Soft power, hard power, space power: Space programs of the United States and the United Kingdom

Master Thesis

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There, to the silver ice between the orbs,

Through time, through death, through storms,

There— we rush! For no better fate awaits,

Than for us to become— an interplanetary race.

- **Pavel Antokolsky**[1]

[1] Antokolsky, P. (circa 1934). *Sobranie sochihenii*, 4 vols. (Moscow: Khudozhestvennaia literatura, 1971), 1:380.

Acknowledgements and Disclaimer

This thesis represents a passion that I have developed for outer space since a long time ago. Space represents the ultimate frontier of human knowledge. I consider myself curious and thriving to learn all the time, and thus researching space politics and policy had my uttermost attention and passion.

I want to thank Dr. Joery Matthys for his feedback and patience while I was writing this thesis. Without his helpful insight, I would not have been able to do this research. I thank my family for their incredible support during my studies. I also want to thank my friends Povilas, Phil, Daniel, Laurynas, Johannes, Timna and Varun for their insights and feedback into improving my work, and for the amenable discussions we had every time we were together. To my landlords, Hyang and Jos, thank you for making me feel at home.

Finally, I want to thank the member berries, Star Wars, Guardians of the Galaxy, David Bowie, Rick and Morty, Spock, Interstellar, Carl Sagan and Isaac Asimov for stirring my passion for space.

Contents

Abstract

The first countries to reach the confines of outer space were the URSS, United States, and the United Kingdom. Fifty years later, more actors are reaching the ultimate frontier. Drawing upon International Relations Theory, this thesis uses Peter (2010) to assess whether the space power of a country can be determined for the generation of hard or soft power. It then discussed whether the space power of the United States and the United Kingdom are driven to generate hard or soft power. What are their goals and objectives? The US and the UK, being two of the three historical space users, still use outer space extensively.

The concept of space power has been conceived from military academia. Contemporary scholars in the field of space politics have asserted that other activities of a country's space program, such as the civil/research activities, also play a role in the space power of a country. Policies, strategies, plans, defense reviews, budgets, and space systems demonstrate whether a country seeks to use its space power for military or civil/research purposes. Performing this analysis allows to explain the drivers of each space program.

Keywords: space power, hard power, soft power, space policy

1. Introduction

The 'Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space' was signed in 1967 by twenty-seven countries. Among these countries were those that had established space programs by the time the treaty was signed: the United States of America, United Kingdom, and the Soviet Union. The main objective of this treaty was –and is- to maintain the medium of outer space solely for peaceful purposes.

Cue fifty years later. Anti-satellite weapons (ASATs) have been used by China[2] and the United States[3]. With the rise of private space companies, outer space has become more accessible. With new actors, such as India, investing heavily in their outer space capabilities, the space medium has become increasingly contested. But, why is space being increasingly used?

Space has not been used solely for peaceful and research purposes like the Outer Space Treaty establishes. It is widely acknowledged that Sputnik 1, the first man-made object to be launched into space in 1957, triggered a crisis in the United States (Peoples, 2008; Kay, 2013). In the UK, the launch of the Sputnik-1 was perceived as a signal of the Soviet Union's superiority in space (Barnett, 2013). It triggered a technological competition between the US and the URSS, referred by President Kennedy as a 'race' (John F. Kennedy Presidential Library and Museum, 1961).It is known nowadays as the 'Space Race', which some scholars argue ended when the Americans landed on the Moon (Schefter, 2000). The Space Race was seen as a struggle, which started in favor of the Soviet Union, and later shifted to the United States.

The focus of this research will be the United States and the United Kingdom. The two countries, along with the Soviet Union, were the first explorers of space. In present days, the United States, the United Kingdom, Russia, Germany, France, India, and China are using space for different purposes. Some systems launched are used for navigation (GPS), some are used for environmental and climate research, others for communications or intelligence collection. With the growing numbers of private space companies, more actors are able to reach space, a feat that in the past was considered impossible if a country was not considered a power in the international setting.

[2] See http://www.theage.com.au/news/national/fury-at-space-destruction/2007/01/19/1169095981210.html
[3] See http://www.nytimes.com/2008/02/21/us/21satellite.html?ex=1361336400&en=ea5702ff269483cc&ei=5088&partner=rssnyt&emc=rss

What can each country gain from using this medium? To what purposes do each country use the space medium? What is the link between power and space? The research question in the next section seeks to solve these enquiries.

1.1 Research question

What are the main drivers of space power in the United States and United Kingdom for the period 2009 - 2017?

1.2 Academic and Societal Relevance

This thesis presents two case studies that demonstrate the drivers of space power in the United States and the United Kingdom. The policies and implementation of the countries' space power are used to improve their position in the international setting. The link to Crisis and Security Management is thus depicted by the usage of outer space to achieve goals related to security interests.

Space applications require a large expenditure of public resources. The research, development, maintenance and launch of a single space equipment requires a considerable amount of public funds for extended periods of time, accompanied by the risk present in the launch of space equipment. For the society, it may mean a misguided use of public resources, or a wise investment in science and education. The numerous advantages of using outer space may include performing research that is unique to the space medium, incentivizing private and public sector investments, and/or using military equipment for enhancing the armed forces of a country. By comprehending the priorities of each space faring country, the societal relevance of this thesis is to be able to understand the expectations of each country for using the space medium.

Since this thesis analyzes extensively the space policies of these two countries, there is a clear link with the field of Public Administration. According to McKinney & Howard (1998), the field of Public Administration is:

> "*[T]he study of government decision making, the analysis of the policies themselves, the various inputs that have produced them, and the inputs necessary to produce alternative policies*" (p.62).

By analyzing the drivers of the US and UK's space policies, this thesis seeks to comprehend the direction towards which these actors emphasize their space efforts. Thus, this research is closely linked to the field of Public Administration due to the analysis of inputs in the UK's and US's decision-making regarding their space programs.

1.3 Knowledge gap

This thesis will apply the concept of space power developed within International Relations academia to the study of space policies. The study of the international political effects of space capabilities has been extensively researched. Lupton (1988), Gray (1996), Robinson (1998), Fredriksson (2006), Pfaltzgraff (2011), Khan & Khan (2015), among others, have studied the political implications on the usage of space and the role of space power theory in International Relations. However, as it can be seen in Lupton's (1988) work, space power theory was born from the military concept of *air power*. By establishing the natural advantages of the space medium as a unique way of enhancing the armed forces of a state, space power used to exist only as a military concept.

Other authors, such as Peter (2010) argued that previous research on space power theory has been heavily militarized since it is based on a theory that is drawn from *air power* theory, as seen in the work of Lupton (1988). The advantages of the space medium are not solely of military nature. Other applications, such as civil/research space systems do enhance the space power of a country. Therefore, a more comprehensive theory of space power needs to incorporate other aspects of space applications.

By using the concepts of hard and soft power developed by Nye, Jr. (2009), this thesis seeks to further contribute to the knowledge gap contributed by Peter (2010). Generating hard or soft power through space means prioritizing the space medium for military or civil/research purposes. The development of military equipment means the enhancement of armed forces, which, in turn, furthers the hard power of a country, while the usage of the space medium for civil/research purposes fit within Nye, Jr.'s (2009) concept of soft power. But, how does one establish whether a country seeks to generate hard or soft power through space?

