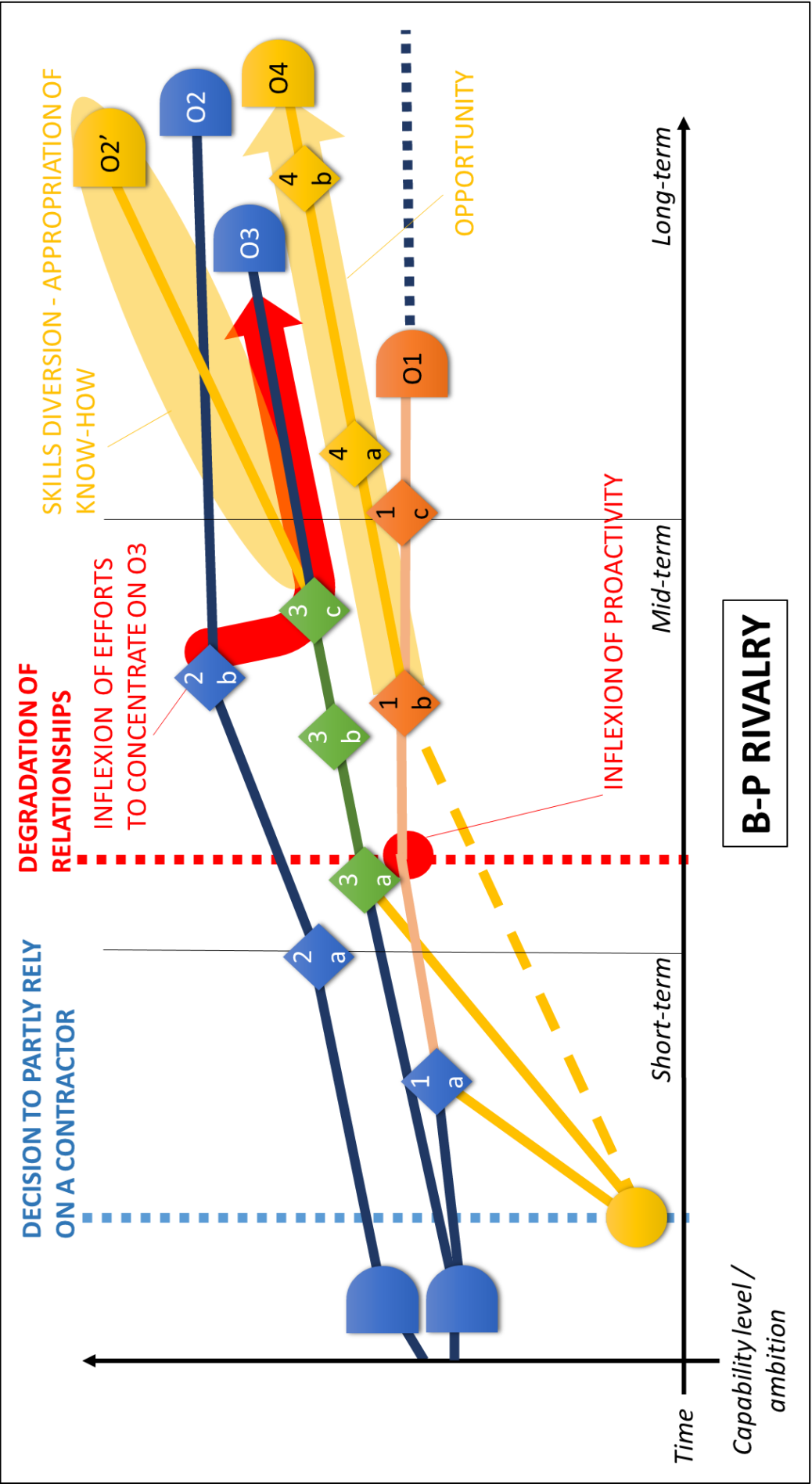


Diagram of degraded relationships:



A robust synergy between a Beneficiary and a Proxy is the key issue for both partners to benefit from the relationship. This synergy is impossible to maintain on the long term (final objectives reached for both actors) but can be fostered on the mid-term (intermediate common objectives). To that end, an equilibrium in the Proxy's posture has to be sought. This posture is influenced by the posture of the Beneficiary (common retroaction).

### *3.c.2 For States, the possible loss of sovereignty in some capacity fields.*

#### **This rivalry could lead to a possible loss of sovereignty in some capacity fields or other states prerogatives/regal domains.**

For example, the capacity now outsourced by SpaceX to bring and return of spacemen. Even if there is also a governmental program in this domain (Orion program), it is a capacity left to a private actor. Nevertheless, this company, becoming very powerful and ambitious, could attempt to supplant the state in the legal and financial aspects of a colon life on Mars. The terms of service for Starlink contained most of what one would expect from a mundane internet service provider agreement<sup>63</sup>. Indeed, the section regarding legal aspect indicates: "For Services provided on Mars, or in transit to Mars via Starship or other colonization spacecraft, the parties recognize Mars as a free planet and that no Earth-based government has authority or sovereignty over Martian activities. Accordingly, Disputes will be settled through self-governing principles, established in good faith, at the time of Martian settlement."<sup>64</sup> Even if the reality will be more complex, especially because Washington would have its say in the legal desires of SpaceX. Indeed, this text is in opposition to the right on Earth, included the OST. Then we can assume that tensions could raise between the two actors regarding legal aspects.

Additionally, we can think once again of the sold of the French part of Ariane to Arianespace in 2016. Without a participation in this industrial flagship, it will be a more independent proxy. France has less capacity to influence this company, and consequently less possibility to impose his vision of space policy.

Using a proxy allows a Beneficiary to access new technologies and/or capabilities but it also prevents the Beneficiary from mastering this capability. Actually, the Beneficiary becomes dependant from its Proxy at the time (loss of sovereignty/autonomy) but also for the years to come (mortgaging future autonomy). To cut the dependence relationship with its Proxy, the Beneficiary will have either to accept a temporary disruption of capabilities or to shift from the dependence to a Proxy to a dependence to another Proxy.

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<sup>63</sup> Reported by The Independent, 28 October 2020.

<sup>64</sup> This para sounds like a reminiscent of a declaration put forward by the Earthlight Foundation, a non-profit organization committed to preparing for the expansion of humanity beyond Earth.

### 3.c.3 *The impossibility of determining wills and objectives of all the actors.*

Proxies is a kind of double-edge weapon. Intrinsically, they allow for covered actions but they are also a source of uncertainty in space. In a monitoring perspective, each asset can hide an adversary action. With the exponential rise of the number of satellites, and the natural duality of space capabilities, it will be a real challenge to monitor each of them. Few countries have a SSA able to cover the whole globe, and their capabilities of detection are kept confidential. For the others, in order to detect a manoeuvrable asset with suspicious behaviour diluted in the mass of man-made orbiting objects, it is just like looking for a needle in a haystack.

Suppose we can monitor every asset, there is such a variety of possibilities for a country to hide an objective or a will that it will be very difficult to be unmasked. The launch from the Chinese rocket in early September 2020 apparently brought an asset named *Shen Long* with some similitudes with the American *X-37B*. Everybody speaks about it, but finally nobody can define what was the real aim of the flight, hereafter the element in the very brief release of *Xinhua*, the state media company. Even if this was a clear State spaceship, this illustrates that a monitored asset can keep for him its secrets. Another example is the new Chinese ground base station built in Argentina. The official destination of this infrastructure is linked to the recent lunar mission, but such a detection plot is crucial for China in order to be able to obtain a complete SSA. The question is not to really know what is going on in this station, but the opaqueness of the station's operations and the lack of information make its precise goals quite difficult to know.

Then, it is already difficult to have a complete SSA, but it is even more so to determine goals of every assets and actors in space (even if they are States), their roles, their missions or their objectives. **Relying on shadow proxies, and in particular if organised in chains of proxies, is a very efficient way to unlink an action with its sponsor *a posteriori*, but also to mask the real objective of an asset *a priori*.** This phenomenon is reinforced by the possibility to place in orbit dormant assets (either totally inactive or only executing secondary/masking tasks).

A proxy strategy, based on a deep dilution course of action, will increase the “fog of war” in space. It could therefore be a destabilizing element in a very sensitive environment, where the risk acceptance is very low. The impossibility to categorise assets would clearly lead to consider them as possible threats (to manage or suppress).

### 3.c.4 *A potential rise of conflictuality in closer space.*

The increasing number of assets in space, linked or not with proxies, gives more chance for accidental crashes<sup>65</sup>. However, **the difficulty to attribute actions carried out by a Proxy to the beneficiary State could lead to an uninhibited behaviour regarding hostile actions and conflictuality in closer space.** We don't speak here about

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<sup>65</sup> See part 2)b).

destructions in a “Clausewitzian” conflicts, but about friction due to the multiple links between the possible actors. To illustrate, we could use the analogy of the flag of convenience. Several firms or States invent and execute genuine schemes in order to act in a non-reprehensible manner and/or to lose every entities trying to investigate on their activities. Attribution is consequently almost impossible.

In closer space, these actors can look at new *modus operandi*, relying on innovation and technical novelty, as well as on disruptive courses of action. Aline Leboeuf affirms that “*fluid wars*” are the result of efforts in order to break the “*routine wars*” and consequently to destabilize adversaries<sup>66</sup>. In the same way, the notion of “*off limits war*”, extremely relevant in closer space, implies the combination of new tactic and new equipment. In *Unrestricted Warfare*<sup>67</sup>, Chinese generals Liang and Xiangsui explain that this kind of war is not a radical one, but is using means out of the rules/norms/routines generally accepted. ASAT experiments carried out by several states illustrate this situation, as they are in clear opposition with the OST provisions, which are supposed to be abided by.

Closer space is a domain where proxies are supposed to break the rules. This trend would lead to increase conflictuality in space. The confrontation rules would change as well leading from direct open clashes to permanent indirect multi-level frictions.

To conclude on the problems generated by the reliance on Proxies, we could say that opting for a diluted proxied strategy may put some States at risks. Difficulty in controlling its Proxy and loss of autonomy in some key fields are the main difficulties a Beneficiary could face. In addition, a large use of Proxies in space would lead to rise the global level of violence in a very sensitive environment. However, these problems are balanced by the control levers Proxy offer.

### **3.d The advantages of using proxies in space: a better escalation control mechanism.**

#### *3.d.1 The rise of States’ agility in space through Proxies.*

By using Auxilia in the *Limes*, the Roman Empire was able to use its own troops on strategic operations and areas. By using proxies everywhere around the world during the cold war, the USA and Russia were able to keep an acceptable level of violence for both powers and therefore, to avoid open conflicts.

**By using proxies in space, States are able to focus on their strategic objectives. It allows them to share responsibilities and costs with private companies.** This is crucial in a context of tight budgets and importance of public opinions. Depending on

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<sup>66</sup> Aline Leboeuf, *Les conflits fluides : concepts et scénarios*, *Politiques étrangères*, September 2005

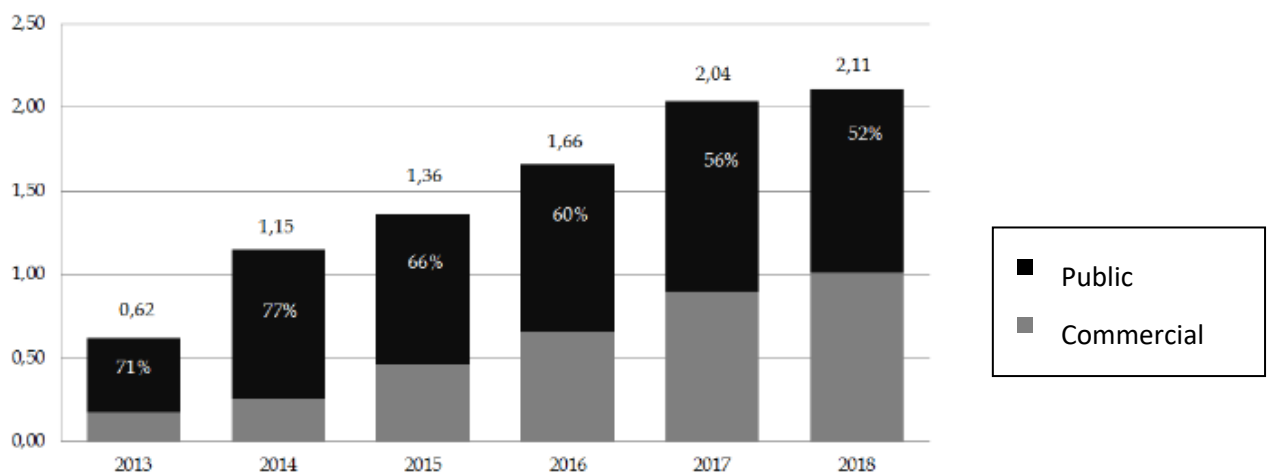
<sup>67</sup> Qiao Liang and Wang Xiangsui, *Unrestricted Warfare*, Ed. PLA Literature and Arts Publishing House, 1999



the strategic importance given by states to programs, they can choose to finance it on their own, or to share the burden, either with other states or private company.

