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Space Strategy

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Foreword

The day when the upper atmosphere ceased to be an impassable barrier, man may have unwillingly opened a window onto a world that he would either turn into heaven or hell. The importance of this responsibility relates to the link between these two limits, the thickness of our atmosphere and the thickness of the universe.

In his recognized inspiration and style, Antoine de Saint-Exupéry wrote: "We all live in the same cause, are borne through life on the same planet, form the crew of the same ship"[1] and this ship is so fragile that it is completely invisible at such a distance of the Sun. It is but a mere insignificant thing at the scale of a system including our Sun and some surrounding stars. At the scale of our galaxy, we are but a strange anomaly, and at the scale of the Universe, we simply do not exist.

We should refrain from any exuberant triumphalism any time we discuss strategy. And there lies the point of this book, which approaches with caution and skepticism, all aspects of strategic obligation as must be supported by the crew-members in this ship. And if our ship is none other than Noah's ark, then our strategy is survival. Strategic operation then becomes an operation of cautiousness.

The author refers to this major preoccupation in the present book:

> "The matter of space weaponization is subject to debate: some claim it has already begun, most say it is inevitable, while a minority of observers hope that the madness of men will not extend to outer space. A third notion is presented here: space martialization that would seamlessly allow installations to be used for combat uses".

1 Antoine de Saint Exupéry, Terre des Hommes (English version: *Wind, Sand and Stars*) – "*Nous sommes solidaires, emportés sur la même planète, équipage d'un même navire*".

It is obvious that advances in space exploration will continue to take giant steps. Freed from the friction of the atmosphere, spacecrafts can preserve their kinetic energy almost indefinitely.

Atmospheric flight brought us speeds such as Mach 2, heights of dozens of kilometers, distances in the dozens of thousands of kilometers. Space has already given us Mach 25, millions, billions of kilometers, and light-year distances.

Using the same amount of energy as a Concorde, a spacecraft flying for 10 days would be able to take a crew of men to Mars. The first would have travelled 320,000 km (approximately the distance from the Earth to the Moon) struggling against atmospheric drag, while the latter would be able to travel 100,000,000 km, 3,000 times more, and be able to continue on its trajectory without using the slightest amount of fuel.

By jumping into space, we have entered a sanctuary which we know nothing about, and did so with the greed of an invader on a run-down ship, breathless, and with a crew that is constantly in conflict and unable to navigate carefully.

Will we be the Don Quixote of the galaxy, a mere virus at the scale of this saintly universe, or a seed able to flower into the best of humanity over the coming centuries?

In the first case, we will simply disappear, without leaving a trace in a Universe that did not even notice our presence. In the second case, we will become new members of a greater brotherhood, already populated with our “guardian angels”.

But, for the moment, our strategy is focused on the possibility of using space to better control the belligerent instincts of a few crew members, and in doing so, better protect those who have already managed to amass some spoils of war. If we continue to splash our oars aimlessly, we will no doubt go around in circles for a while longer. But a common, intelligent and organized trajectory will captivate the wiser members of our crew.

The author, with much wisdom, approaches the strategic matters of intergalactic enemies and threats, such as the “Earth-crossers” that are asteroids or comets, like the icebergs in *Titanic* patiently waiting to cross paths with our ark. One of them will approach our orbit in 2029. Knowing how to destroy this assailant will be proof of our new step toward wisdom. Proof that Humanity is able to work together to protect its ship, apply itself enough to survive long enough to slowly explore this sanctuary, and draw the energy and science it has to offer, which will lead it to its next stage of existence.

Our children, grandchildren and great grandchildren will read in their history books about how men were able to find a way to live in peace without fearing that the sky will fall on their heads. They will, in turn, pursue this great strategic mission of making our civilization a singularity that goes beyond Earth's vicinity to bear a universal message engraved on the tablets of eternity.