This thesis shall thus analyze the space policies of the United States and the United Kingdom, in order to demonstrate that these can determine whether the space power of a country is set to generate either hard or soft power.

1.4 Reading guide

The main objective of this thesis is to comprehend how the United States and the United Kingdom delineate their space policies in order to achieve space power. Chapter 2 introduces the Theoretical Framework. It gives a brief summary of International Relations theories of Realism and Liberalism, conceptual definitions of terms such as *balance of power*, *power*, *space power*, and *hard* and *soft power*. Chapter 3 introduces the research methodology used to

determine the drivers of the two countries' space power. This chapter also justifies the recourse to an 'Exploratory Multiple Case Study' design. Chapter 4 is the analysis of each case, summarizing the history of each country's space programs, and implementing the methodology established in Chapter 3. Chapter 5 is the Comparative Chapter, addressing both similarities and differences of each case. Chapter 6 addresses the conclusions and limitations of this thesis.

2. Theoretical Framework

In order to understand the concept of space power and the way it is exerted by states, the idea of *power* itself must be discussed. To this end, the following section firstly introduces the reader to the two main theories of International Relations: Liberalism and Realism. From the two streams of thoughts, two very different definitions and conceptualizations of *power* and "*balance of power* in International Relations can be derived. These will be the object of a second sub-section. A third section then introduces Space Power Theory, and the works of Pfaltzgraff (1998) and Peter (2010) in conceptualizing space power. Lastly, the reader is introduced to a categorization of three types of power*: hard, soft* and *smart power*, and their applicability in the context of space power.

2.1 International Relations

The field of International Relations, as is commonly acknowledged, focuses on the ways inter-state relations are managed (Daddow, 2009, p.51). It is broadly described as a field that:

> "*deals with and seeks to develop understandings of international social, political and economic life, where each of these terms in turn, the international, the social, the political and the economic, are in themselves subject to contention and contestation*" (Fabri, 2000, p. 296).

The study of inter-state relations pertains the study of state behavior (Daddow, 2009, p. 52). Accordingly, this behavior is influenced by two fundamental terms within the field: *anarchy* and *sovereignty* (Daddow, 2009, p. 51; Goldstein & Pevehouse, 2006, p. 3 - 4).

Mearsheimer (2013) defines an anarchical international system as one with "*no centralized authority or ultimate arbiter that stands above states*" (p. 79). *Sovereignty*, on the other hand, has different meanings in academia. Krasner identifies four components of sovereignty: Interdependence, domestic, international and Westphalia sovereignty (Krasner 2001a, p. 2; 2001b, p. 3 – 4). The different types are not mutually exclusive. They can work aside, and even counter each other (Krasner, 2001b, p. 4).

In analyzing and understanding a world order characterized by anarchy and sovereignty, two streams of thought emerged as the dominant rationale in explaining inter-state relations.

2.2 Liberalism

As a stream of thought, which emerged in the beginning of the twentieth century, Liberalism stands from the premise that humankind is improvable (Dougherty and Pfaltzgraff, Jr., 1996, p.60). It assumes that states, although they have different interests and agendas, may cooperate both domestically and internationally (Jackson & Sørensen, 2007, p. 98).

The theory emerged out of the realization, post WW I, that military alliances, in the pursuit of a balance of power, had created the inevitable escalation of war at a worldwide level (Jackson & Sørensen, 2007, p. 32). It is in rejection of this belligerent dogma, that liberalist thinking introduced the idea of altering international relations by introducing international norms and institutions, and by promoting the democratization of states in order to encourage peaceful relations (Dougherty & Pfaltzgraff, Jr., 1996, p. 60).

The League of Nations was created acknowledging this objective, with the purpose of guaranteeing an international order and giving room for states to resolve their differences through arbitration. The latter however failed to become a strong international organization capable of influencing the international system (Jackson & Sørensen, 2007, p. 35). It did so because of the rise of European fascism and the resurgence of authoritarianism, leading many European nations to leave the table of negotiations in the 1930's (Jackson & Sørensen, 2007, pp. 34 - 35).

2.3 Realism

In reaction to the limitations of liberalist theory explaining inter-states relations in terms of peace, democracy and diplomacy, another stream of thought gained importance. Realist theory pertains that the relations between actors in the international system are based on conflicts of interests among countries and the people (Jackson & Sørensen, 2007, p. 37).

Realisms' main assumptions, according to Dougherty and Pfaltzgraff (1996), are: (i) the nation state is the central actor in international relations; (ii) in an anarchical setting, every state struggles for survival of their own (p.58); (iii) states have greater or lesser capabilities within the international setting; (iv) domestic and foreign policies do not coexist; (vi) states are rational actors following their own national interest; and (vii) "power" determines state behavior (p.58). International politics are a struggle for power (Morgenthau & Thompson, 1985). Where this

struggle is inevitable and natural (Little, 2007, p. 96), each state will act depending on their interest that is defined in terms of power (Korab-Karpowicz, 2013).

The following table summarizes both schools of thought's main tenets:

	Realism	Liberalism
Goals of actors	Military security.	Varies per area. Transnational politics make goals difficult to define. Transnational actors pursue their own goals.
Instruments of state policy	Military force mostly, economic instruments at times.	Resources used according to area. Interdependence, international organizations, transnational actors are major instruments
Agenda formation	Balance of power and security threats are priorities.	Agenda is formed according to power resources, international regimes, importance of transnational actors and interdependence.
Roles of international organizations	Minor roles, limited by state power and military force.	Major role in setting agendas, creating coalitions, and setting arenas for weak states.

Table 1. Summary of Realism and Liberalism (Keohane & Nye, 1977, p. 37).

The following section consists of a conceptual framework. It introduces the reader to the concept of "balance of power", dear to the Realist stream of thought. It then offers a working definition of power and an explanation of the different types (or channels) of power existing in today's world politics.

2.4 Balance of power

Balance of power, according to Haas, has no unique definition (Haas, 1953a). Dougherty & Pfaltzgraff (1996) claim that this term can encompass and be used in different meanings, from (des)-equilibrium to a balanced distribution of power, or policy and system (p. 37). However,

both argue that politicians have used the concept to seek superiority in the international setting, rather than creating an objective balance with rivals. The concept of balance of power means an objective arrangement where there is an equal distribution of power or a universal tendency that could help in describing or predicting state's behavior (Dougherty & Pfaltzgraff, Jr., 1996, p. 38). It can be a guide to prescribe how a politician should act if there is a disruption of the balance; and it may be a system that refers to the actors' identity, integrity and independence (also called international society). Other authors, such as Stefano Guzzini (1998), argue that the concept of balance of power can have four different meanings (p. 45). It may be a policy aimed to shift into a certain state of affairs or it could mean the actual status of the state of affairs. It can also be used as a measure for the distribution of power, or it may mean any sort of distribution of power (Guzzini, 1998, p. 45).