Once again, French satellites *Pleiades* is a perfect example. When it comes to SSA, France chose to develop the *GRAVES* successor with sovereign founding, as it is described as the base of French SST capability, but consider additional capabilities as a partnership with Germany, the European initiative EUSST, or to buy it as a service.<sup>68</sup>

For the USA, using *SOYOUZ* to send astronauts in the ISS has become unacceptable, because it was expensive, but also because using Russian assets, and therefore challenger's assets, was not satisfying. Since NASA main objective is *Artemis*, private public partnership with *SpaceX* was a perfect solution to deal with this situation. Of course, it was not free, but the burden was shared between the state, private founding and Elon Musk's own purse. The success of *Dragon* and *Crew Dragon*, but also of *SpaceX* launchers, allow this company to pursue its expansion and to develop new capabilities without relying only on public money.



1. Estimated SpaceX turnover, in billion dollars<sup>69</sup>

By pursuing its own personal goal, sending people to Mars, Elon Musk launched the development of the *Starship rocket*, which should be able to launch more than 100 tons for less than 20 million dollars. NASA own heavy launcher project, *SLS*, should be able to launch a smaller payload for a tremendous cost of 1.5 billion dollars! In this condition, NASA should continue to use private services. In all case, they will have choice. By permitting to SpaceX to develop its range, they gain agility. Besides, the cost reduction could allow new States to have access to space.

**It is not only a matter of costs reduction. A Proxy allow the Beneficiary to redirect its efforts** (human resources, energy, infrastructures...) to new greater objectives: once the secondary objectives (routine activities, support services...) are carried out by Proxies, the Beneficiary can focus on long-term ambitious projects, which can be

<sup>68</sup>

<https://www.defense.gouv.fr/content/download/563618/9727385/Strate%CC%81gie%20spatiale%20de%20de%CC%81fense%202019.pdf>

<sup>69</sup> <http://www.senat.fr/rap/r19-131/r19-1312.html>

considered as Primary objectives in the space domain (famous achievements unlock public or private fundings and new programs...).

Proxies allow States to focus on their primary objectives. Depending of the desired level of autonomy, States have the choice to call for a private partner, even if they are able to develop their own solution. In any event, Proxies are enablers for Beneficiaries, toward more agility and freedom of action.

### *3.d.2 For States, the improvement of States' space policy and capabilities.*

Progressively, states implement the use of proxies in their strategy and doctrine. Simultaneously, Space become a particular battlefield with dedicated command structures<sup>70</sup>. This phenomenon illustrates a major change regarding space for several countries. In order not to be downgraded, the situation implies at the same time a change in the policy and a financial effort in the technological field.

**Proxies play a crucial role first in the intellectual domain.** The start-ups of the New Space are more agile than a heavy and robust structure as a defence ministry, a National space Agency or a big firm (old space). These organisms are generally reluctant to new ideas because of a deep risk aversion (they are responsible for their choices in front of their shareholders, public opinion or political leaders). Profits or good use of national funds can be jeopardised by hazardous choices. That is why Proxies can help them orient their programs in a new direction and propose ways to do it. These new actors have built their strategies and programs on new ideas, thanks to new thinkers. They generally have nothing to lose designing disruptive solutions, and a lot to get if they succeed. Proxies can therefore test, experiment and propose these solutions to the old space.

**In the capacity domain, they also are an important laboratory in order to predict what will be the tools and capacities available in space.** In addition, Proxies can carry out full-scale tests without involving the Beneficiary nor putting its reputation at risk.

As a result, the business relationship between the Proxy and the Beneficiary can theoretically take different forms:

- the Proxy brings all-inclusive already tested solutions to the Beneficiary. The Beneficiary only provides the funding, with conditions attached (timeline/objectives).
  - The Proxy bears the risk alone.
  - The technological transfer is low in both directions.
- the Proxy is tasked by the Beneficiary to implement in a new way a classic solution designed by the Beneficiary.
  - The Beneficiary bears the risk and the Proxy becomes a subcontracting agent.
  - The technological transfer in both directions is moderate.

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<sup>70</sup> NATO recently decided to create a new spatial Centre of Excellence in Toulouse, France

- the Proxy brings an expertise (brains and innovative procedures) and designs new solutions with the Beneficiary. These solutions will be tested and implemented in a second time by the Beneficiary and the Proxy.
  - Risks are shared in this partnership.
  - The technological “infusion” is very high, in both directions.

Proxies participate in the development of national space policies and capabilities. The Beneficiary-Proxy relationship can lead to generate disruptive innovations in many fields.

*3.d.3 For States, the possibility to redirect adversaries’ efforts in chosen directions favourable to their own interest.*

**If Proxies can foreshadow future types of actions in space, they can also influence or push in desired direction others countries.** The breakthrough of the New Space, born in the US, and its potential new prospects in the exploration and excavation of celestial bodies seem to bring others in this race. It gives the parallel on the Star Wars during the Cold War, where the US reached to bring Russia in a track favourable to the American. They finally lost, exhausted in a technological and financial fight.

The case of Luxembourg could be an example. Member State of the EU, they published in 2018 a draft bill regarding space activities<sup>71</sup>. This draft bill is still to be discussed by the Parliament. This state is the first after the US to elaborate and adopt a *lex specialis* governing space mining<sup>72</sup>. As such, it provides legal certainty and guarantees a protection for investors, explorers and miners, which would extract space resources. Even if this project is not applicable yet (regarding the fact that the launcher is the first responsible), it could change with new types of launchers<sup>73</sup>. Since 2017, Luxembourg has signed many MoU and MoC, notably with countries engaged in the *Artemis* Agreements (US, Japan, Australia, UAE). Numerous start-ups in the Space domain installed in Luxembourg, were lured by financial advantages<sup>74</sup>. If this country considers exploration and mining in Space as a crucial economic field, it can be seen as a US proxy in the EU. Indeed, this Space policy is not shared until now with others member states. If the EU is not considered as an adversary, this situation contributes to expend the US vision regarding space activities, so favourable to them as it gets. **It finally influences others space powers, thinking they must not miss this hypothetical activity and be late in the future.**

A space Proxy does not necessarily conduct the Beneficiary’s main effort. The role of the Proxy can also be to lure the Beneficiaries’ competitors, within an indirect deception

<sup>71</sup> Space Activities Act, or Space Activities Draft Bill.

<sup>72</sup> Act of July 20, 2017 on Exploration and Use of Space Resources (Loi du 20 juillet 2017 sur l’exploration et l’utilisation des ressources de l’espace).

<sup>73</sup> Virgin Orbit has launched with success a rocket from a Boeing 747 in January 2021. Even if this technique is not designed to space mining, we could imagine others in the future.

<sup>74</sup> According to Luxembourg Space Directory 2020, 60 space companies are actually on the Luxembourg soil (representing 2% of the GDP).

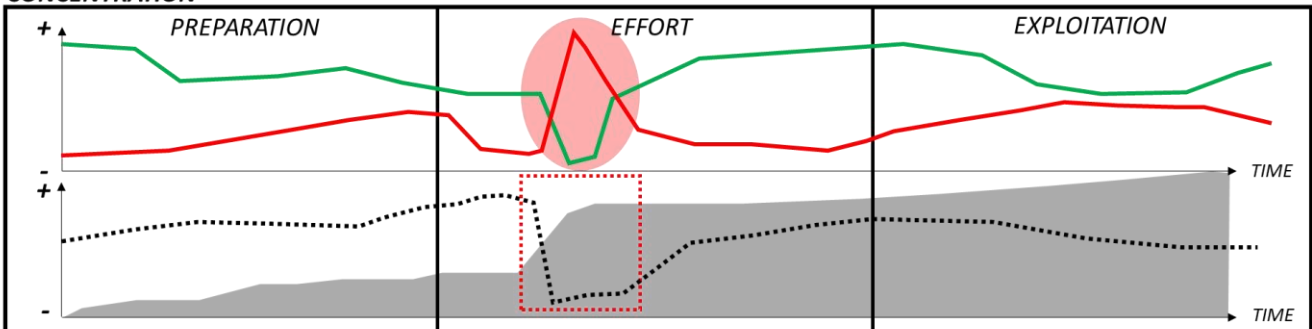
strategy. The Proxy divert the adversary from countering the Beneficiary's main effort, and push the adversary to disperse its efforts.

### 3.d.4 Dilution of actors in space, dilution of violence in time.

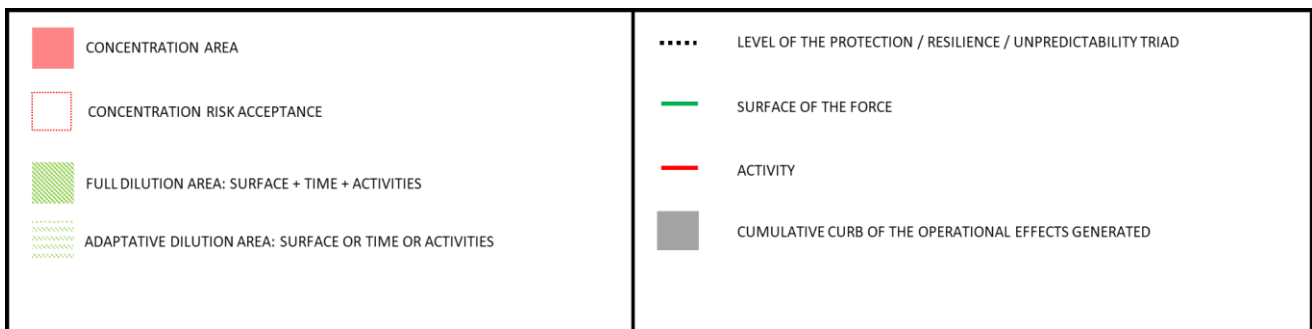
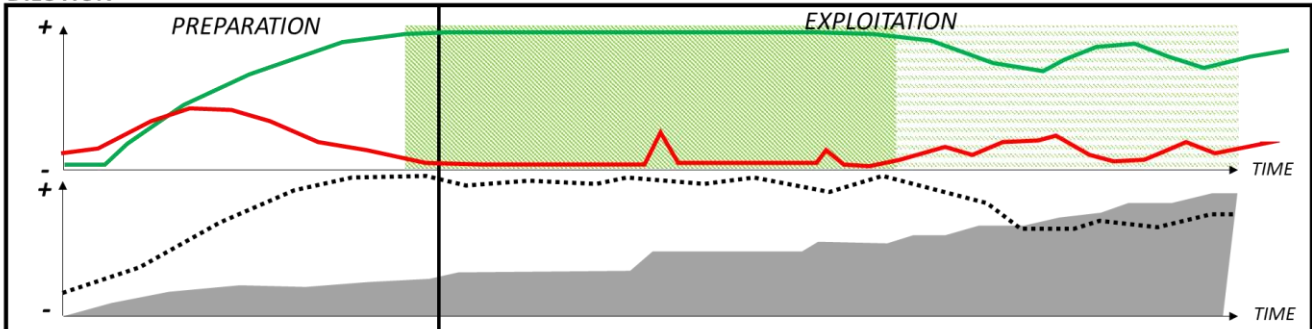
Any strategy takes place in two different dimensions: space and time. The way an actor is conducting its activities in space has implications on the way these actions are distributed in time. However, these implications diverge when considering the principle of *concentration* and the principle of *dilution*:

- Concentrate offensive actions in space means also concentrate actions in time. The principle of **concentration is always bi-dimensional: it is a single-cursor principle** because it closely links space and time.
- On the contrary, dilute actions in space does not mandatory mean dilute actions in time. **Dilution is a two-cursor principle because you can choose to dilute either only in space or in both space and time.**

#### CONCENTRATION



#### DILUTION



A COMPARISON BETWEEN THE MECHANISMS OF CONCENTRATION AND DILUTION

We shall dig in this direction and look at the dilution mechanism in space. On a theoretical point of view, we can assume that the way adversaries/competitors are distributed in space would have an impact on the way violence is distributed in space (violence is a side effect of the use of strength to carry out offensive actions; in a way it is the perception of strength by any actors being targeted by an attack or witnessing it). This first assumption is based on the intuitive and basic principle establishing a direct link between an actor and its actions. For space strategies, it means that widely spreading capabilities in the three space layers could lead to diffuse the effects of these capabilities when used. In other words, deconcentrating assets would lead to deconcentrate offensive actions: **diluting actors in space would lead to dilute violence in space**. As mentioned in paragraph 3.b.2, proxies will have a key role in deconcentrating assets, through the DHD and also thanks to the DPD.

We could argue that, on a technological point of view, it is possible to concentrate the effects without concentrating the effectors, especially in space where physics allows very long-range and wide-spectrum weapons. Consequently, a dilution of offensive effectors in space would not necessarily mean a dilution of violence in space. Nevertheless, if this is true for a dilution in the geographical layer, it does not apply for a dilution in the other layers: the superficial dilution in the first layer is not enough to lower the concentration of actions and therefore to lower a sudden and very destructive peak of violence. **However, a deep dilution in all the layers of the offensive effectors but also of the services an actor wants to protect (dialectic approach), inevitably leads to a dilution of violence in space and time**. Because of a *capability limitation principle*, any attacker will not be able to attack all the adversary's diluted capabilities at the same time, while carefully discriminating between the adversary's capabilities and other services (neutral or friend). This is especially true with diluted offensive capabilities as each offensive asset will be weaker than a single asset concentrating all the firepower. Furthermore, erasing adversary's capabilities will not mean defeating its will to fight as all services will be redundant and, therefore, still serviceable after the attack.

As a result, a widely shared and deep dilution would certainly lower the level of possible violence in space. It would also make restrained violence a possible course of action, getting it out of the “*taboo zone*”. If the principle of dilution is deeply and widely applied, there will be no burst of violence in space leading to warring escalation but a permanent restrained level of violence, making space a “normal” field of confrontation.