General Jean-Loup CHRÉTIEN

Preface to the First Edition of *Stratégie Spatiale* (2011)

Colonel Jean-Luc Lefebvre dedicated the first edition of *Stratégie spatiale* to the strategy of space and subtitled it "La guerre des étoiles: une vision française"[1]. To my generation of aviators, *La Guerre des Etoiles* refers to President Reagan's Strategic Defense Initiative (SDI), which was initiated on March 23, 1983.

This was a project that relied on constellations of sensing and killer satellites, *Brilliant Eyes* and *Brilliant Pebbles*. Precursor to the notion of deterred deterrence, which is mentioned in this title, SDI satellites were designed to shield the United States from ballistic strikes. The Balance of Terror could, therefore, be broken allowing the free world to win the Cold War on the ground.

One French strategist of the time, General Pierre Gallois – another aviator! – demonstrated mathematically that the American project was not realizable, at least not with the technology of the time[2]. This analysis eased President Mitterand's concerns; as in his mind, national deterrence remained just as plausible as it was based also on a piloted component.

Soviet strategists saw this differently: the USSR had to take the challenge. Kremlin leadership gave the order for a similar protection system to the enemy's and financed the program despite precarious economic straits.

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1 The first edition of this book, *Stratégie spatiale*, Editions L'esprit du Livre, 2011, was subtitled "*La guerre des étoiles : une vision française*", translating as "Star Wars: a French vision" in reference to the eponymous project by Ronald Reagan combined with the fact that the author is performing a study influenced by French culture.

2 GALLOIS P., *La Guerre des cent secondes*, Paris, Fayard, 1985.

The rest is history. The USSR was ruined and collapsed. Many analysts admit that the SDI was one of the contributors to this collapse. The United States never realized their space shield, but financed a number of missile-defense programs efficient against limited strikes from certain territories. They even offer allied nations protection under a common antiballistic "umbrella" within NATO, a proposition that was officially retained by the summit in Lisbon in November 2010.

Outer space is, to this day, the last area where the reign of peaceful cohabitation is maintained and effectively respected. After having fought on land, at sea, in the skies, will the 21st Century see man open up to a theater of operations in space?

While the worst is never guaranteed, one should always prepare for it. We must therefore envisage this Star Wars. It is reassuring to see a French vision on this matter appear.

Four star-General Jean-Paul PALOMÉROS
Chief Staff of the Airforce from 2009 to 2012
Allied Commander Transformation of NATO from 2012 to 2015

Notice to Readers

Can strategic thought be applied to outer space?

The gambit of this study is to demonstrate how to properly pose the question and provide elements of a response. Using a didactic approach, this book is aimed not only at confirmed strategists, educated searchers, concerned members of the military or students of ***strategic concepts***, but intends to remain accessible to non-specialist readers who are simply interested in acquiring the keys to understanding current issues. Thus, before entering the core of the subject, the first couple of chapters will be dedicated to specifying the nature of the question, outlining the outer space environment and will initiate the uninitiated to the specificities of a confusing space. Naturally, initiated readers can simply review these opening chapters dedicated to notions he or she may already be familiar with. Fans of speed-reading are invited to focus on Chapter 8 that summarizes the fundamental elements of this topic with the "Twelve Principles of Space Strategy".

In terms of space strategy, it can be hard to draw a divisive line between politics and actual strategy, something that Serge Grouard experienced in *La guerre en orbite*, presented as an *Essai de politique et de stratégie spatiales*[1] when he chose to simply embrace both in his book. He commented that there were numerous works analyzing space policies from different actors and agrees with General Sir Rupert Smith that wars and conflicts take place on four levels – political, strategic, theatrical and tactical[2]; his study opts to focus on the strategic aspect, the definition of which is discussed in Chapter 1.

1 This translates as an essay on space strategy and policies, GROUARD S., *La guerre en orbite*, essai de politique et de stratégie spatiales, Economica, 1994.