Lasswell and Kaplan (1969) argue that balance of power is not a state of equilibrium, rather a process (p. 251). For them, the equilibrium does not exist. They distinguish the process of power-balancing and the "balance of power" doctrines (Lasswell & Kaplan, 1969, p. 251). Balance of power, for the authors, is a remainder, rather than a characteristic. The doctrine, however, formulates the policies -or strategies- that will be used by the participants in the aforementioned process (Lasswell & Kaplan, 1969, pp. 251 - 252).

The concept of balance of power has several purposes (Claude, Jr., 1962, p. 11 – 40; Dougherty & Pfaltzgraff, Jr., 1996, p. 38). It is said to be capable of: preventing a universal hegemony; preserving the elements of the system; ensuring stability and security in the international system; and prolonging peace by deterring war. These can be achieved through different means, including dividing and ruling, creating buffer states, compensations after war, reduction of armaments, competitions, and/or creation of alliances (Dougherty & Pfaltzgraff, Jr., 1996, p. 38).

In Kissinger's view (1994), the balance of power can be used to restrict the possible domination of states by a stronger one, and thus, limit potential conflicts (p. 20). Balance of power is then one possible outcome, where the combination of other states keep in check aggressive actors of the international community. The other outcome is hegemony of one powerful state (Kissinger, 1994, p. 20). However, Morgenthau considers the concept of balance of power deficient on the grounds that a multistate system keeping one state in check can be the vector of war (Morgenthau, 1994, as quoted in Dougherty & Pfaltzgraff, Jr., 1996, p. 40). Nevertheless, the concept of balance of power is widely used as a guide , as it gives a high degree of flexibility,

as Haas argues (Haas, 1953b). Although crude, the concept is indeed widely used by politicians (Dougherty & Pfaltzgraff, 1996, p. 41).

This work has used the concept of balance of power widely. However, it has not explained the concept of power yet. The next section shall introduce the concept of power in IR.

2.5 *Power*

"*International politics, like all politics, is a struggle for power. Whatever the ultimate aims of international politics, power is always the immediate aim*" (Morgenthau & Thompson, 1985, p. 31).Power, as argued by Morgenthau & Thompson (1985), is used by politicians and people to define their goals in several ambits of life (p. 31). They define is as "*control over the minds and actions of other men*" (1985, p. 32). They also define the term *political power* as the relations of public authorities over the citizens. Political power can be exercised by different means, such as orders, threats, charisma, or any combination of these (Morgenthau & Thompson, 1985, pp. 32 - 33).

In a Realist understanding, power is the exercise of -or threat of the exercise of- coercive force (Claude, Jr., 1962, p. 6). However, in Liberalist thinking, power may be exercised through non-violent channels such as civil authority, influence on opinion and/or wealth (Russell, 1938, as quoted in Lasswell & Kaplan, 1969, p. 93).

Power could thus be thought of as conceptually multidimensional (Baldwin, 2016, p. 50). Its character depends on factors such as scope, domain, weight, base, means, costs, time, and place (p. 50). Morgenthau & Thompson (1985) identify geography, natural resources, industrial capacity, military preparedness, technology, leadership, and the quality and quantity of the armed forces, as determinant factors of power (pp. 127 - 42). Keohane & Nye, Jr. (1977) however, identify other factors of power, which are introduced later in this research. These factors, such as the economic power or minority rights, are determined as elements of a type of power: *soft power*. But, before clarifying the concept of *soft power*, this thesis explains in the next section the concept of *space power*, continued by the explanation of *hard* and *soft power.*

2.5.1 Space power

With the development of new technologies, a new realm of power has emerged (Hays, 2003, pp. 30-33). Outer space, since the launch of the *Vergeltungswaffe 2* (V-2) and the Sputnik satellite, became the new political-military arena to be dominated (Pfaltzgraff, Jr., 2011, p. 32).

Pfaltzgraff (2011) argues that, with the emergence of a new arena, there is a necessity for states to control it, in order to ensure its security and welfare (p.26). The primary function of aerospace as an arena was to enhance earth operations, but later deemed a necessity to develop offensive and defensive capabilities to dominate this setting as well (Pfaltzgraff, Jr., 2011, p. 26). He argues that IR theories emphasized power relationships as the main variable in order to understand the behavior of states in the world. Thus, he defines space power as the "*capabilities whose most basic purpose is to control and regulate the use of space*" (Pfaltzgraff, Jr., 2011, p. 26).

In the same line of reasoning, Lupton (1988) defined space power as "*the ability of a nation to exploit the space environment in pursuit of national goals and purposes and includes the entire astronautical capabilities of the nation*" (p.4). He asserts that the military component of space power is similar to that of air, sea, or land forces. These kind of forces have, normally, destructive capabilities. But, they may also perform support to the destructive forces (Lupton, 1988, p. 4).

Space has become a contested arena due to its strategic nature. Pfaltzgraff (1998) argues that technology has brought an effect of altering different spaces, such as the air or the sea (p. 32 – 33). In the case of space, it has numerous advantages, such as allowing a state clear vision of the skies, and/or a global perspective (France & Sellers, 2011, p. 45). This has provoked an increment in the usage of space for military purposes. However, there is a need to distinguish between the *militarization* of space and the *weaponization* of space. The first term refers to the launch and use of satellites for secure telecommunications, space surveillance, and reconnaissance (Association Aeronautique et Astronautique de France (3AF), 2008, p. 61). This is a passive use of space. *Weaponization*, on the other hand, consists in deploying weapons in space that may be used in that arena, or to be used in any other battlefield on the planet (Association Aeronautique et Astronautique de France (3AF), 2008, p. 62). The latter is regulated by international law through different treaties and conventions. However regulated, the deployment of weapons in space is becoming more conceivable since 2007, as China used an anti-satellite weapon (ASAT) to destroy one of its malfunctioning satellites[4] (Saunders & Lutes, 2007).

[4] See also http://thediplomat.com/2017/01/how-china-is-weaponizing-outer-space/ ; https://www.scientificamerican.com/article/war-in-space-may-be-closer-than-ever/

Some authors argue that the concept of space power depends heavily on military theory. Peter (2010) explains that the theory should be expanded in order to include other factors (p. 350). He describes the unique physical and political attributes of this medium. Due to the nature of outer space, military strategists have seen space as a support for terrestrial operations (Peter, 2010, p. 350).

Peter (2010) argues that due to this extensive use of outer space, space power theory should be more comprehensive, taking into account other effects of space (p. 351). He then defines space power as the

> "*total strength and ability of a State to conduct and influence activities to, in, through and from space to achieve its goals and objectives (security and military, economic and political) to affect desired outcomes in the presence of other actors in the world stage and if necessary to change the behavior of others by exploiting the space systems and associated ground-infrastructure as well as political leverage it has garnered*" (Peter, 2010, p. 351)

The author argues that the usage of space has a number of *effects* (2010, p. 351). These are categorized between *military*, *diplomatic*, *economic*, and *cultural effects*. This section has explained *the military effects* on the usage of outer space, since states have used space to generate hard power. The *diplomatic effects* of space can be seen as soon as a state is active in this medium (Peter, 2010, p. 351). This gives a state the ability to influence international policies that concern the usage of outer space, as well as giving that state a status of leadership and willingness to cooperate with other states, generating prestige at an international level. The *economic effects* of the usage of outer space are seen on a national economy because of the nature of the workforce needed and the development of industries that can support the activities of a state in space (Peter, 2010, p. 352). The *cultural effects* of space activities generate a strong social impact. When a space activity is successfully accomplished, it may cause the mobilization of citizens that advocate for more space activities (Peter, 2010, p. 352). Thus, Peter (2010) argues that space power uses elements of national power to generate influence (p. 352).