### *3.d.5 Making space an independent field of confrontation*

The “proxisation” phenomenon of space conflicts could also lead to make space an independent field of confrontation.

As long as space was used as an enabler for nuclear deterrence, it was part of the global field of confrontation. In a nuclear war indeed, the whole planet, including ground, seas, air, space, public opinion, etc. is a single field of confrontation, because of the range and the effects of the weapons, the trajectories of ICBM, the different types of launching

platforms, the psychological consequences, etc. In current conventional war, relying completely on space services since 1990, with space services supported by unique, expensive and irreplaceable satellites, space is just an extension of the terrestrial field of confrontation (space as an essential support for operations on earth). Losing in space would inevitably lead to lose or to get paralysed on earth. Finally, even during peace time, these unique, expensive and irreplaceable satellites are so precious to ensure the normal life of societies, that any attempt in space to disrupt these services would lead to massive and immediate retaliations on earth, by the targeted state (destructing a satellite means putting definitively the services down). As a result, up to now, it was not possible to think about space as an independent field of confrontation.

However, in the context of a diluted proxied space, the latter can become a place where operations can be conducted without risking an unwanted spill over in the other fields of conflictuality. The spill over effect is based on the definition of thresholds, under which the conflict can be restricted to one desired field of confrontation. The more unique, valuable and irreplaceable space assets are, the lower the “spill over threshold” will be. On the contrary, the lower the effects on space services of a conflict in space will be, the higher the “spill over threshold” will be. **As a matter of fact, a deep and shared “multilayers dilution”, through different types of proxies, will inevitably lead to lower the possibility of a complete and definitive disruption of services. It will therefore rise the “spill over threshold” from space to other domains of confrontations**, and to a global confrontation.

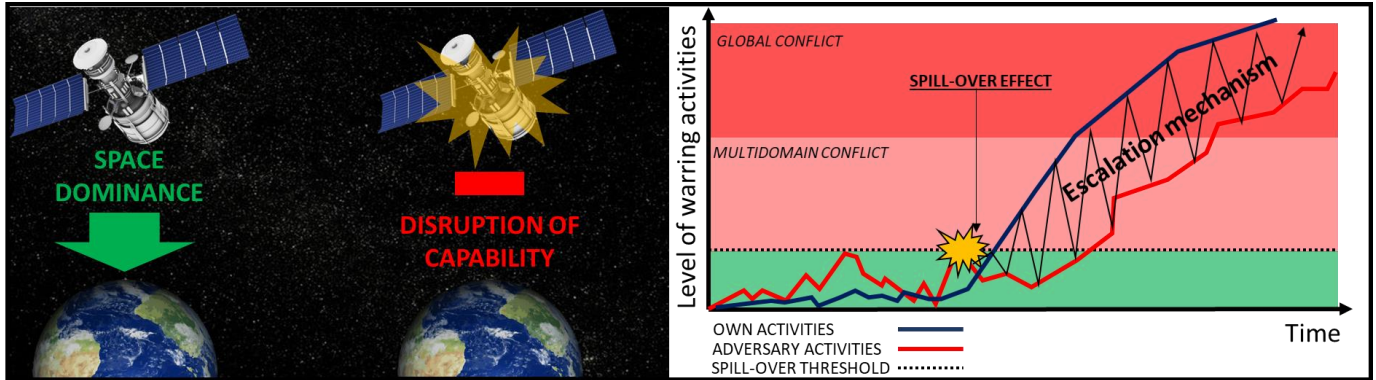
Inside this bordered domain, space actors will be freed to try to take advantages on their competitors and to trigger localised, small-scaled conflicts. As it will not be possible to take a decisive advantage in space at strategic level (e.g. to gain victory on earth only thanks to space), and as it will be possible not to face massive retaliations after an attack, more actions could be undertaken to get an advantage at operational and tactical level in space. It means that **space is entering a normalisation process: it is being downgraded from a strategic field of confrontation to a mere theatre of operations**. Space is therefore getting more and more independent<sup>75</sup>.

Following page: comparison of the spillover threshold effect between a diluted and an undiluted space.

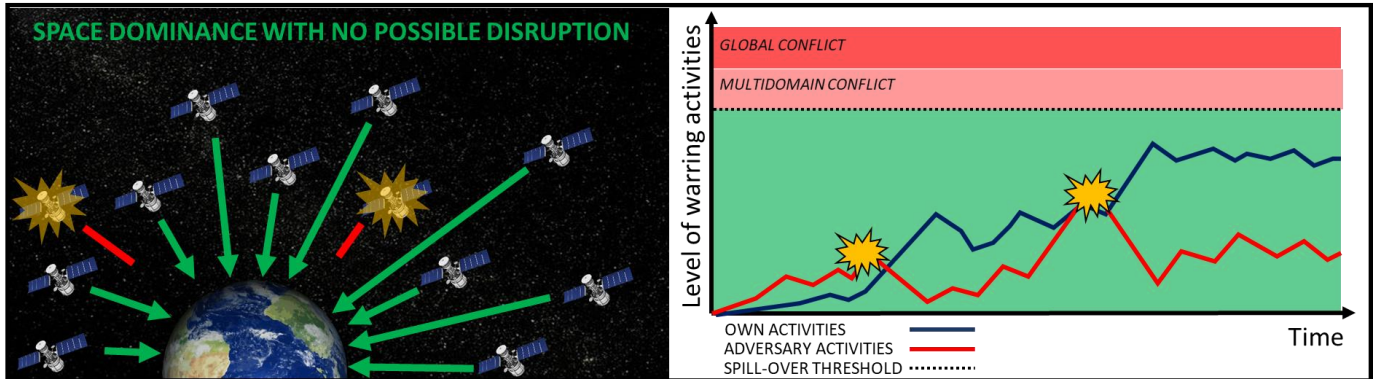
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<sup>75</sup> We should point out that this is already true for outer space where celestial bodies are key points to seize (operational value for space conquest, commercial exploitation, fame (acceptance of new budgets by public opinions)...). So far, closer space is often only considered in relation to earth (as a high point) while outer space is a new terrain in itself.

#### LOW THRESHOLD IN AN UNDILUTED SPACE



#### HIGH THRESHOLD IN A DILUTED SPACE



In a “proxied space”, it will be possible to unlink an offensive action in space and a global confrontation on earth, without renouncing to the strategic advantage offered by state-of-the-art space services, on underequipped adversaries. **The old model was based on a “strategic advantage – strategic risks” couple; the new model could be based on the couple “strategic advantage – operational risks”.**

#### 3.d.6 Shifting from a deterrence paradigm to a modern conflict model.

As mentioned in para. 2.c, space has long been linked with nuclear deterrence. This native history has deeply shaped the construction of space strategies for decades. After the cold war, the deterrence paradigm was still relevant for other reasons: vital space services were ensured by unique valuable and almost irreplaceable assets. In a new “proxied space”, where actors, assets and services are diluted in the four layers, space can become a normal field of confrontation. This evolution allows to think of space using a modern conflict model and not one inherited from the deterrence paradigm.

In the nuclear deterrence paradigm, warring parties try to deter their adversary by the fear of retaliations. Whatever the different evolutions of the doctrines were, it is only a matter of life and death, of survival or mutual assured destruction. This model theoretically prevents both parties from daring direct offensive actions and maintains a long-term frozen situation. However, it inevitably leads to fast and massive escalation when an action is voluntarily or accidentally triggered. The deep use of proxies, in the four layers, through the DPD, the DSD the UD, and most important thanks to the DHD,

will allow **shifting from the old model of deterrence by retaliation to a modern one of deterrence by resilience**<sup>76</sup>.

In this new model, **the dilution of vital interests (space services) and their physical supports (space assets) acts as an inhibitor**, as a blocking agent for a massive escalation. The benefits of such an escalation (disruption of an adversary's space services) would indeed be so lowered (very temporary and/or partial disruption) that the costs (unveiling of a capability, consumption of assets' energy reserves, possible destruction of the asset in retaliation etc.) would exceed those benefits. On the contrary, **the dilution of offensive capabilities will allow actors to strike without fearing retaliations** leading to the complete destruction of their space capabilities. This new freedom for launching space attacks would maintain a permanent low level of violence as mentioned in the previous paragraph.

As a result, this new deterrence by resilience will apply in space as it applies on earth for the current "grey-zone conflicts"<sup>77</sup>. The same regulation laws and phenomena as for terrestrial conflicts will therefore rule a proxied space. Thanks to the deep proxiation of their capabilities, space actors will only try to dominate temporarily the power balance, to get a relative limited advantage on an adversary. It will no longer be possible to definitively defeat this adversary in space. **Space activities will no longer aim at completely destructing the adversary's capabilities but at constructing the relationship with him in order to modify its will in accordance with one's goals.** Space strategies will therefore aim at defining and using the relevant driving levers of the adversary. It should be stressed at this point that space levers will remain particularly powerful among all the existing levers.

The use of proxies, and the dilution of capabilities they allow, will change the rules of the game in space: the regulations of interactions between space actors will not be organised anymore by a *deterrence by retaliation* but by a *deterrence by resilience*. This new regulation will allow a certain level of violence but will prevent from many major escalation.

### **3.e Conclusion: space proxies, particular or common advantage ?**

A space Proxy is an autonomous actor, with its own goals and interests. If a Beneficiary space powers wants to have a Proxy work in its interest, it can use three courses of action (CoA):

- **Coercion. The Beneficiary forces the Proxy to work for it.** In the case of an official proxy, the Beneficiary can lead a hostile takeover bid and integrate the proxy inside its own workforce. For a shadow Proxy, the Beneficiary can threaten the firm or its leaders (threats also encompass the classical *MICE* used to force someone in doing something: Money, Ideology, Compromise and Ego).

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<sup>76</sup> *Modern deterrence, preparing for the age of grey-zone warfare*, RUSI, Elisabeth Braw.

<sup>77</sup> *Id.*



- This CoA is very effective but can only be used once. A new Proxy has to be found for each new action.
- The risk of inversion of the Proxy-Beneficiary relationship is very low.
- **Rewarding. The Beneficiary pays the Proxy out for a specific objective.** In the case of an official proxy, the Beneficiary subcontracts the Proxy: funding under achievement conditions. For a shadow Proxy, it can be a reward in cash or in other types of advantages.
  - This CoA is not very effective as it can only concerns small segments of a strategy and/or short-term objectives. The contract has to be redesigned after each objective reached.
  - The risk of inversion of the Proxy-Beneficiary relationship is average.
- **Synergy. The Beneficiary finds a Proxy with shared interests.** For both types of Proxies, the Beneficiary will find a way to align its objectives with a Proxy's objectives.
  - This CoA is quite effective: it implies for the both actors to slightly modify its trajectory in order to cope with the other actor's trajectory, but each actor will dedicate all its energy to reach the common objectives. Common short-term and mid-term objectives can be reached but the relationship between the two actors will be tricky to maintain on the long-term.
  - The risk of inversion of the Proxy-Beneficiary relationship is high.

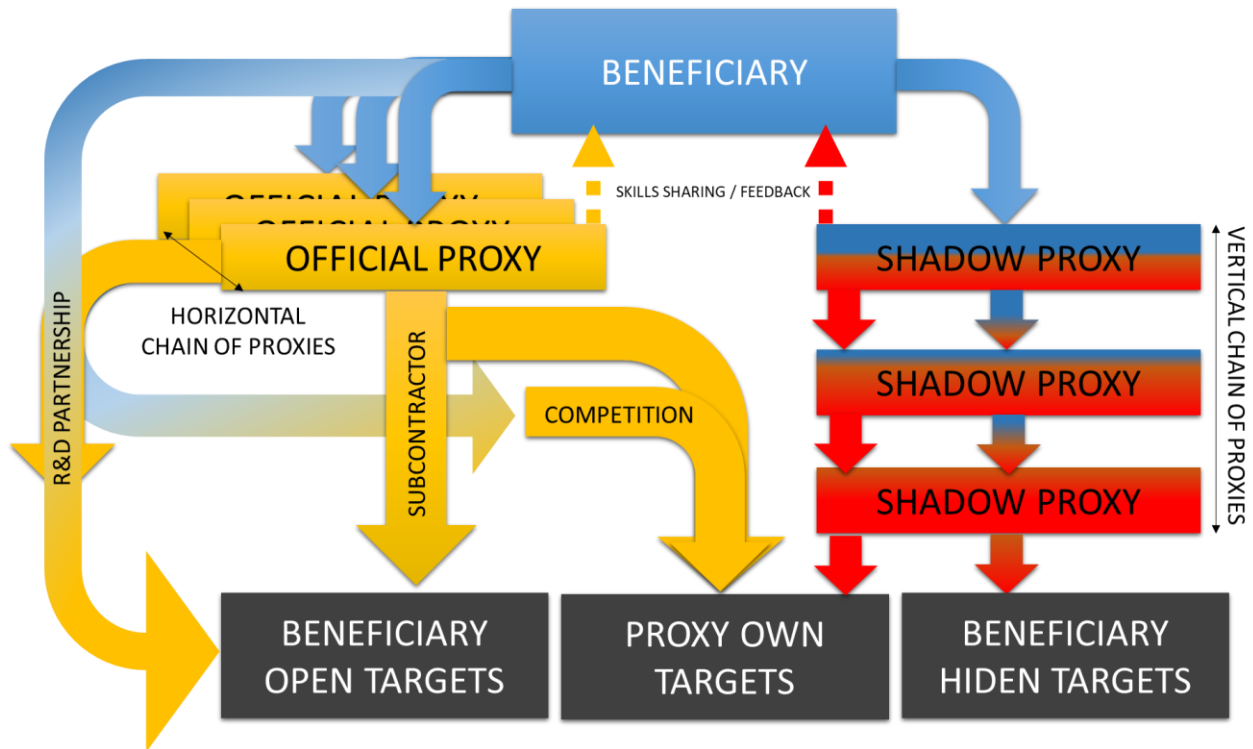
As An additional remark, we could add here that a Proxy is obviously useful for a Beneficiary because it is different: different courses of actions, different status in particular. On the long-term, there is a risk that a proxy asks to get the same advantages and the same status as the national organisations/employees of the Beneficiary. Such a regularisation would turn a proxy into a Beneficiary's internal organisation. It would therefore suppress all the advantages to use a Proxy. This is another reason why short-term and mid-term alliances should lonely be sought.