2 SMITH R., L'utilité de la force, *Economica, collection Stratégies et doctrines*, Paris, p. 10, 2007.

This book is the result of an interdisciplinary approach – transdisciplinary at times – covering not only the fields of strategy and history, but also aeronautics, astronautics and space law and a variety of others, ranging from plasma physics to telecommunications. Each discipline uses consecrated terms that uninitiated readers may not be familiar with. The glossary at the end presents the definitions of a number of terms, expressions and acronyms and their French equivalents.

To help identify glossary entries, throughout the book, they will appear italicized in bold and blue when used for the first time, for example: ***space strategy***. When they appear again, they will appear in roman characters to avoid overloading the typography of the document. The definitions are borrowed from appropriate lexical references or from books such as *Traité de stratégie*[3] by Hervé Coutau-Bégarie and *La guerre en orbite*[4] by Serge Grouard. When there is no satisfactory definition, one by the author is used. The primary used references are listed at the beginning of the glossary and abridged throughout. In addition to the definitions, a French translation is proposed. This is a result of extensive reflection on the French version to use appropriate French terminology rather than using the English words. The author also chose to prioritize entries from the official terminological reference of French language the *Journal officiel* that are available on the *France Terme* website [5]. Particular care has been taken to update the glossary, where a number of new terms have entered into use since the French first edition, such as ***aerospace transition zone***. English readers are encouraged to understand that the French language was an integral part of the methodology for a French thinker, the same way the English language would be reciprocally for an English study. This being, first and foremost, a translation of a French study, it owes it to itself to present the terminological work that was done in that it is intrinsic to the present theoretical consideration. Who knows English terminology may gain from the French in this book.

In short, Space Strategy presents itself as a French study free of any doctrinal ties, binding only the author, who is currently relieved of any official responsibility.

My reason for seeking a new edition of *Stratégie spatial*, as well as for international publication in English, is not only because the original publisher "L'esprit du livre" no longer exists and the initial title can no longer be found anywhere. The five years since the original edition came out have allowed me to verify whether the theoretical foundations remain solid and that there is no need to revisit them. However, certain examples and data are worth updating. Among other things, the sources have all been verified, in particular the Internet links where the relevant documents are available. To simplify the footnotes, website consultation

3 COUTAU-BÉGARIE H., *Traité de stratégie*, Economica, 7th ed., Paris, 2011.

4 GROUARD S., *La guerre en orbite*, Economica, 1994.

5 See: http://www.culture.fr/franceterme.

dates have been omitted, unless it pertains to dated information where the link is no longer available. If the date is not specified, it is between October 1, 2015 and April 15, 2016. This laborious exercise allowed me to confront the versatility of the *web of webs* where available information never ceases to change address and tends to jump from free sites to commercialized ones, if not disappearing forever.

Finally, I would like to extend my thanks to ISTE Ltd. for making this book possible even though my book could contaminate the strategic thinking that takes place beyond the French language. This, and the reactions it may cause, is a risk I willingly take with delight.

Acknowledgments

I would like to thank the many people who answered my requests when writing this book.

The first group that should be mentioned is the group of experts who accepted to dedicate their time exchanging ideas on the theme of space strategy[1]: Mrs. Orianne Barrat-Genies, Analyst at the *Centre interarmées de concepts, de doctrines et d'expérimentations* (CICDE); Colonel Jérôme Bernier, from the *Commandement interarmées de l'espace* (CIE); Professor Jacques Blamont, Scientific Advisor to the Chairman of the *Centre national d'études spatiales* (CNES); Lieutenant-Captain Colomban-Lebas, from the *Centre d'enseignement supérieur de la marine* (CESM); Mr. Jean-Paul Granier, Analyst at the *Direction des affaires stratégiques* (DAS); Mr. Serge Grouard, Deputy-Mayor of Orléans; Second-lieutenant Béatrice Hainaut, Doctoral Student at the *Centre de recherche de l'armée de l'air* (CREA); Mrs. Claire Jolly, Analyst at the Organisation for Economic Co-operation and Development (OECD); Second-lieutenant Marie-Madeleine Marçais, Doctoral Student at the *Centre d'études stratégiques aérospatiales* (CESA); Mr. Emmanuel Nal, Head of Studies at the IRSEM; Ms. Laurence Nardon, Analyst for the *Institut français des relations internationales* (IFRI); Professor Jean-Paul Pancracio, Director of Studies at the IRSEM; Mrs. Oriane Rivaud, Head of Studies at the IRSEM; Professor Jean-Christophe Romer, Associate Researcher at the IRSEM; General Henry de Roquefeuil, Defense Advisor to the Chairman of the CNES; Commander Benjamin Souberbielle from the CESA; Ms. Isabelle Sourbès-Verger, Researcher at the CNRS, Deputy Director at the *Centre Alexandre Koyré* (EHESS -CNRS); General Jean-Daniel Testé, Deputy