As advanced by Peter (2010), space power has been conceived from a military perspective (p. 354). However, the author also argues that a comprehensive space power theory needs to include the civil/research perspectives of space, since the usage of this arena is not exclusively

for military purposes. The following section defines different types of power found within IR theories, with a particular focus on the *hard* versus *soft* power dichotomy.

2.5.2 Types of power

"*Economic power, however vast, cannot halt armored divisions, just as military power itself would not be sufficient to ensure global trade dominance*" (Dougherty & Pfaltzgraff, Jr., 1996, p. 70).

In International Relations, both economic and military power have an important position as elements of national power. Successive researchers have identified different ways of exercising this national power. Wilson III (2008) identifies three different types of power exercise: *hard power*, *soft power*, and *smart power* (p. 114).

Hard power is defined as the capacity to coerce a state to act in a certain way that otherwise they would not do so (Wilson, III, 2008, p. 114). Strategies such as military intervention, coercive diplomacy, and economic sanctions are measures used to enforce the national interests. Realist thinkers would typically advocate such approach.

Soft power, on the other hand, has a different meaning. Nye, Jr. (2009) begins by stating that hard power is a concept known to most (p. 5). It works on the basis of inducements or threats. He argues that old elements such as population, territory, natural resources, economic size and military forces are becoming less important (Nye, Jr. J. S., 1990, p. 154). However, technology, education, and economic growth have become more important in the international setting. Nevertheless, Nye, Jr. also argues that even though technology, education, and economic growth are playing an ever-increasing role in the international setting, military resources remain important in the concept of power (p. 154 – 155). The present day balance of power is not composed solely of military power, but a combination between military power and interdependence. National security does not encompass military threats only, but the economic and ecological threats have been included in the agenda as well (Nye, Jr. J. S., 1990, pp. 156 - 158). New trends have diffused the traditional approach to power. These are *economic interdependence*, *transnational actors*, *nationalism in weak states*, *changing political issues*, and the *spread of technology* (Nye, Jr. J. S., 1990, p. 160).

Economic interdependence has been changed by innovations in the communication and transportation sectors. The decline in the costs of these two have transformed the global market,

increasing the development of multinational and transnational corporations, diffusing the role of governments and a subsequent intervention (Nye, Jr. J. S., 1990, p. 161).

Transnational actors and investments have created and changed interests and policies globally. For example, the French government, which had attempted to restrict Japanese investments in the French market, was outsmarted when Japanese authorities decided to implant industries in other EU countries, in order to export to France freely (Nye, 1990, pp. 161 – 162).

The increasing importance of private actors has made the military power difficult to apply in *weak states* (Nye, Jr. J. S., 1990, p. 162). Social mobilization has increased the cost of military intervention. Nye (1990) argues that the case of Vietnam and Afghanistan is an example of the costs for the US and URSS to maintain the troops in both counties (p. 162).

Ecological changes, health epidemics, and terrorism are world issues that have changed the nature of global *political issues* (Nye, Jr. J. S., 1990, pp. 163 - 164). These issues arise as the result a number of states trying to control transnational actors, as opposed issues, which were characterized by direct conflicts between states. An ecologic issue may have a domestic root, but it has international repercussions (Nye, Jr. J. S., 1990, pp. 163 - 164).

The use of *technology* has enhanced the capabilities of weak states (Nye, Jr. J. S., 1990, p. 162). The growth of national arms industries has reduced the dependence that a state has regarding foreign suppliers. The accessibility to different technologies has increased with a globalized world (Nye, Jr. J. S., 1990, pp. 162 - 163).

Keeping these new elements of power in mind, Nye, Jr. (2004) states that the sources of soft power are *culture*, *political values*, and *foreign policies*, and the repercussions these sources produce (p. 266) (2009a, p. 11). He argues that states can achieve desired outcomes without using inducements or threats. Sometimes a country can achieve its desires because of the values the country holds, the example that the country portrays in the international setting (Nye, Jr. J. S., 2004, p. 5). As such, he defines soft power as "*getting others to want the outcomes that you want*" (Nye, Jr. J. S., 2004, p. 5).

Nye, Jr. defines *culture* as "*the set of values and practices that give meaning to a society*" (Nye, Jr. J. S., 2009a, p. 11). It encompasses literature, art, education, science (Zewail, 2010), and mass entertainment. The promotion of a country's culture increases the chances of achieving that state's goals by creating a relationship with others based on attraction. However, culture

does not generate soft power by itself. It depends on the context as well (Nye, Jr. J. S., 2009a, p. 12).

Political values and foreign policies are entwined. For example, the United States' soft power in Africa was weak because of racial segregation during the 1950s (Nye, Jr. J. S., 2009a, p. 13). Nye, Jr. argues that states' soft power can be greatly affected by foreign policies. The promotion of Human Rights internationally by the US government has greatly developed its *soft power* (Nye, Jr. J. S., 2009a, p. 13).

Soft power rests on attraction and seduction, using its ability to shape the preferences of others (Nye, Jr. J. S., 2004, p. 5). In *soft power*, commands are not the most important interaction. The values that an actor holds are the most important components of soft power (Nye, Jr. J. S., 2004, p. 6). This type of power is made of influence, although it is not the most important part of it. For *soft power*, attraction is a priority (Nye, Jr. J. S., 2004, p. 6). The resources that generate such attraction are part of soft power. These resources can be, as aforementioned, technology, values, practices, policies, and/or education. Institutions, as Nye, Jr. (2009) noted, can also enhance the soft power of a country (p. 10). Examples that Nye, Jr. gives, are the creation of the International Monetary Fund and the United Nations by the United States, since the creations of these institutions were consistent with the democratic nature of the country.

Table 2 shows the differences between hard and soft power:

Types of power	**Behaviors**	**Currency**	**Government policies**	**Means**
Hard power	Coercion Deterrence Protection Inducement	Threats Force Payments Sanctions	Coercive diplomacy; War; Alliance; Bribes; Sanctions	Military; Economic
Soft Power	Attraction Agenda setting	Values Culture Policies Institutions	Public diplomacy; Bilateral and multilateral diplomacy;	Science; Research; Education; Economic

			Aid	

Table 2. Types of Power (Nye, Jr. J. S., 2009a, p. 31)

Even though different in their forms, soft power and hard power can reinforce each other. They can interfere with each other, or sacrifice one to gain the other (Nye, Jr. J. S., 2009a, p. 25). Haefele (2001) gives the example of President Kennedy orders to test nuclear weapons at the cost of its international prestige, since the country seemed to have lost some of its hard power prestige after the Bay of Pigs invasion (p. 78). When countries use both hard and soft power, they are using smart power.