For Beneficiaries, relying on Proxies will be a key element to remain agile and therefore synchronized with the fast upgradability of the environment. Proxies are enablers for major space powers to maintain their ranks in the space competition. For space, understood as a strategic domain of confrontation, the generalisation of proxied activities means more violence and frictions, but less escalation and major confrontations. Space proxies design a new equilibrium, seemingly unstable but actually more steady on the long-term.



#### 4. THE “OP-SP” DIALECTIC.

As described in the third part, in the multitude of space actors, you can find a multitude of Proxies. However, two main categories of proxies can be pointed out: the official Proxies and the shadow Proxies.



These different Proxies will have different roles in a general space strategy, but also at an operational level. Both types will balance each other as they carry specific operational superiority factors.

This fourth part proposes recommendation to develop an efficient Proxy strategy with efficient courses of action at operational level.

#### 4.a The shadow proxies (SP): deception and surprise despite the improvement of the SSA.

##### *4.a.1 Norms as the tree hiding the proxy forest.*

In background sections 2.e.2 and 2.e.3, we saw that it is very difficult to have all space actors agree on common rules and regulations. However, under this seemingly difficulty to agree on the terms of such regulations, **the real question is whether space powers really want to regulate access to space?** It is a fact that space is still a place of freedom, on a “first come, first serve” acceptance. In that condition, **no space powers, especially the leading ones, have interest in limiting their freedom of movement.**

To this likely absence of will, the absence of means could be added in some case. Let's go back again to space debris mentioned in 2.e.3. Space debris are naturally increasing due to the existing space debris shocking each other. Passive destruction by entering the

earth atmosphere is not enough to reduce the amount of debris. *Cleospace*, an initiative supported by the ESA has been launched to actively remove a big debris. This is far from being enough to clean orbits. If each country is supposed to be responsible for the debris caused by its missions, there is no strict enforcement of this regulation.

It should be mentioned here that a lot of country apparently want to regulate space activities, but no initiative come yet to a consensus. Even worst, this multiplication of isolated attempt (last to date: creation of a *Courts of Space* in the *Dubai International Financial Centre*<sup>78</sup>) reduce the chance to come to a universal initiative. Finally, the fact that these attempts are launched by minor space powers (Such as the UK<sup>79</sup>) reduce the scope of it. There is no chance to legislate space access and behaviour unless USA leads a discussion, and accept to reduce it freedom of action.

To dig deeper, China and Russia have been pushing strongly toward a law-regulated space system. There is therefore an apparent discrepancy between their official statements, calling for the implementation of firms rules followed by every actors in space and their space strategies based on shadow operations, deception and evading the rules. **The fact is that the implementation of these rules would impede space activities of States under the rule of law, e.g. western countries. If your credibility is not based on the consistency between your official positions and your real behaviour, there is no barrier to escape this law.**

However, you could face a “naming and shaming” action from the international community that could weaken you, on economic and diplomatic points of view. Using proxy is therefore a way to increase the operational gap between western countries and power States. There is scissor effect as it allows to disconnect:

- your statements aiming at reducing your adversaries’ freedom of movements (new restraints for adversaries),
- and your actions, not abiding by the law (reduction of own constraints).

As a result, rules and regulations for space is an additional tool in hidden strategies, accompanying shadow proxy operations.

Despite signs of good will and declaration, there are no recent update in universal laws regarding access to space. It seems that leading space powers have no interest in sacrificing freedom of action and prefer using non-binding statements and regulations. In this framework, the proposal of norms and regulations can be an element accompanying hidden strategies through shadow proxies (SP). These proxies are a convenient way of overriding rules. These rules turn therefore into a two-speed limitation system applying unevenly for all actors: covering shadow operation for the ones, becoming a constraint for the others.

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<sup>78</sup> <https://www.difccourts.ae/media-centre/newsroom/courts-space-launches-orbit-support-global-space-economy>

<sup>79</sup> <https://www.gov.uk/government/news/uk-push-for-landmark-un-resolution-to-agree-responsible-behaviour-in-space>

#### *4.a.2 On a strategic point of view: the “surprise goals” despite closely-monitored actors*

So far, all space powers act more or less openly: if they are probably conducting classified research and development, they closely monitor and document all launches. Each new satellite is referenced and tracked by private and public SSA systems. A simple web search allows the public to know what satellites was launched by the 24<sup>th</sup> of January 2021 *SpaceX Transporter-1* mission<sup>80</sup>.

“Secret” programs are also quite easy to track and monitor, even if exact capacities and goals could remain sometimes undisclosed. Therefore, it is no wonder that private or public initiatives compile and publish suspect or offensive approaches in space, such as the previously named *Secure World Foundation*.

In this context, it is very hard to keep hidden objects in space, and to maintain hidden programs. However, space is a perfect place for their development, even on a legal aspect. Indeed, there is no such thing as space Geneva Convention. Therefore, liberty to think and develop a war ruse is much bigger than in a conventional ground conflict, up to the perfidy. We can imagine diverting from an open goal a space program for other purposes. A maintenance satellite could be turned in ASAT weapon for instance. Each new need is a new occasion to think dual scientific developments. Program such as *ClearSpace* are real opportunities to develop offensive approach: the challenge is to have a *rendez vous* with a non-cooperative object, to catch it and to bring it in the Earth atmosphere for its destruction. It is also possible to hide the real purpose and/or capability of a satellite/program, until its use.

In all case, whatever the considered approach, they are all one-shot rifles: once they are disclosed, the surprise effect is gone and it will set a precedent which will conduct space powers to develop counter measures. **There is no doubt that this development tracks for surprise will lead in a close future to an operational development of shadow proxies.**

Of course, some space powers are currently able to deploy space objects secretly. However, this ability remains a sovereign capability, in which almost no proxies are involved. For instance, the *X37-B* reusable ship is capable of this kind of secret launching. Furthermore, there is no surprise in objectives of such missions (included *Shenlong* mentioned in 3.c.3): it is more than likely military purposes!

As space actors and space assets can be closely followed, the best way to create surprise using a proxy is to divert ongoing programs from its official objective, or to hide the real goals pursued. Doing so, at strategic level, the surprise will not be linked with the effectors’ actions, but associated with the targets/goals pursued, through the upstream dilution.

#### *4.a.3 At the operational level: the arrival of manoeuvre into space.*

The space situational awareness is improving on an ongoing basis. The different detection equipment dedicated to keep an updated vision of what is orbiting will go on

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<sup>80</sup> <https://www.elonx.net/spacex-smallsat-rideshare-missions/>



being more accurate, having a longer range, and following more objects. In closer space, it is, and it will be, harder and harder to hide in the first layer. As shown in the previous paragraph, using shadow proxies is a proposed solution to hide the goals even when the assets are clearly followed and monitored. It is true at a strategic level; it is also true at the level of space operations: **using shadow proxies will introduce surprise in space operations and tactics, despite an effective SSA.**

Surprise is the ability to be unexpected. It is possible to surprise an adversary on the type of action, on its time or place, on its strength and intensity or on the real goal pursued with this action. Surprise is not a magic component of victory, nor is it even sufficient or necessary to take the advantage on an adversary. However, surprise is what allows to get a local and temporary superiority on the adversary's forces. It is a major component of the power balance at tactical and operational levels. Any decision in military operation indeed is based on the perception of the situation. The accuracy of this perception is established thanks to intelligence (gathered and analysed). Surprise is the failure of the adversary's intelligence which creates a discrepancy between the adversary's perception and the real situation. Surprise the adversary (as it is for deception which is a form of surprise) means having him decide or accept to be weaker than you are at the point you assess to be the keystone of its system.

Surprise is therefore a major constituent of the manoeuvre, that is to say of the evolutionary disposal of strength and capabilities aiming at gaining a local superiority on the adversary and defeat him at tactical or operational levels. If you cannot surprise the adversary, it is impossible to get a local superiority on him (except if you have an absolute global superiority) as he will synchronise his reactions with you. No possible surprise leads to a frozen situation.

**At operational and tactical levels, shadow proxies' surprise will rely on the use of the *downstream dilutions*** (see paragraph 3.b.2). Their courses of actions will therefore take place mainly in the first and the second layers: keeping their location hidden so as to launch remote attacks, maintaining the ambiguity on their real nature and on their targets in order to carry out close direct attacks, saturating the SSA tanks to decoy assets or using the same platform as vital shared services to escape retaliations.

As there has been a race for terrestrial conflicts between the sword and the shield, there will always be a race in Space between SSA and stealth. As a result, it does not seem relevant to build a strategy only on the ability to hide assets in Space, as it will not be possible to keep superiority for a long time.

However, using shadow proxies and *downstream dilution*-based courses of action will create the possibility to surprise an adversary in space and, as a matter of fact, to make manoeuvre possible in closer space as in outer space. It will indeed not only rely on stealth but on ambiguity.

#### **4.b. The official proxies (OP): weakening the destruction capability of shadow proxies**

##### *4.b.1 Sharing risks and responsibilities: who dares in space wins*

As explained above, the use of SP in space permits a new era, which is not really stabilized until now. The use of OP is better known and bring some crucial consequences.

Regarding financial responsibility, every state companies have to be accountable to the government leaders and finally their citizens. Every budget has to be defended and explained. If they have an opportunity to evade any risky, but crucial, domains such as innovation, obviously they will not refused. Therefore, **OP are a way to share the risk of innovation while boosting it.** Indeed, these private companies have more autonomy to decide of their research and development effort. OP permit to shift of a vicious circle: sensible to risk and big inertia, so less innovation, to a virtuous one: shared risk and agility, so more innovation.

It's exactly the logic when France sold his part of *Arianespace* in 2016 in order to accelerate the development of Ariane 6. Two years before, an Ariane 6 rocket "unsolicited" and proposed by Safran and Airbus, different of the CNES' plans, was presented in order to be able to be competitive with the solutions proposed by the new launching actor SpaceX. In 2015, the sold was approved. This power grab of these private companies illustrates a will to change the structural approach of the space industry<sup>81</sup>.

The Chinese structure presents a multitude of State-Owned Enterprises (SOEs), and constitutes a different way of proceeding. If there is no competition between those because a unique structure defines the objectives<sup>82</sup>, it exists a kind of competition between the provinces. Indeed, they have objectives and they make everything in order to reach them and have capitals. The plan is to develop the middle of the spectrum, without big innovation except in some precise areas (telecommunications for example). China try to mitigate the lack of innovation due to his structure – there is no private actor as such<sup>83</sup> - by international cooperation, in close cooperation with the *China Institute of International Studies* (CIIS). China executes this cooperation via influence especially through UNOOSA, thanks to groups (such as G77<sup>84</sup>), concept (such as BRI<sup>85</sup>) or tools

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<sup>81</sup> *Le Monde*, Dominique Gallois, 10 June 2015.

<sup>82</sup> SASTIND: State Administration for Science, Technology and Industry for National Defense. This entity supervises the Chinese space industry as well as the China National Space Administration (CNSA)

<sup>83</sup> 85% of Chinese companies linked to space domain are private, but research and development is state lead.

<sup>84</sup> Group-77

<sup>85</sup> Belt and Road Initiative. One of the aim is to export Chinese technological leadership, and targets industries that China has begun to excel at. The BRI Spatial Information Corridor (SIC) is a kind of extension of the BRI to Space.



(such as the China Space Station<sup>86</sup>) where it tries to rally OP to his “shared vision”<sup>87</sup>. Therefore, China is using OP to share risk and gain power in the space domain.

“Who dares wins”. If this catchphrase seems to apply for space, OP are a way to share risks and to be innovative.

#### *4.b.2 On a strategic point of view: a new “economy war”*

OP create a big change in strategy: they shift the conventional war of physical confrontation to a kind of technological and economical war. Because they are official and acceptable, they permit a new equilibrium in a domain where the kinetic action is banned by a mutual destruction result. In a way, they enable the continuation of war in space. Every new battlefield cannot be banned, the enemy will, a day or another, use it in order to defeat you. **But the OP can make space less kinetic, and finally can allow an inevitable confrontation weakening the risk of destruction.**

Indeed, OP are often technology companies installed in the space activity, and are crucial actors in the innovation race. SpaceX has been the first to dare and develop the reutilisation of different stages of a rocket. The others launching actors were reluctant to go in this direction but the financial advantage is now attested. Now they try to make up for the underperformance in the last years.