1 Reusing the acknowledgments from the original French edition, persons are cited in alphabetical order with their titles from 2011. Unless otherwise specified, this will be the case for the rest of the names present in this acknowledgment section.

General Officer to the Director of Military Higher Education, who in 2015 became Head of the *Commandement interarmées de l'espace* (CIE); Mr. Jacques Villain, Space Historian; and Engineer in Chief of Armament Olivier de Vulpillières, Head of Studies at the IRSEM.

I also extend my gratitude to the experts who responded to my requests in writing: Mr. Gérard Belmont, from the Laboratory of Plasma Physics and Professor Jacques Blamont of the CNES, on the constitution of the upper atmosphere; Dr. Philippe Achilleas of the *Institut du droit de l'espace et des télécommunications*, Professor Mireille Couston from University Lyon 3, Mr. Mario Hucteau of the CNES and Professor Laurence Ravillon of the University of Bourgogne for matters relating to legal limitations between air and space; Mr. Fernand Alby on the subject of space debris; and astronaut Jean-François Clervoy for his detailed responses to my questions surrounding physiological perception between air and space.

Special thanks go to people who accepted to meet with me: Professor Jacques Blamont for his description of the upper atmosphere; Admiral Alain Coldefy for our informal exchanges on the link between space and deterrence; and Professor Armel Kerrest for animated conversations on the legal limitations between air and space.

The proofreaders of the original manuscript will forgive me for not mentioning them again; they are all part of the aforementioned group of experts. I do, however, wish to give special thanks to General Gilles Desclaux, Commander of French Air Defense (CDAOA); General Vincent Lafontaine, Director of the *Centre interarmées de concepts, de doctrines et d'expérimentations* (CICDE); as well as the General Gilles Lemoine, Director at the *Centre d'études stratégiques aérospatiales* (CESA) for helping me organize the proofing of my project by experts. I also thank Colonel Pascale Martin for her attentive reading and my friends Jean-Louis Henriot and General Michel de Lisi whose comments forced me to push my conclusions further. A number of observations, sometimes contradictory, were passed on to me. I did my best to take note of all of them as scrupulously as possible, though without ever deviating from my convictions.

Creating the glossary brought me into contact with the specialist commission of terminology and neology of space science and techniques. Thanks to the input of the secretaries there, Mr. Jean-Louis Astor and Mr. Jacques Arnould, under the authority of the Chairman, Mr. Michel Petit, the members of the club not only answered my questions but also co-opted me to help the with their project. Since 2010, we have worked together on new definitions that the present glossary will include. I salute them at this time for their voluntary contribution to the expansion of the French lexical field of space.

I would like to pay homage to the author of *La guerre en orbite*, written in 1994, a reference which offered a solid base and essential guide to my thought process. Many thanks to Mr. Serge Grouard, now deputy of Orléans, for his effective support despite a heavy workload. I join Archibald Haddock in raising my tumbler of whisky to his health and that of our Tintinophile readers who will understand that reference!