Smart power, according to Gallarotti (2015), is "*the use of both hard and soft power to attain foreign policy*" (p. 245). The term smart power was coined by Nye, Jr. (2009b), arguing that that soft power, by itself, cannot produce effective policy (p. 160). Gallarotti (2015) argues that one example of smart power is the case of humanitarian interventions, where a protector states uses military power in order to protect states against aggressions or for peacekeeping (pp. 253 – 254). He also argues that the misguided use of one affects the other. When the US decides to implement an international environmental agreement, it will affect its economic growth (Gallarotti, 2015, p. 254). Sometimes a single instrument can do both, such as international aid given to a country that will, in turn, use it to pay a debt.

The Space Race is an example of the display of both hard and soft power. Haefele (2001) argues that after the launch of the Sputnik satellite in the 1950s, a part of the world viewed USA as the strongest economy, though the world opinion also thought URSS to be the strongest in military power and more advanced in space exploration (pp. 68 – 69). The reaction on US politics can be seen in the Killian Report of 1955 which studied the United States' technological capabilities of reducing the threat of a surprise attack. This report argued: "*We must constantly seek new technological breakthroughs that will bring about significant advances in our military power*" (Technological Capabilities Panel of the Science Advisory Committee of the Office of Defense Mobilization, 1955).

But, how can space power be used in terms of *hard* or *soft* power? The next chapter clarifies such process and how the space policies and the implementation of these policies into space power will be analyzed.

3. Methodology

3.1 Research Design

As mentioned in the past chapter, space power has been closely linked with hard power, that is, the usage of military means in order to influence and attain desired outcomes (Wilson, III, 2008, p. 114). Peter (2010), however, argued that space power could also be attained by other means, such as soft power. What are the elements of hard and soft power?

In order to classify the policies that generate hard power, this work analyzed and classified those who view space as a mean to coerce other actors. This means a policy that is military driven. Table 2 displays that hard power uses coercion in order to attain the outcomes that it previously set. According to Nye, Jr. (2009a), military means are used to threaten and coerce another actor. Thus, this research classified the policies, strategies, and plans into those who establish space as a medium to be used militarily.

Soft power, according to Nye (1990), is the usage of means that generate an attraction from one actor towards the other in order to attain previously defined goals. The elements that can be used to attain these outcomes are education, science, technology, and culture (Nye, Jr., 2009a; Zewail, 2010). These are all elements that, according to Peter (2010) can influence the space power of a country. Space generates other diplomatic, cultural, and economic effects. Soft power, as different from economic or hard power, uses a different currency to attain these outcomes. Since soft power, as argued by Peter (2010), can also generate space power, this thesis used the elements of soft power (culture, science, education, and technology) and searched the space policies of these two countries and determined which ones can be classified into those that generate soft power. Table 2 displays that, instead of coercions or bribes, soft power uses culture, institutions, policies, and/or values that generate an interest by which another actor will *want* to achieve a certain goal, rather than being *forced* to do so.

Figure 1 shows how this thesis classified policies (according to their driver). It then determined how the policies generate either *hard* or *soft power*, and ultimately were translated into space power.

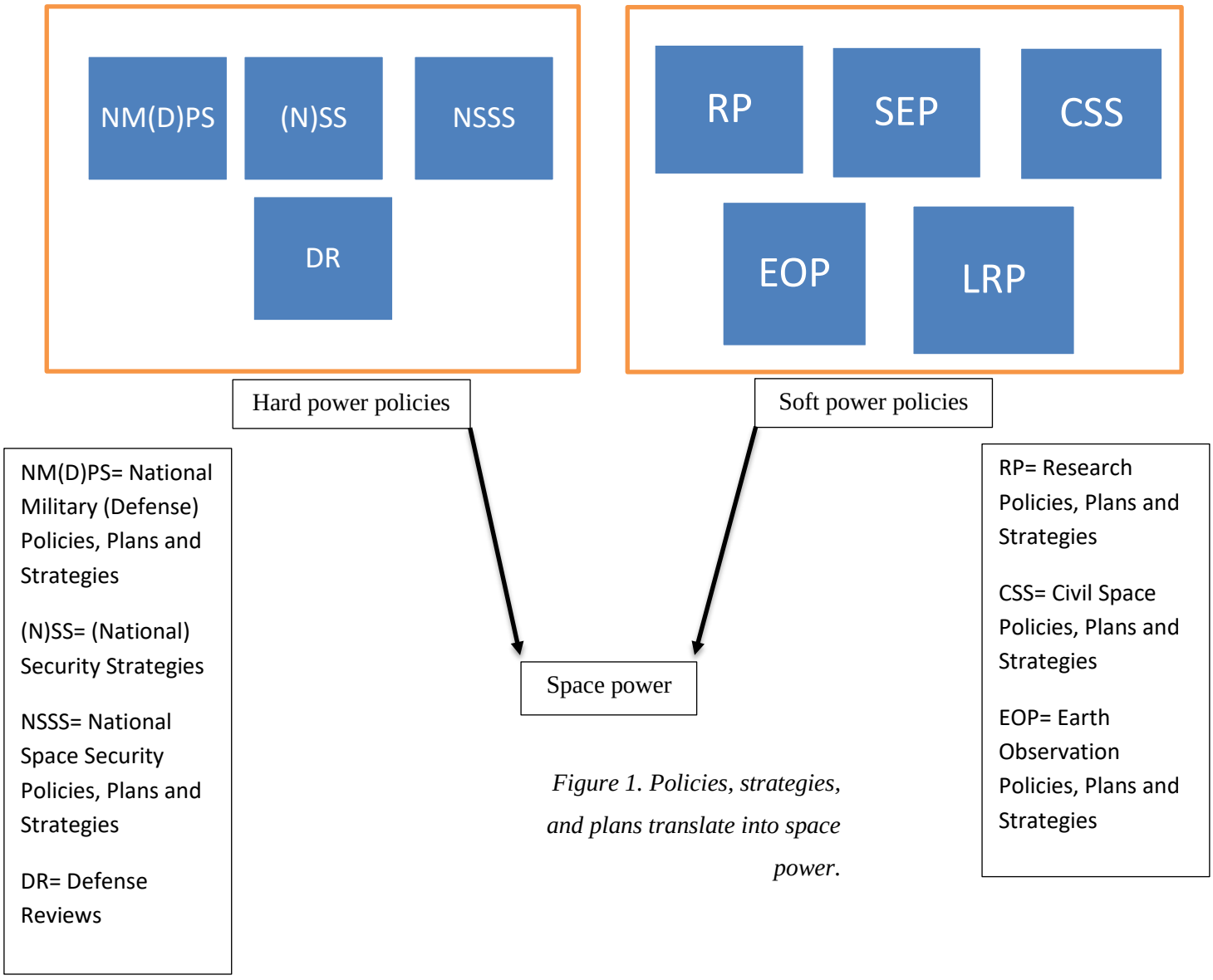

Figure 1. Policies, strategies, and plans translate into space power.

On the one hand, the policies, plans, strategies and defense reviews that seek to delineate the national security and/or military goals are categorized as *hard power*, since they look at past military and/or national security goals, and modify them to the necessities and vision perceived by each government. Thus, and using the concept of *hard power*, these publications are considered *hard power* policies.