In the actual context, the technological race must be linked to sustainable economy. The recent tweet of Elon Musk on the 21<sup>st</sup> of January regarding a price attributed to the better sequestering carbon technology illustrates his will to master the production of carbon neutral synthetic propellant. He couples an ecological image for the company with the will to master the complete end-to-end production of his launcher, adding his own propellant production. This example of *SpaceX* shows that the confrontation in space is reflected in an economy war, considering the important amount of budget for research and development.

At strategic level, the OP are a key element in the construction of a dedicated economy for space war. This economy is the bedrock for strategic action in a field where effectors are very expensive and require a high level of R&D and industrial skills.

#### *4.b.3 At the operational level: the modern reserves.*

As described above, we consider an official space proxy to be a declared contractor in charge of carrying out some missions in space or for space on behalf of a major actor (state or company), with its assigned sub-objectives and the associated rewarding budget. Using this type of proxies would enhance the arrival of disrupting capabilities (technological jump) in general and the “disaggregation of space capabilities” in

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<sup>86</sup> CSS constitutes a showcase for cooperation, opened to all (contrary to the ISS), in close cooperation with UNOOSA’s Access to Space for All Initiative.

<sup>87</sup> US China Economic and Security Review Commission’s 2019 Report to Congress.

particular. It would also permit a bold organisation to share risks and responsibilities when implementing a daring project. At a strategic level therefore, relying on official proxies would bring a better balance risks (financial losses and damages to the reputation) / advantages (superiority on competitors on a qualitative and a quantitative point of view). Similarly, at the operational level, using official proxies would generate the creation of virtual reserves.

How to define the reserve on an operational point of view? The reserve is an unengaged force used when absolutely necessary to rise the global combat capability in order to get the relative superiority on an adversary and defeat him. Setting a reserve up does not necessarily means keeping combat units off the battle, and launch it into the battle when the situation is serious. It is not always a matter of dividing the total number of units between those immediately engaged and those engaged later. It can also be a matter of **building a global strength by adding the effective engaged strength (identified total combat potential) and a possible unengaged strength (assumed surge capability)**. Adding forces instead of dividing the force is what the official proxies allow.

**The official proxies offer the possibility to surge when needed** thanks to the provision of redirected capabilities, on a contractual basis or after an opportunity is identified. These capabilities are capabilities ordinarily dedicated to very different purpose (commercial purpose when the proxy is a private company for example), or duplicated capabilities (the proxy developed its own capabilities on its side). It could also be some own capabilities of the Beneficiary<sup>88</sup> that can be redirected from their original purpose to the new urgent need thanks to the proxy who can accomplish the mission itself on order (on a notice previously agreed). Indirectly, it is also thinkable that sharing the burden of the risk with a proxy allow both the Beneficiary and the Proxy to save room for audacity when the situation gets serious.

That is why, official proxy can be considered as a virtual combat capability and therefore as a modern reserve. The contact with the Proxy should include this possibility and the threshold (associated to clear cues, easily identifiable signs) above which its usual functioning is modified, redirected to meet the needs of the beneficiary. **The creation of a credible reserve lies in this provision in the contract distinguishing the normal cooperation and the crisis mode.** The official proxies can then be considered as a “*surge reserve*”, permitting the Beneficiary not to split its overall strength and therefore statistically increase its chances to get a better power balance in front its adversary.

Using official proxies, through a mix of *upstream* and *downstream dilutions*, can be considered as a strength multiplier as it virtually creates a *surge reserve* that can be engaged when needed. It enables the Beneficiary to fully focus on the main tasks while the proxy is ready to handle the “flank-guard” activities, and/or to reinforce when it is necessary.

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<sup>88</sup> *Proxy warfare and the future of conflict, take two*, The RUSI journal, Vladimir RAUTA, 2<sup>nd</sup> of April, 2020.

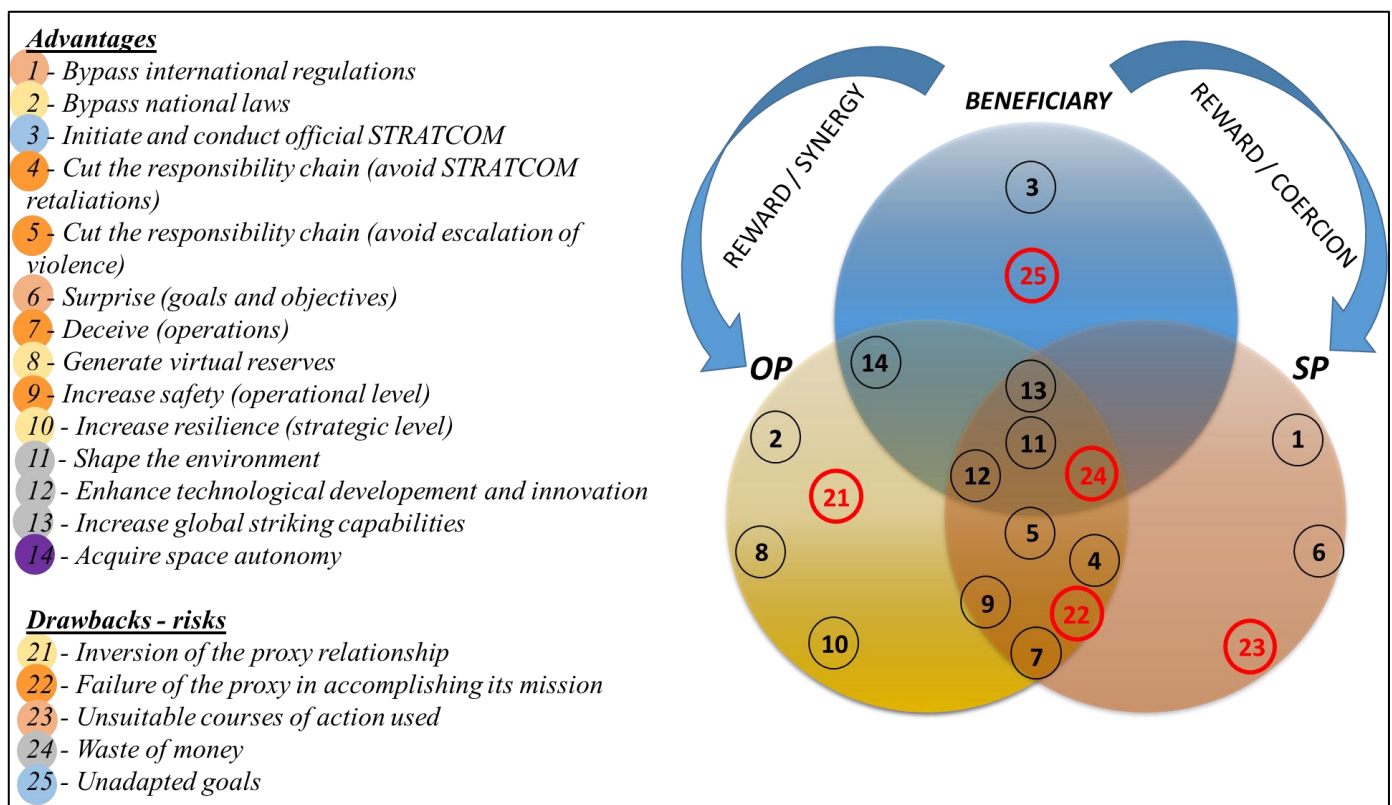
#### **4.c Walking on two feet: balance the use of OP and SP to comply with the principles of war.**

Op and SP have different and complementary capabilities, advantages and drawbacks. An efficient space strategy, divided in different segment of space operations, could therefore rely on a good combination of OP and SP. In order to assess if a combination of OP and SP can lead to take the superiority over an adversary in a space confrontation, we chose to confront their use to the three main principles of war: freedom of action, economy of forces and concentration of efforts.

**The underlying question is whether space Proxies can compensate the current nature of space, as a strategic domain of confrontation, to enable a space power to develop a chosen space strategy, and not just cope with space's constraints and restraints.**

##### *4.c.1 OP and SP strengths and weaknesses.*

Because of their different nature, using OP and SP brings different advantages and different risks. The following *Ven diagram* proposes a picture of the advantages and drawbacks associated to an official proxy strategy and a shadow proxy one. Specificities brought by the Beneficiary are also presented.



Both OP and SP allow increasing safety and deception in space operations and permit to escape from the responsibility chain, on a strategic point of view. On the contrary, using OP could put a Beneficiary at risk of turning into its proxy's proxy while using SP could generate reputational risks, if the operation is discovered.

#### *4.c.2 Freedom of action in space*

For the French Army, the freedom of action is defined as follow: “ability for the commander to dispose of his assets whenever, and to act despite the adversary and the constraints of the environment and circumstances in order to reach the assigned objective”.

**To ensure the freedom of action, the commander must take care of:**

- **Safety, in order not to be surprised;**
- **Forecasting and anticipation of events and adversary actions;**
- **Ability to gain initiative and to impose his will.<sup>89</sup>**

**Both official proxies and shadow proxies are useful to comply with these three issues, in space.**

**Obviously, safety is becoming more and more a topic when conceiving a satellite.**

Depending on the purpose, builders will include passive (e.g.: shielding...) and active (e.g.: camera, auto-defence weapons ...) measures in the satellites designs. At the deterrence by resilience previously explained, self-preservation of assets is ensured by the fact tha a same asset, a same open proxy, could be used by various space actors, but with different level of quality and quantity. Imagery or positional satellites illustrate this idea: used by a various panel of actors, supressing or altering these capacities could affect actors of opposite sides, and therefore cancel any gain.

**One of the SSA’s goal is to cope with the second issue.** Some space powers want to keep a sovereign capacity of SSA. At one point, SSA assets could be primary targets in case of open conflicts. Using a combination of official and shadow proxies is a good solution to keep a permanent SSA capability, if the sovereign one was to be attacked. It is also vital for a space power to keep a powerful and competitive industrial sector. Used as proxies by other space powers or challengers, they will allow to keep a close eye on competitors projects. Furthermore, it will allow these companies to pursue innovation and development without relying on public founding, and by doing this, contributing to the space capability.

**Finally, the ability to gain initiative and to impose his will could result of a combination of sovereign capability, especially kinetic or non-kinetic ASAT assets, with shadow proxies,** even if, as previously written, there are one-shot rifles. In a way, it could be a kind of mirror principle of the surprise attenuation, mentioned above. A space power can target a capability, even used by everyone, if it disposes of a secure way to keep it, by using shadow proxies. Furthermore, by communicating on its sovereign capabilities, a space power can demonstrate its own extent of its capabilities, and objectives, in order to emphasize its own ability to “impose his will”. That is why we can find extract of space strategies on open sources, which includes the level of integration of proxies.

Freedom of action in space is deeply intertwined with the second principle of war, concentration of efforts.

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<sup>89</sup> FT-02 : <https://fr.calameo.com/read/00514150962198e8ebfc2>

Both official and shadow proxies are useful for a space power to keep its freedom of action. There is a virtuous circle when it comes to freedom of action: the freedom of action allows a space power to generate more freedom of action.

#### *4.c.3 Economy of forces*

It seems easy to transpose in the space domain the second principle of war: the economy of forces. Of course, price and technology make space hard to reach and to act in. Consequently, economy of forces is much sensible in space. However, the advantage of space regarding the economy of forces is on the face of it clear when we speak of situation awareness, intelligence, surveillance and reconnaissance.

This principle means **assuring an optimum availability of friendly forces for the operational effort**. It permits the preparation of the effort and the combination of appropriate effects. On the ground, it means preserving a coherent division of strength (see hereafter for the concentration of efforts)<sup>90</sup>. In space, it could be defined as the good balance between the use of proxies (SP and OP) and the actions or effects directly conducted by the Beneficiary. This general principle means coordinating in an efficient way all the capabilities proposed by the actors in space and the actors for space.

The **optimal repartition**, and the **judicious use of means in order to obtain the best ratio capabilities/effects to reach the goal assigned** are the two crucial steps preparing the convergence of effects.

The judicious use ensues of this following obviousness: manoeuvre is not based on a unique major action. This major action will benefit from the major part of operational resources and secondary actions will be executed in support of the main one.

The optimal repartition must reach two goals: **gaining an operational concentration for a unique main action** and **preserving it against unexpected things**.

- Appropriate capabilities have to be identified in order to deliver expected effects for the tactical effort on the adversary, the terrain, the environment and time. To choose, the criteria are the key functions: C2, operate and support. In all these domains, space assets appear appropriate, and to obtain the operational concentration, proxies will be used. Indeed, as seen in part 3.b, they participate to resilience through the dilution of capabilities.
- The second goal is about preserving the main effort. As explained in part 3.d.1, States can rely on space proxies to handle the secondary objectives. For example, the space tourism developed by private companies could be a kind of secondary mission to catch this economical field. It is based on capabilities which will determine the secondary forces to assume two distinct roles, reduce surprise and prepare “anti-random” measures:

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<sup>90</sup> French general Beaufre explains that “it is necessary to know how to divide its resources rationally between protection against the opposing preparatory manoeuvre, its own preparatory manoeuvre and decisive action. This optimum distribution is (...) the economy of forces.”