Up there, there is no sound, no smell, no more than there is food you can eat or objects you can touch within the protection of a spacesuit. Space is accessible in only one sense: sight. But what a sight! Its horizon is only limited by the age of the Universe, which is said to be close to 13.8 billion years according to the most recent estimations from the Planck space laboratory, which has allowed us to draw up the map of the Universe by observing ***background microwave radiation***.

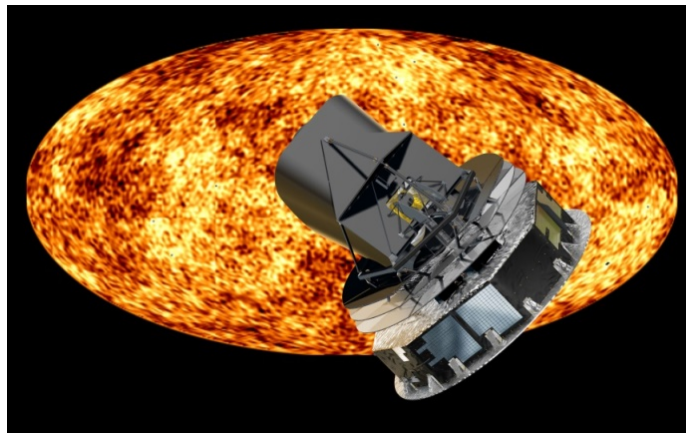

Figure 1. *Planck observing background microwave radiation (© ESA)*

Subsequently, this book deserves to be illustrated because space seen from Earth, just like Earth seen from space, are wonderful sights! However, I did not realize the difficulty of such a publication, and I must therefore thank ISTE Press and John Wiley & Sons for publishing the book in color. I must also express gratitude to the following companies: Airbus Space & Defence (formerly Astrium) and Thalès Alenia Space, as well as the French Space Agency (CNES), European Space Agency (ESA) and the American Space Agency (NASA) for the photographic resources they graciously put online in open access for authors such as me. In that regard, the *Centre national d'études spatiales* deserves a mention for their bespoke greeting and the fantastic iconographic research work that was performed on my behalf by Marie-Claire Fontebasso and Orianne Arnould should be strongly underlined. I also salute my brothers in arms from France and other countries, in particular the *Marine nationale* and the United States Air Force Space Command (AFSC), whose

immediate cooperation was much appreciated. I am also grateful to Isabelle Sourbès-Verger and the co-authors of *L'espace, nouveau territoire*, published by Belin, for authorizing me to reproduce a number of their particularly informational images. Overall, I want to express my gratitude to all authors who accepted for their work to be mentioned in this book. There was one image, in particular, that was particularly difficult to get a hold of, despite being available in low resolution over the Internet. It was the one of the "*three monkeys of wisdom of temple Toshogu*" located in Japan. An incredible chain of spontaneous solidarity, initiated by M. Jonathan Moutra, Auditor at the *Centre d'études diplomatiques et stratégiques* (CEDS), which traveled all the way to M. Shunsuke Ueda, Professor at University Kinki, who eventually took the photo especially for the book. This voluntary cooperation does them honor.

Publishing images presents severe technical challenges. Also, numerous illustrations available online were not published due to their low resolutions, which is the case for most of the diagrams and charts useful to understanding physical phenomena. Should I have simply left them out? Most certainly not! I therefore thank Jean-Charles Brunet, graphic designer under employment of the *Direction Generale de l'armement* (DGA) for editing these images that ended up being far nicer than the originals.

This book would never have seen the light of day without the help from the staff at the *Institut de recherche stratégique de l'Ecole militaire* (IRSEM), which I formally thank for supporting this project that was my main center of focus and primary activity for over a year.

Finally, three flag officers honored me with their signatures. The spontaneous agreement from General Jean-Paul Paloméros, then chief of staff of the French air force, to write my preface, left me deeply moved. I wish to thank my "senior" from the *Piège*[2] both respectfully and dearly. A man of action, but also of thought, he is one of the rare flag officers moving for space action to be accepted for its true value by decision makers and our defense-setters. Beyond its leader, it is to the French air force that I direct my gratitude. This is the institution that fed my passion for space and accepted to dispatch me to the IRSEM so that I may continue my work and write this book.