On the other hand, research, space exploration, civil space, Earth observation, and Land remote policies, plans, and strategies are considered as *soft power* policies because they seek to use space for a different purpose than military. By applying the concept of *soft power*, this research sees that these policies use science and research to broaden the space agenda. Thus, by using outer space as a domain that enhances research and science activities, these publications seek to generate *soft power* through outer space.

Space policies, strategies, and plans of a country -depending on how they are directed (for military or research purposes) - determine whether space is meant to be used to generate either *hard* or *soft power*, which is then translated into space power.

In order to establish the drivers that determine the two countries' space power one needs to analyze the policies and their explicit goals (whether military or research-centered). Once the policies were classified into the two categories, the analysis of their implementation ensued. That is, the resources and equipment allocated for space activities. As soon as the policies were analyzed, the drivers of the space power of the United States and the United Kingdom could be determined.

The research question that this thesis answers is "*What are the main drivers of space power of the United States and United Kingdom in the period 2009 – 2017?*" In order to do so, this research determines whether the space power of the two countries is driven by a military or civil/research purpose. It will conduct a qualitative research in order to determine the drivers behind the space power of the US and the UK. More specifically, it will conduct an exploratory multiple case study research. This design is introduced in the following section.

3.2 Multiple case study design

This thesis will conduct an exploratory multiple case study in order to analyze the policies and implementation that helped the United Kingdom and the United States attain space power between 2009 and 2017. It uses and complements Peter's conclusion on the need for a comprehensive space power theory, by which the civil/research aspects of space policies and activities are included to determine how is the space power of a state (Peter, 2010, p. 354). What are the reasons for using an exploratory multiple case study?

Yin (2003) argues that questions beginning with "what" are questions that require conducting an exploratory study, since there is a goal of explaining specific inquiries (pp. 6 – 7). Questions that begin with "what" have the option of using different strategies that can answer the research question. These strategies are: experiment, survey, archival analysis, history, and case study (Yin, 2003, p. 5).

The present research seeks to explain the main drivers of two countries' space power in a specific period of time. It will not focus on quantifying the number of documents and sources that can be classified as testimonies of space power. Rather, it will analyze each policy using any type of power (hard or soft) to generate space power, their implementation and use over the

set period of 2009 to 2017. Since this research analyzes two specific cases -United States and United Kingdom-, it will then conduct a multiple case study. It investigates and comprehends the context in which this phenomenon occurs in these two countries (Yin, 2003, p. 13). In this research, the phenomenon under scrutiny is the usage of space and the policies and implementation within the space programs. In order to understand the phenomenon, this thesis deems necessary to analyze space policies, determine their underlying objectives intentions, and establish the drivers.

Peter (2010) briefly researched the space power capabilities of Europe as a whole, including public space agencies, the European Union, and the European Space Agency. This work will not analyze Europe as a whole. It will rather focus on one country of the region which plays a role in the development of space capabilities of Europe: the United Kingdom. The other case that is studied is the United States, due to its large presence in outer space applications. The two cases were chosen due to the similar historical background of their space programs, which were primarily military. The beginning of their space program can be traced to the end of World War II, when German rocket scientists were extracted by the Allies for their expertise in the development of the 'Vergeltungswaffe', also known as V2, the first ballistic missile to be used at the time.

Both space programs began with the determination of continuing the research and development of ballistic missiles (Boyne, 2007; Hill, 2012). However, the US had more resources invested on the research of ballistic missiles due to the beginning of the Cold War. Thus, the US was prepared to invest heavily on the development of ballistic missiles that would carry nuclear warheads (Boyne, 2007; Peoples, 2008). The UK, on the other hand, did not have enough resources due to the economical constraints as a consequence of World War II (Hill, 2012). It still developed ballistic missiles as a result of the Cold War, as will be later described. Since both space programs had a military background and later invested in the civil aspect of the space program, this thesis shall focus on the period of 2009 – 2017 in order to see whether there is still a trend in using space for military purposes or it has shifted to civil/research activities. Lastly, due to the global presence of these two countries through the influence of their armed forces and their permanent membership in the UN Security Council, the types of activities these cases perform in outer space might affect the kind of influence they have among international actors.

Thus this thesis researches whether there is still a determination to space for military affairs within the space program or if a shift in the drivers of their space policies exists and thus, their space power in the period 2009 – 2017.

In order to do so, the next section explains how it will determine the drivers of their space power.

3.3 Data collection

Yin (2009) states that there are six important sources of evidence: documentation, archival records, interviews, direct observation, participant observation, and physical observation (p. 113). This work used documentation and archival records in order to have a greater validity of results. It used multiple sources due to one of the principles of data collection, as established by Yin (2003, p. 97). He argues that multiple sources of evidence allow a researcher to address a broader range of issues. This process is called "data triangulation" (Yin, 2003, pp. 98 - 99). The usage of multiple sources permitted this thesis to have a comprehensive and broader image of the developments in these countries, while increasing the validity of the results as well. Since the analysis of the work is on the development of the space policies in a recent period of time, this research used a historic approach to first understand the background of the space programs. Then, it analyzed the policies and implementation of the space programs in order to determine the drivers of space power of these countries.

While using the theoretical framework to search for drivers of the two countries' space programs a "cross-case synthesis" technique was applied, as explained by Yin (2003, p. 133 - 137). This technique is used to analyze multiple cases as a separate study. This means that each case is studied individually (Yin, 2003, pp. 133 - 134). The determination of the drivers of space power in these countries depends on searching thoroughly for indicators as to which directions these programs are heading (whether there is a military or civil/research purpose).

3.4 Data analysis

So how did this research determine which policies are relevant for answering the research question? Looking at the policy documents that determine the guidelines, objectives and goals of each country space program, this thesis found that the documents specify how outer space is beneficial for military or civil/research purposes. Thus in order to determine which documents are relevant for the analysis, this thesis focused on those specific documents that mention outer space, space medium, or space systems. The documents that determine outer space for one purpose or the other were considered space policies, as defined by Sadeh (2002, p. xiv). After

finding space policies that were relevant to the analysis, this work classified space policies into those focused on military outcomes and those focused on civil/research outcomes.

The analysis of space policies and their implementations was divided in two categories: space policies and implementation that generate and/or contributes to *hard power*, and the ones that generate and/or contribute to the *soft power* of the country. Since *hard power*, according to Nye (2009a), includes the usage of military power (p. 31), this thesis searched and analyzed the policies into ones that are militarily-driven, that is, that focus on using space solely for military purposes.

In order to analyze the military aspects of space activities, space policies, directives, strategies, and budgets established during the period 2009 - 2017 were analyzed. It was done in order to establish the importance of the usage of outer space for military purposes. Then, this thesis examined the military space budget and the military space equipment currently placed in outer space. It analyzed the budget allocated to different entities, such as the National Reconnaissance Office (NRO), National Geospatial-Intelligence Agency (NGA), and the Missile Defense Agency (MDA). However, even though the NRO and NGA are components of the Department of Defense, they are also part of the United States Intelligence Community (USIC) (Agrawal, 2017).