- Anticipate the fog of war and be prepared to react to unexpected things. Indeed, targeting with the main effort a frailty of the adversary implies to assume a certain weakness facing his strong point. This first role leads to endow these forces of:
  - intelligence capabilities. As actors in space, proxies have a role as it gets;
  - being able to support and secure (i.e. divert the adversary of intelligence and prevent the main force from interacting with the adversary) the main mission. Through its agility, and especially the mobility brings by SP explains in part 4.a.3, proxy participate actively in this role;
  - completing deception actions. As seen in part 3.d.3, proxies can redirect adversaries' efforts in chosen direction, they are consequently well placed to act in this domain.
- Reserve. This force is a reaction capability in order to face an abrupt change of situation or to exploit an opportunity not anticipated. These qualities are based on autonomy, adaptability and responsiveness. This last quality could be defined as the ability to shift quickly the course of action according to the attitude of the adversary, especially in order to maintain the intensity at the lower level. As explained in part 3.d, proxies are particularly designated to take the lead when conflictuality does not exceed a threshold of violence. The concept of modern reserve for OP developed in part 4.b.3 illustrates that in space, they can participate to this role.

Consequently, Proxies in space are well suited to preserve the main effort, undertaking the two roles linked to this mission. Then, in order to preserve the judicious repartition of means and the capability to realize a tactical effort - i.e., ensuring the principle of economy of forces -, it is crucial to use proxies to obtain a good balance of violence to avoid transforming a secondary action in the main one and to avoid a dispersion of efforts.

A combination of OP and SP helps maintaining the optimum availability of friendly space capabilities for the main effort. In addition, Proxies act as moderating agents to control the level of violence in order to shape the enemy forces as well as the environment.

#### 4.c.4 The concentration of efforts.

This second principle seems apparently impossible to reach in the context of a dilution strategy. As shown in para. 3.b, *concentration* is the “*mirror-principle*” of the *dilution*, that is to say its exact opposite. However, an adversary can achieve the same results through the *dilution* as it could have achieved through the *concentration*. Hence, in space, it is possible to concentrate the efforts without concentrating the forces.

Concentrating the efforts means **producing converging effects through the combination of well-articulated effectors**<sup>91</sup>. On the ground, combining the effectors means splitting its strengths between a main body designed to reach a maximum performance of destruction in the chosen space-time framework, a secondary force aiming at maintaining the dispersion of the adversary and a reserve which is a kind of insurance against surprise. In space, the situation is not so different in reality. As explained before, state-private companies partnerships (official proxy) generate a virtual reserve in order to face surprise. The global dilution of capacities leads to a general dispersion of strength, including that of the adversary. The long-range and wide spectrum capacity of weapons and effectors in space allow a great destruction performance, as does the main body on the ground. Thus, all the building blocks necessary to concentrate the efforts are also gathered in a diluted space, but differently.

**The convergence of effects is made possible by the complementarity of the capabilities, their availability at the right time and their efficient coordination thanks to an adapted C2**<sup>12</sup>. In a diluted proxied space, these three needs can be met through the combination of official and shadow proxies:

- The redundancy of means allows their permanent **availability**. This redundancy relies on the disaggregation of capabilities, implemented by official proxies in the framework of a partnership with States.
- The **complementarity** of means is achieved through the combined use of official and shadow proxies. The Beneficiary can develop and set up a wide array of open and hidden capabilities. Then, the capability score can be played when necessary.
- The **efficient coordination** is harder to achieve, as the global space capacity is divided in a large number of operators, abiding by different regulations, under different chains of command/services. However, all space assets are linked on a permanent basis with the control station on the ground. If an operation, gathering various assets, is planned and tailored with precision, its implementation can be conducted with zero latency and full efficiency.

It is therefore possible to concentrate efforts during a space operation, even if you have opted for a strategic dilution. What is still to be determined is whether this is relevant or not to concentrate your efforts in such a diluted proxied space. The dilution is a permanent stance allowing resilience and unpredictability as mentioned in para 3.b. The dilution is designed to minimize the effects of an adversary attack while maximizing the effects of its own attack. Thus, it is an enabler for the concentration of efforts. However, as previously mentioned, launching a coordinated attack in a diluted space can only be achieved once; it is a one-shot rifle, we could say. Once the attack is launched, all the assets unveiled their position, nature and intention. These assets are vulnerable to a direct retaliation, to a suppression of enemy space capabilities (SESC), either directly (kinetic/non-kinetic action in space, or from earth (destruction of the control station, ASAT missile launching...)) or indirectly (suppression of the proxy relation between the Beneficiary and the third party (financial attack, naming and shaming, prosecution in court ...)).

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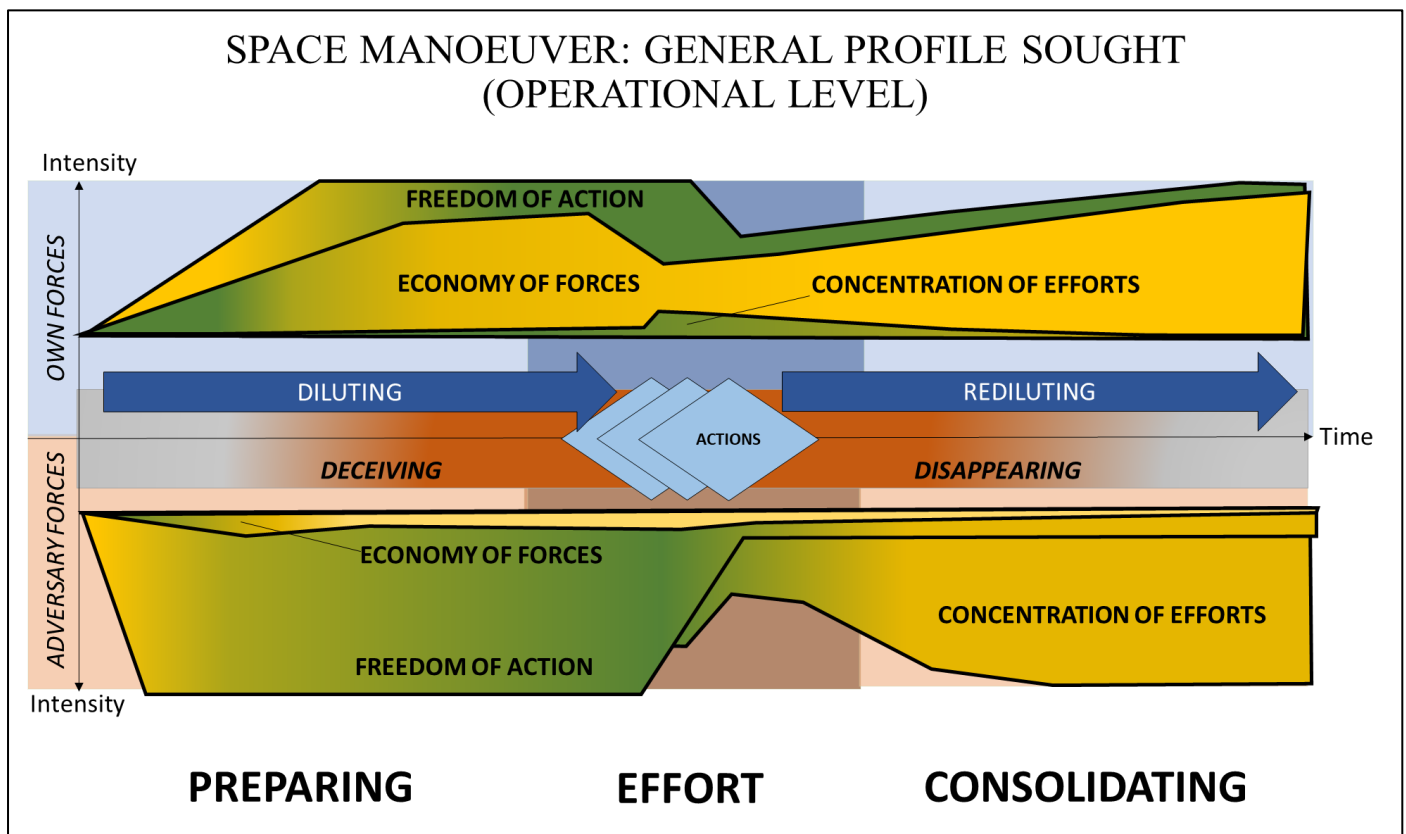
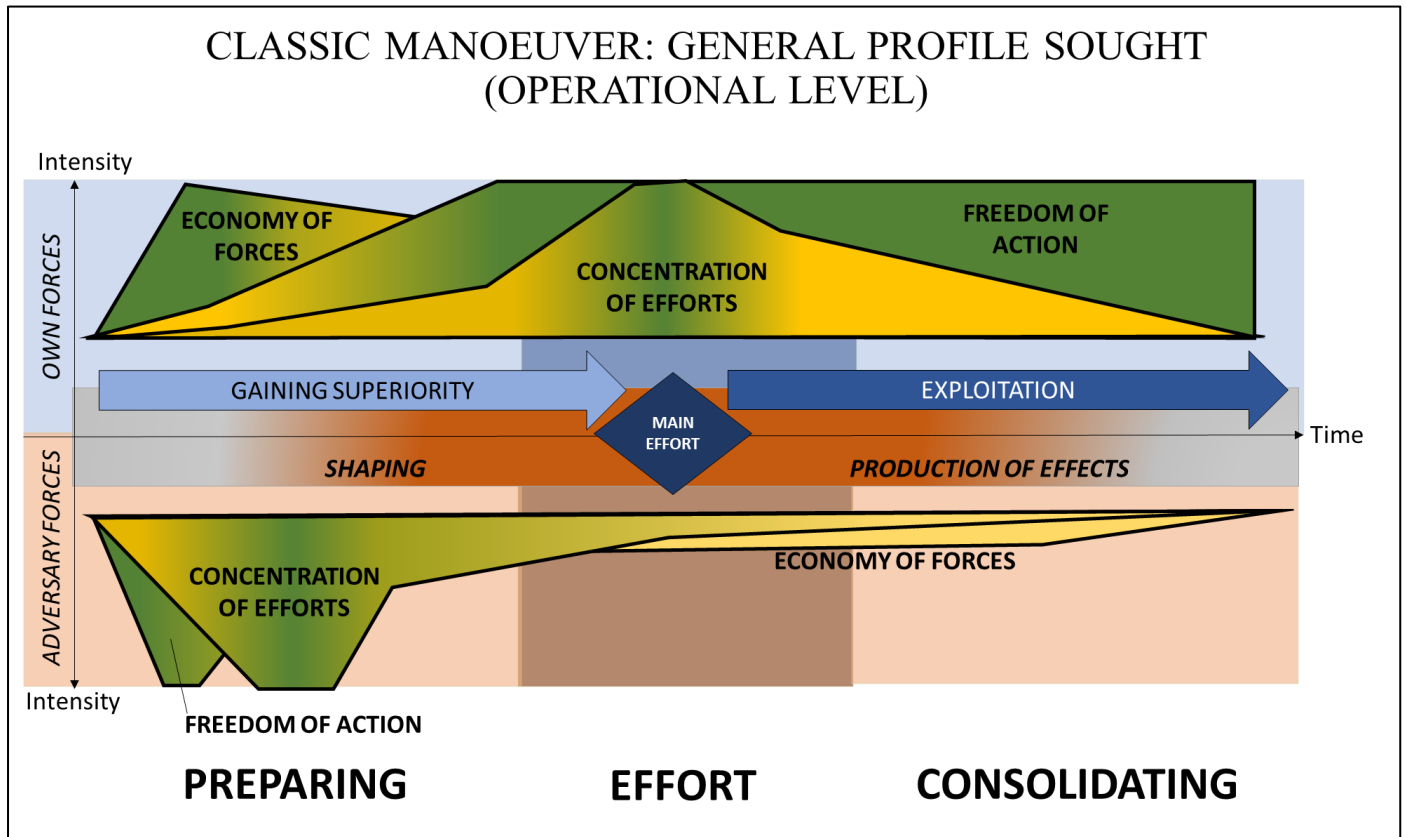
<sup>91</sup> *La combinaison des effets : synthèse des trois principes de la guerre ?*, COL COSTE, conference given at French War College.

An attack concentrating the efforts in a diluted space must be strong enough and efficient enough to overcome at once the adversary: it should be a decisive move. After such an attack a new dilution process should be started from scratch, with full efficiency achieved after months, or years. On the contrary, diluted actions, under the SSA threshold and keeping intentions hidden, could erode an adversary capability through a **concentration of effects by accretion on a long period, instead of a concentration of efforts on a short period.**

It is possible to comply with the principle of concentration of efforts using official and shadow proxies in the framework of a dilution strategy in space. However, this concentration should be the end point of the strategy: both its achievement and its termination. To reach the maximum performance of the dilution strategy, a concentration of effects by a long-term accretion should be preferred.



4.c.5 Comparison between a classic manoeuvre and a space manoeuvre in the light of the three universal principles of war.