The postface, written by General Patrick de Rouziers, then inspector General, brings a geopolitical aspect to this book, which intentionally limits itself to strategy. In his previous functions is Brussels and Paris, General de Rouziers has always been

2 *Le Piège* is the name given by veterans of the *Ecole de l'air* in Salon-de-Provence, which trains officers for the French air force. This nickname was initially given to a military aircraft in which the crew would be trapped (*piégé)* if it were shot down.

vocal about reinforcing French and allied space power. He is an authority on the matter. Thank you, Patrick, for your kind support.

The *divine surprise*, if you will, came from across the ocean. I did not expect an answer back for a preface when General Jean-Loup Chrétien sent me a reply days before the cut-off for the first edition of *Stratégie spatiale*, sending two pages of philosophical and prospective contemplation that open this book. In the days when I was a young officer and still dreamt of one day becoming an astronaut, Jean-Loup, our first French astronaut, was my hero. Today, he has come back down from the stars and taken root on our spaceship called Earth in communion with his brothers and sisters of the forest of humanity. He still excites curiosity and enthusiasm and the idea of something sacred making him a worthy successor to Antoine de Saint-Exupéry. I salute them both for kindling the greatest flame that can burn in a man's heart that of a noble idea pursued not only for one-self, but also for the people who will come afterwards.

The task of updating and correcting the second edition of *Stratégie Spatiale* was an even more solitary adventure than writing the initial book. There are few people to mention here. However, this actualized version would never have seen the light of day without the help of Nicole Israël, who supports me far beyond this service, and her friend Daniel Etiemble, without whom I probably never would have contacted ISTE Group. I would naturally like to salute the professionalism of Chantal Ménascé who retained my online proposition for a publication and renewed the rhythm of a busy writer in a man who was already steadily moving to that of a quiet retiree. Thank you Chantal, but also Raphaël, Harry and everyone from ISTE.

I am very grateful for the chance at an international release of this humble French title surrounding a field that is no doubt endless for the Americans, Russians and Chinese that are currently leading the race. However, modesty does not impair competence or recognition, as demonstrated by Cold War era Colonel Robert Genty that both the Soviets and Americans recognized as a unique judge of space records[3]. May the memory of this master be equally honored as an example of intellectual creativity and scientific rigorousness, which he imparted upon his students with passion.

3 Colonel of the French Force, Robert Genty (February 23, 1910 – December 14, 2001) was the sole judge of space records for 35 years. A specialist in space mechanics, he invented the notion of heliosynchronous satellites that regularly revisits the same points on Earth at the same time, and is in this right is considered the "founding father" of observation satellites. Robert Genty taught at the *Ecole nationale supérieure des télécommunications* (now Télécom ParisTech) where the author had the honor of being his student.

"In summary, researching and writing remains a long solitary path, with moments of exaltation when discovering new landscapes, but also its arduous deserts when doubt is at your heels. I couldn't have made it without the presence of my wife, Martine at my side. Her affection and confidence are the mark of unwavering support. I thank her passionately", was my conclusion in 2011, without possibly imagining that she would precede me in joining *Our Father* in the heavens in Spring 2014. I undertake the writing of this book once more guided by the flame of her secret presence, in the warmth of my heart.

Introduction

Space: The Final Frontier of Strategy

> "Outer space has become a key environment in the global economy and international safety alongside the seas, the skies and land"[1].

To enlightened observers, space is either at the core of strategic implications[2] or is a new strategic domain to itself[3]. Space is strategic[4] to military leadership which links two notions that are already synonymous in American military command[5]: nuclear and space.

Being of the mind that we should be wary of *a priori* blatancy, this study does not assess whether or not space is strategic, but rather how strategic reasoning can be applied to ***outer space***, made accessible to vehicles as far back October 4, 1957[6].