The USIC is a federal group of sixteen government agencies that work independently and cooperate in intelligence activities (Executive Order 12333, 1981). As such, the USIC is highly secretive. However, the head of the USIC, the Director of National Intelligence, has the obligation to state publicly the total allocation of resources used by the USIC. Yet in 2013, the Snowden leaks revealed the resources allocated within the USIC (Gillman & Miller, 2013). These documents showed that the NRO and the NGA received an estimate 15.2% and 6.6% of the total budget of the USIC, respectively. Since access to the budget of NRO and NGA are highly classified, this paper uses the same percentages seen in the documents published in 2013, in order to analyze the budget published by the Director of National Intelligence each year. Thus, this work used publicly available budget published by the Director of National Intelligence and calculated the 15.2% and the 6.6% that are estimated to be allocated to the NRO and the NGA, respectively.

In the case of the United Kingdom, this research analyzed the UK Ministry of Defense's (MoD) space policies, strategies, plans, budget and equipment in order to determine whether the UK uses space for military purposes.

In order to determine which space policies generate soft power through space, this paper used the following mechanisms. First, using Nye, Jr.'s (2009a) definition of soft power (p. 31), this paper found the policies, plans, and/or strategies that sought to foster the research of space science, and the usage of space as a medium to research the planet. This also includes cooperation agreements drafted by both states with other actors, both at the bilateral and the multilateral level. The space activities that were researched were those that were/are used for civil/research purposes, such as meteorology, exploration, Earth imaging, and similar programs. Second, this work researched and compared the budget of civil/research used in space activities in each country. In the case of the United States, some federal agencies such as the National Oceanic and Atmospheric Administration (NOAA), NASA, and the US Geological Survey, use satellites for civil/research purposes..

In the United Kingdom, before the creation of the UK Space Agency (UKSA) in 2010, the British National Space Center (BNSC) was the agency responsible for coordinating the UK space program. Once the BNSC became the UKSA, the latter assumed all functions of the UK space program. Since the country is a member of the European Space Agency (ESA), this work also analyzed the contributions to the ESA and the space system benefitting the UK's space program for the period 2009 - 2017.

3.5 Reliability and Validity

The reliability of this study, as an exploratory multiple case study, will heavily depend on the procedure used to analyze policies and their implementation. Peter (2010) performed a procedure that this work used as a guide, in order to include more aspects to analyze. However, this research found that some documents, specifically policies and implementation measures of military space applications, are classified due to national security interest. An example of the lack of sources can be seen in Chapter 4, in which a calculation of resources assigned to two intelligence agencies in the US (the National Reconnaissance Office and the National Geospatial-Intelligence Agency) was performed. The two agencies are part of the intelligence community in the US. Their budgets are classified due to a national security interest. Since this research had to calculate their budgets, it took the percentage of the resources allocated to these agencies in leaked documents of 2013 and assumed the allocation of resources to be constant between 2009 and 2017.

While analyzing the UK, this research found that the Ministry of Defence did not mention explicitly its allocation of resources for military space activities. Thus, in order to calculate the

budget for military space activities, calculated the annual expenses of the UK's military space program. By using the Private Finance Initiative for the launch and operation of Skynet (a group of military communication satellites), this thesis divided the resources assigned to the contract by the duration of the contract, and used this data to calculate the expenses in military space activities between 2009 and 2017.

This study performed a multiple source data collection, in order to build the validity of this research. By looking at the government's guidelines and goals of the policies of the US and the UK, as well as the means of implementing these policies, this research saw the objectives for using outer space. Analyzing these objectives and implementations, this thesis managed to see both cases' drivers for fostering their space power.

3.6 Operationalization

This section explains how space policies will be analyzed to determine whether there is a military or civil/research driver as determinants of space power. That is, either by hard or soft power. A question arises here, and it is to establish how to identify the policies and their drivers.

First, it is necessary to define space policies. Space policies, according to Sadeh (2002) are "*the courses of action taken to achieve political and technological determined outcomes* (p. xiv). This means to identify policies that affect the intention of the usage of outer space. These policies outline clearly how and/or what the country should achieve in space. Sadeh (2002) also establishes that space policies deal with the environment, national security, commerce, and international cooperation (p. xiv).

Next, it seems imperative to establish whether a space policy is military or civil/research - driven. In order to do so, this thesis will look for the following indicators within the policies:

- Military - driven policies: Policies that seek to use outer space with military resources as a medium to generate power. The space policies that seek to use military resources establish how the space systems will be used in space. Thus, this thesis searched for military functions such as surveillance, enabling and enhancing military communications, enhancing resilience against physical attacks, gathering intelligence, and enhancing ground, air, and sea forces using navigation systems, among other military functions that uses space.
- Civil/research - driven policies: These policies are those that establish a clear guideline that establishes space for research purposes, and/or portray outer space as a means to

study the planet, the solar system and the universe. These policies seek to research on the environment, urban planning, aeronautics, exploration of space, develop new technologies, and foster space science. These characteristics contribute to the generation of soft power through space.

Therefore if a space policy is military- driven, it will be then classified as a *hard power space policy*, due to its determination to establish the space medium as a tool for projecting military power globally. If, on the other hand, the space policy is civil/research-driven, it will be classified as *soft power space policy*, due to the determination of outer space as an instrument for performing research and fostering the development of technologies for the benefit of society. This classification allows this work to analyze the pertinent policies, strategies, plans and/or reviews that establish a set of guidelines and objectives for the usage of the space medium, and it will thus assist in determining how the United States and the United Kingdom direct their space power. Table 3 shows the indicators within the policies that will be searched in order to classify them.

Theory	**Concept**	**Definition**	**Indicator**	**Data Sources**
Space policies		"*[T]he courses of action taken to achieve political and technological determined outcomes*" (Sadeh, 2002, p. xiv).	Guidelines and objectives set by public entities linked with outer space that seek to establish the usage of outer space.	▪ Examination of relevant written material
	Hard power space policies	Strategies, policies, and/or plans that seek to enhance the military power of a state. A strategy, policy, and/or practice that is military-driven will set the usage of space systems as a military mean to coerce. This means that the policy, strategy and/or plan will seek to generate hard power through space.	Usage of space-based systems to enhance ground troops, perform surveillance, enable military communications, espionage, and/or intelligence functions.	▪ Examination of relevant written material

	Soft power space policies	The use of resources and activities that creates values and benefits in exploring, understanding, researching, managing and utilizing space for researching on the climate, weather prediction, geological research, among other forms of research. Policies, strategies, and/or plans that seek to enhance the usage of space systems as means to research on science will then seek to use space as a generator of soft power.	Usage of space systems for climate and environmental research, Earth observation capabilities, space exploration, and space science.	▪ Examination of relevant written material
Space power		"*total strength and ability of a State to conduct and influence activities to, in, through and from space to achieve its goals and objectives (security and military, economic and political) to affect desired outcomes in the presence of other actors in the world stage and if necessary to change the behavior of others by exploiting the space systems and associated ground-infrastructure as well as political leverage it has garnered*" (Peter, 2010, p. 351).	Space infrastructure, activities, applications, systems and ground-infrastructure that are encompassed within the space capabilities of a country.	▪ Examination of relevant written material

Table 3. Operationalization.