#### 4.d Space Proxies : turning constraints and restraints into assets

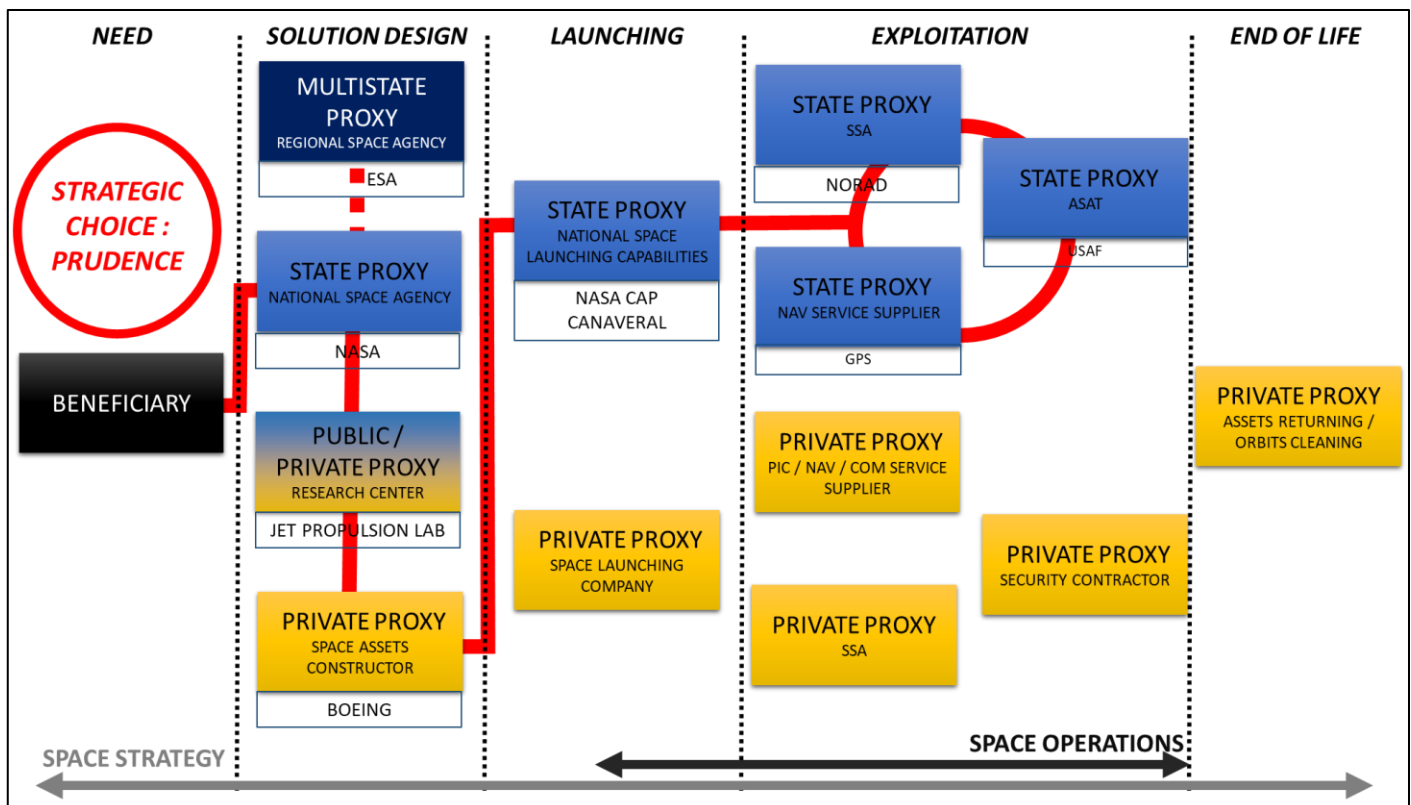
##### *4.d.1 General conclusion on a combined proxisation strategy.*

A combined action of Shadow and Official Proxies allows a Beneficiary to comply in space with the three principles of war: freedom of action, economy of forces and concentration of efforts. It is also an efficient solution to back one's action up in space, thanks to the couple safety-surprise.

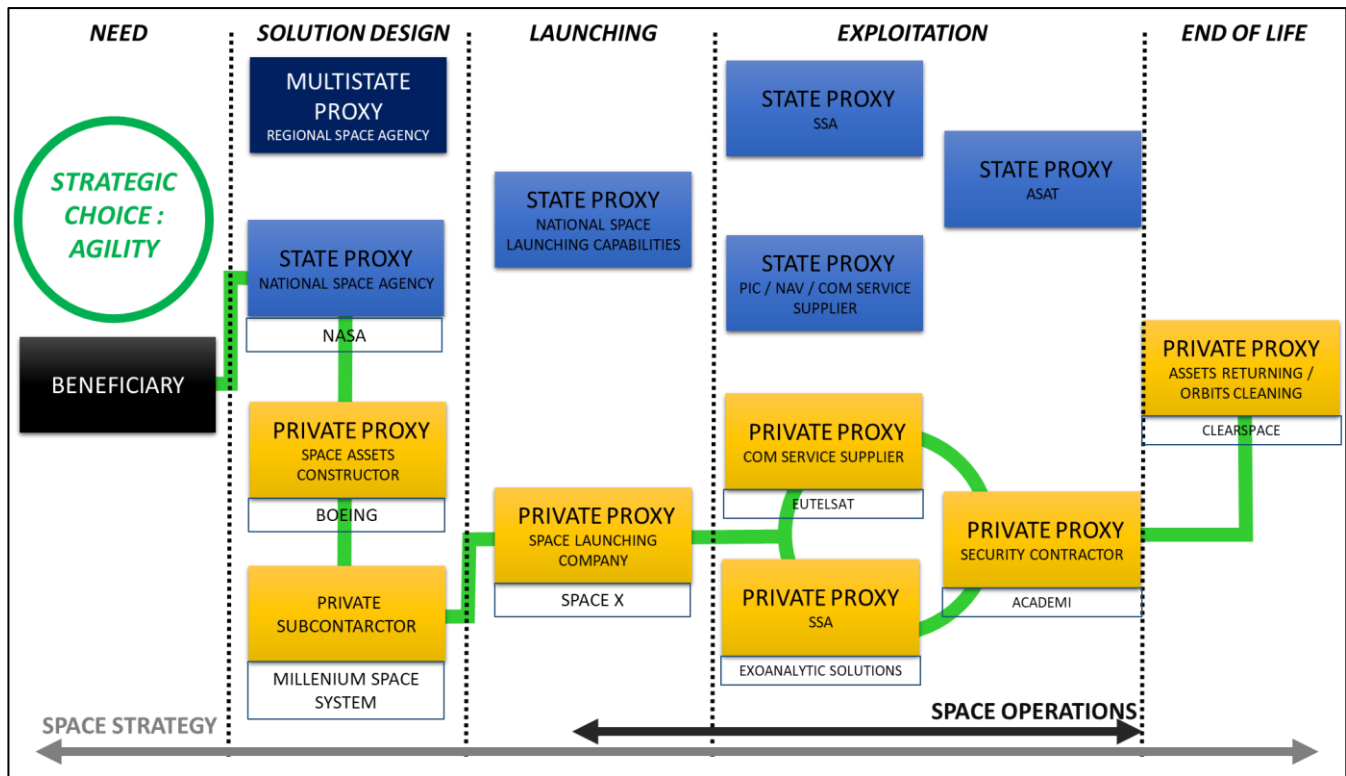
The use of Proxies in space therefore allows the implementation of performing strategies and make possible for a major power to bypass space constraints and space restraints, and perhaps turn them into advantages.

##### *4.d.2 Different kind of combined proxied strategies: a first approach (examples).*

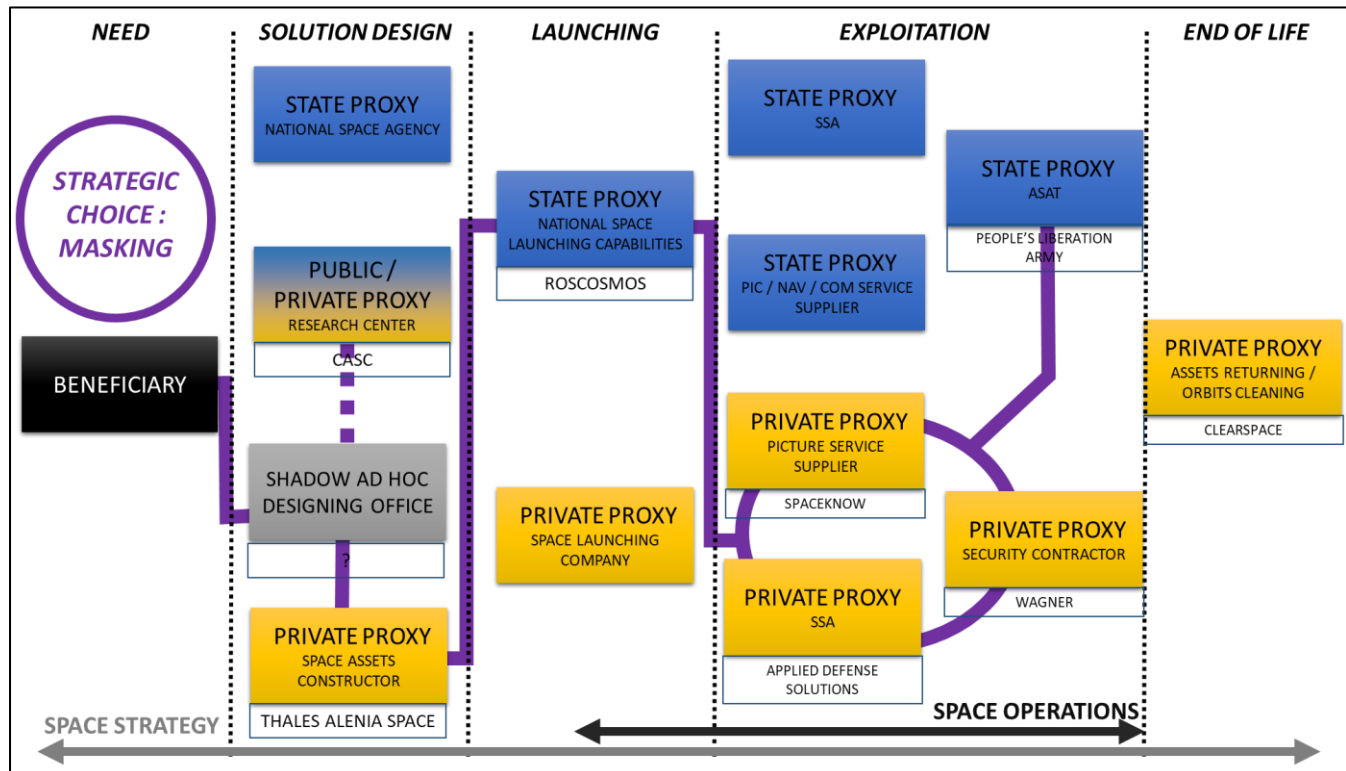
###### Traditional state proxisation strategy (example)



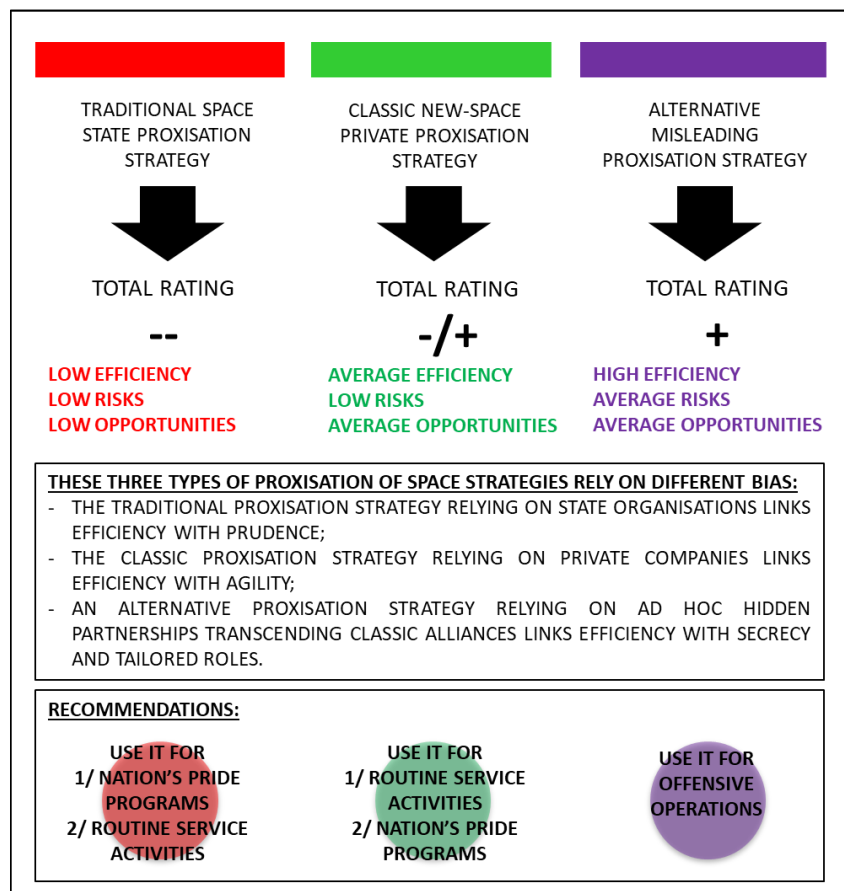
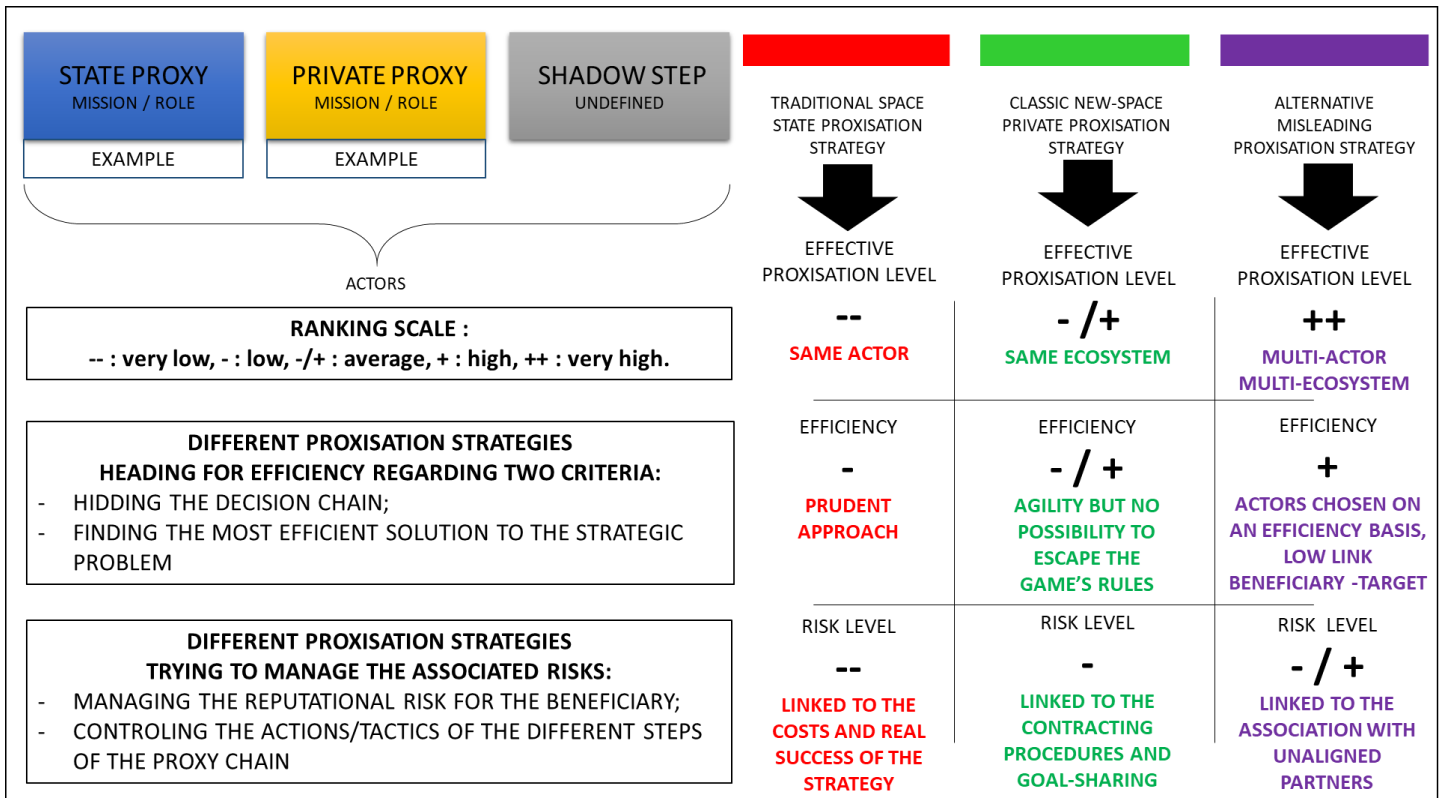
### Classic new-space private proxisation strategy