In this study, we will use the generic term "space" to describe outer space (or ***exoatmospheric space***[7]).

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1 *Défense et Sécurité nationale, Le Livre blanc*, Editions Odile Jacob Paris, 2008.

2 GARCIN T., *Les enjeux stratégiques de l'espace*, Emile Bruylant, Brussels, 2001.

3 NARDON L., "L'espace, un nouveau champ stratégique", *Politique étrangère*, vol. 2, pp. 249–251, 2007.

4 MONTANIÉ B. (rear-admiral), "Espace militaire – L'espace est stratégique", *Revue Défense nationale*, no. 3, March 2004.

5 United States Strategic Command (US STRATCOM).

6 On October 4, 1957, the USSR successfully satellized Sputnik 1, Earth's first artificial satellite. In all fairness, it should be noted that the first vehicles to access space were the V2 rockets designed by the Germans and launched on September 8, 1944. Certain trajectories of these missiles peeked at 330 km. For reference, see the Techno-science website: http://www.techno-science.net/?onglet=glossaire& definition=10194.

7 In French, the dictionary of the Académie française (9th edition) dedicates the term *extra-atmosphérique*, but the term *exoatmosphérique* is also usable to describe space outside of Earth's atmosphere.

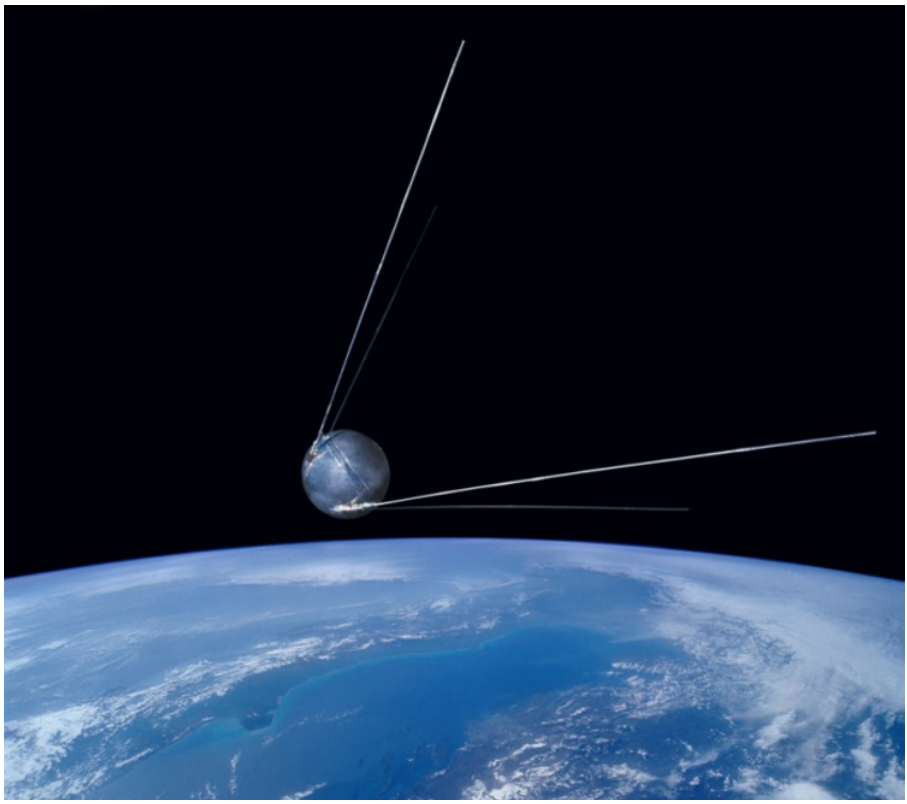

Figure I.1. *Sputnik, the first artificial satellite of Earth (© CNES)*

The nature of the environment constrains strategic thinking. Hence, upon a first approach, despite space spanning vast distances, the topography and obstacles restrict strategists to using linear devices: progression axes and frontlines characteristic of battles on land. In the high seas, maneuverability is total: it is two dimensional on the surface and three dimensional under the sea, but is reduced to land approaches.

Aerial weapons access the third dimension upward and elevate strategic considerations from the surface to large volumes. Common and exclusive elements of each environment – condition of the terrain or the sea, clouds and atmospheric conditions – play into Clausewitz's ***fog of war***.

Figure I.2. *Aircraft carrier Le Charles de Gaulle approaching a port (© Marine nationale (French Navy)). "In the high-seas, maneuverability is total: it is two dimensional on the surface and three dimensional under the sea, but is reduced to land approaches"*

To classical terrestrial strategy, as old as war, have been added naval strategy, as old as ships, and aerial strategy as old as *those magnificent men in their flying machines*[8]. They each have their specificities and common characteristics, and are greatly complementary.

Born of progresses in artillery, our recent access to space has already proven itself useful, as strategic nuclear missiles contributed, if not to winning the Cold War, at least in avoiding it from degenerating into a full scale "hot" war. It is now acceptable to think about this particular environment in terms of strategy. The present book proposes a contribution to this line of thought.

This didactic objective leads us to adopt a plan of investigation articulated over nine chapters. Chapter 1 allows us to frame the subject by defining the expression

8 Reference to the film by British filmmaker Ken Annakin of 1965 titled "*Those Magnificent Men in their Flying Machines, or How I Flew from London to Paris in 25 Hours and 11 Minutes*". This film traces the history of an air race from London to Paris in 1910 and which prefigured the future of aviation within the brewing world conflict.

"space strategy", presenting the strategic method of analysis we will use and presenting the issues that will serve as primary structural markers. Chapter 2 outlines the meaning of "outer space", a question as simple as the altitude at which it begins, but still, to this day, having no universal answer. The description of the specificities of outer space and how to move within it are the center of Chapter 3, because it is impossible to begin a discussion on the possibilities of action in space without prior knowledge of the restrictions presented by this environment. Once the setting and its possible actions have been established, it becomes possible to approach the central question within strategic space considerations argued in Chapter 4. The analysis of possible actions is split into three points of view from, against and within space, which occupy, respectively, Chapters 5 to 7. The links between space strategy and land, sea and air environments as components of a global strategy are among the themes we will touch on here. Chapter 8 offers a recap of the ideas presented in this book and offers them under the canonical form of *Twelve Principles of Space Strategy*. Finally, Chapter 9 imagines some ways in which we can go beyond this strategy.

The conclusion opens a prospective debate between the worrying risk of ***weaponized*** space dominating Earth and the reassuring perspective of space being used as shield for humanity against global threats. As of yet, there have been no wars in outer space, because there is no territory to dispute within it. The surface of the moon could very well become the first apple of discord between competing powers. However, there is no longer any possible war without space. This study initiates readers to the subtleties of concepts such as ***space militarization*** and ***weaponization*** by demonstrating that there can exist an intermediate position known as ***space martialization***. It also demonstrates how space capabilities make-up essential components of ***information dominance***, key to power in the 21st Century. It constitutes an "opening" of strategic thought applied to a distant and invisible place that has yet become completely unavoidable in our day-to-day lives and in the ways we make war.

For specialists, strategy touches on the quintessence of reasoning. To the uninitiated, space represents emptiness. So how can we marry space and strategy?

Etymologically speaking, the quintessence or ether represents the fifth element after fire, water, earth and air. I have demonstrated in past works that each element corresponds to the states of matter (plasma, solid, liquid and gaseous). Space, the last element to be conquered by man, is associated with the fifth element[9]. And, considering that it envelops our entire physical universe, does it require the entirety of strategic thought to be understood.

9 LEFEBVRE J.-L., *A la recherche du cinquième élément: du feu à l'espace, une brève histoire de conquêtes*, L'Harmattan, Paris, 2007.