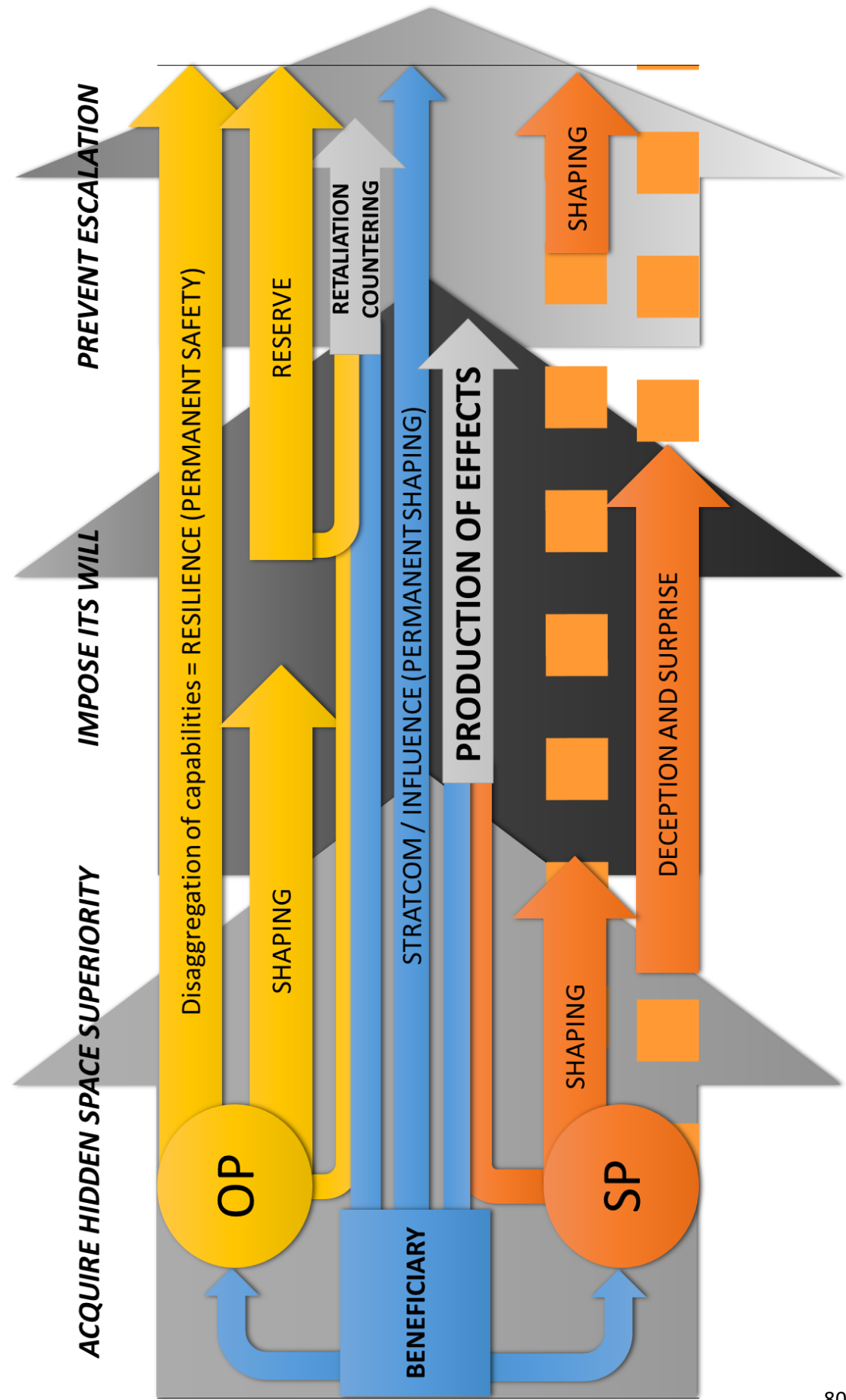
### Alternative misleading proxisation strategy.



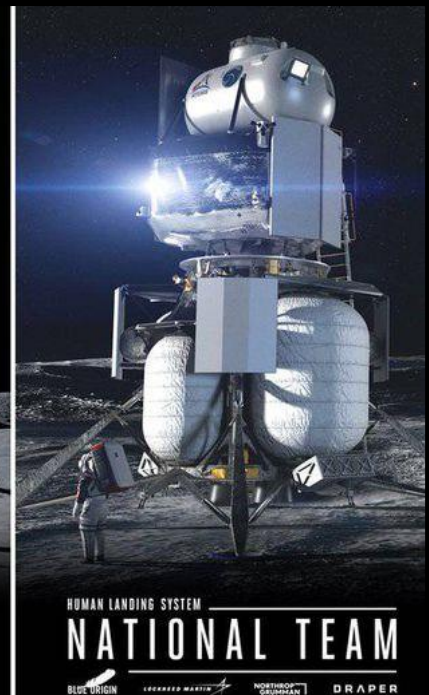
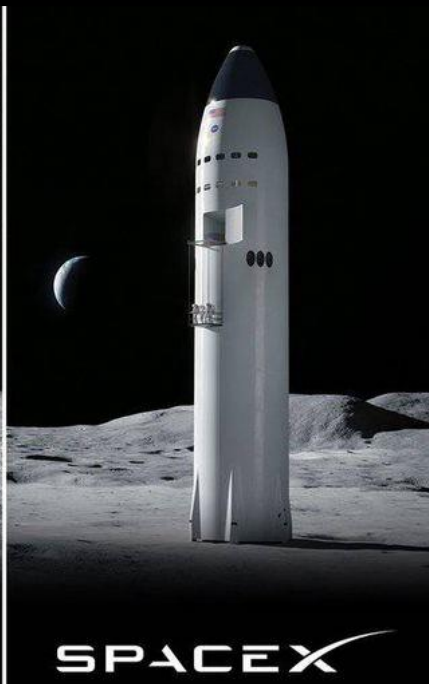
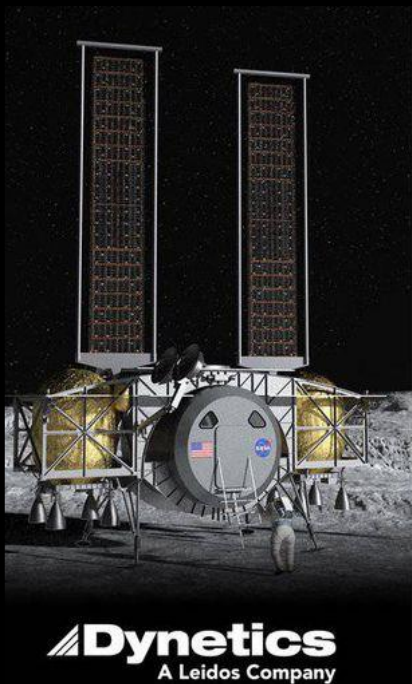
## Diagrams keys and conclusions



4.e A proposal of proxied Space operation kinematics (synthesis).







## 5. CONCLUSION

We have seen from the 1950s a kind of race to closer space with some analogy with **the Age of Discovery**. Initiatives of countries were divided, each of them trying to advance their programs and innovations in order to show his power.

Since the 2000's, there are more parallels with **the Wild West**. States are not playing their own partition alone. However, there are some frictions with other powers and the aim of some programs are specifically to turn aside emerging threats in space. The objective is not only to show his power and to develop new economic domains, it's about trying to override other competitors.

In this framework, relying on different kinds of Proxies, for all or parts of a space strategy, is a pragmatic way for Space States to impose their will, in Space and through Space, without risking an unwanted escalation which could jeopardize their vital interests in the end. As a result, using Proxies is not only a way for Space States to enhance the effectiveness of their strategies, it is also a self-generated mechanism bordering this competition for supremacy in closer space.

A combined use of OP and SP will allow space powers to compete either for supremacy or for a mere autonomy in space. Through a deep dilution strategy, a relevant use of these proxies allows to comply with the general principles of war, and the basic requirements of secured and efficient courses of action: shape the operational environment, increase resilience and safety, allow surprise, prepare counter-retaliation actions etc. In a word, space proxies are not only enablers but also conditions to overcome adversaries in a fast-moving environment.

Now, this movement will target a new area with outer space, and there is not only States in this quest but also proxies particularly agile in it. They sometimes support States in their Space policy; they sometimes compete with them on economic issues. They answered a commercial request, but they now aspire to lead some market such as human space flight and launches to low orbit.

In 2019, 95% of the estimated \$366 billion in revenue earned in the space sector was from the *space-for-earth* economy<sup>92</sup>. The remaining percent deals with the supplying people already in space. To date, never more than 13 people were in space at one time<sup>93</sup>. Government-led space programs must be inevitably focus on *space-for-earth* activities that are in the citizens' interest, such as national security, basic science, and national pride.

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<sup>92</sup> Matt Weinzierl and Mehak Sarang, Harvard Business Review, 12 February 2021

<sup>93</sup> Id.

## 6. TEN MAIN RECOMMENDATIONS TO WESTERN SPACE POWERS.

While permanently **allowing proxies handle segments of States' space strategies**, in order to globally increase the national space capability,

1. **Never rely on a single subcontractor** for key capabilities (redundancy) in order not to lose its freedom of action and its ability to negotiate with its proxies.
2. **Seek synergy with the proxy**, and not just a “rewarding relationship”, in order to boost innovation (R&D prospective), avoid useless competition (goals redundancy) and reduce proxy's ability to become a competitor.
3. **Implement the disaggregation of space capabilities**, through subcontracting national companies, in order to increase the global resilience of national space services.
4. **Generate virtual reserves** through official proxies, in order to boost space capabilities when needed. This possibility must be prepared when contracting.
5. **Accept to use shadow proxies** in order to increase national space agility and reduce constraints weighing on space strategies (reduce the constraints gap with power states).
6. **Reintroduce deception and surprise in space strategies and operations**, through shadow proxies, on goals at strategic level and on targets at operational level.
7. Use shadow proxies to **shape the environment** by covertly modifying the conditions of the operation. Use official proxies to shape the environment by influencing space actors.
8. **Combine the use of shadow and official proxies, under a unified SpaceCom C2**, to carry out effective strategies in space through operations complying with the principle of war.



9. **Hide space defence capabilities in civil satellites** (dual technologies) and **seek the reversibility of civil capabilities to military ones.**
10. Foster the call for its own companies, useable as proxies, **in order to make competitors dependents.**