4. Analysis

Prior to the presentation of results, the following section summarizes the origins of the space program of the United States and the United Kingdom. Follows, an analysis of the space policies and the power that is then generated in the case of each country during the period of 2009 – 2017.

4.1 Overview of United States space program

4.1.1 Brief history of the space program

To look at the history of the US space program, it is imperative to explain the origins of the National Advisory Committee for Aeronautics (NACA), and then into World War 2, more specifically "Operation Paperclip", as NACA and "Paperclip" served as the main basis for the development of the United States space program.

NACA was created on March 1915, and was charged with conducting research in aeronautics (Anderson, Jr., 1976, pp. 1-2). By 1929, NACA was becoming famous internationally due to the important results it was achieving in aerodynamics (Anderson, Jr., 1976, pp. 3 - 4). During World War II, NACA's priorities focused on short-term urgencies of military aircraft, improving the performance of aircraft in terms of speed and reachable altitude (Anderson, Jr., 1976, pp. 7-8). New technologies, such as rockets, jet engines and atomic bombs, would drastically change space policy. With the Cold War beginning, the US was looking for strategic ways to outmaneuver the Soviet Union, and is where Operation Paperclip helped with the development of the US space program (Anderson, Jr., 1976, p. 8).

Operation Paperclip was an operation performed by the Allied Forces in 1945 whose objective was to seize the intellectual capital that Germany achieved during the course of World War 2 (Boyne, 2007). Among the scientists that were brought to the United States under Operation Paperclip was Wernher von Braun, the lead designer of the V-2 rocket (Bilstein, 1996). This missile served as the basis design of latter space rockets (Collins & Aldrin, Jr., 1975).

In the mid-1950s the US space program began its course with the International Geophysical Year (Moulin, 2010, pp. 688 – 689; Anderson, Jr., 1976, p. 11; Odishaw, 1958, p. 115). The United States launched Explorer 1, the first US satellite to be placed in Earth's orbit (Anderson, Jr., 1976, pp. 15 - 16).

By 1958 it was decided that the national space program should be split in two components: a national military component conducted by the DoD, and a national civil space component,

conducted by NASA (Anderson, Jr., 1976, pp. 17 - 18 (Alexander, 1989, p. 97). NASA was created by the National Aeronautics and Space Act of 1958, taking over the functions of the previous agency, NACA. It would pursue space exploration programs in concert with the military (Anderson, Jr., 1976, pp. 17 - 18). One week after its creation, the first American manned space flight program, Project Mercury, was approved (Anderson, Jr., 1976, p. 21).

In 1961, President John F. Kennedy announced that the United States would reach the Moon by the end of the decade, named Project Apollo (Launius, 2006, p. 227). It is a lesser known fact that the same year President Kennedy announced Project Apollo, the National Reconnaissance Office (NRO) was established (Berkowitz, 2011, p. 1). This new agency was tasked with the design and operation of reconnaissance satellites. Among these was the CORONA Reconnaissance System, the first of the reconnaissance satellites and a cornerstone of the agency that performed reconnaissance missions in conjunction with the Air Force SR-71 and the CIA A-12 airplanes (Berkowitz, 2011, pp. 8 - 9).

During the 1990s, space systems played prominent roles. During the First Gulf War, reconnaissance satellites, communications and navegation systems were used for the first time by the US-led forces (Berkowitz, 2011, pp. 18 - 19). NASA announced the construction of the International Space Station (ISS) with other international space agencies with the objective of conducting space science experiments, observation of the planet, serve as a transportation nod, and conduct applications of new technologies (Memorandum of Understanding between the National Aeronautics and Space Administration of the United States and the Russian Space Agency concerning Cooperation on the Civil International Space Station, 1998).

In the meantime, NROs activities have diversified. NROs reconnaissance satellitles collect a variety of data pertaining to tests of foreign aircrafts, missiles, communications, while also collecting information for the planning and conduction of military operations (Berkowitz, 2011, pp. 26 - 27). In this last activity, NRO has aided in the "War on Terror" by collecting intelligence for military operations, cooperating with other agencies in order to combine data, while also providing communciations to the military. Even though NRO has diversified its activities due to the changing security arena, it has also maintained its original function, which is to provide an arms control based on international agreements (Berkowitz, 2011, p. 29).

In order to continue with the analysis of the United States' space program, it is necessary to first divide the activities performed by the US government in two branches: military and civil.

4.1.2 The United States' government space program

The US government' space program is divided in two branches: military and civil/research. Figure 2 shows the agencies that engage into space activities in the United States[5].

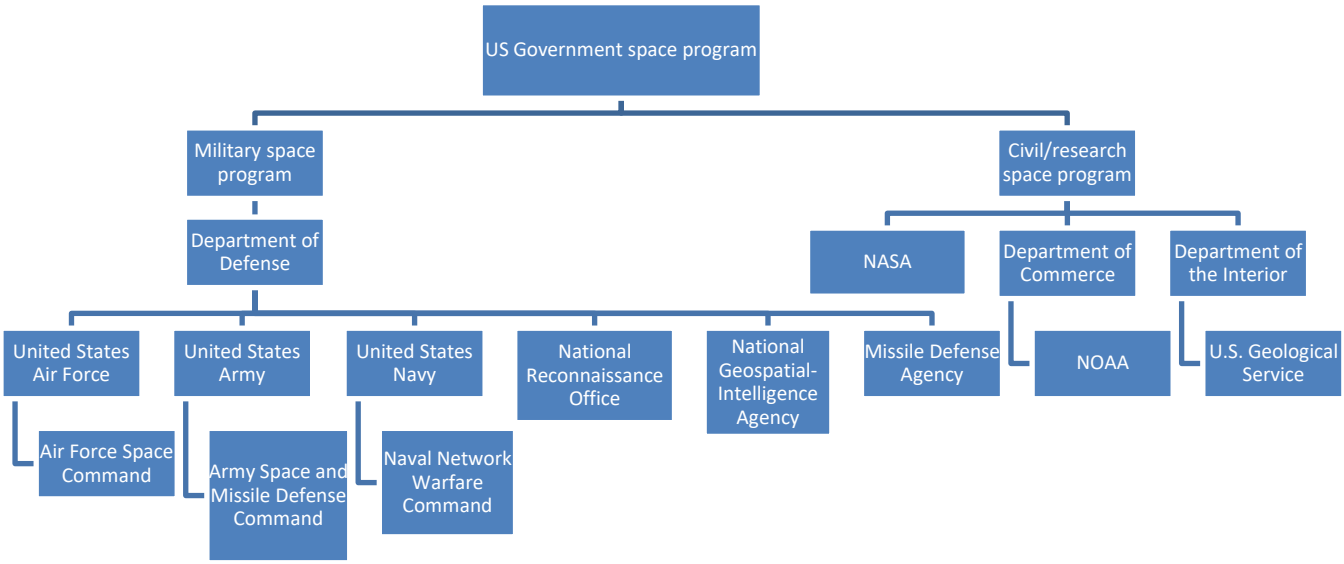

Figure 2. Public US entities that engage in space activities

These agencies engage in space activities and follow the National Space Policies. These space policies have been applied during the period of 2009 to2017, and have set the principles, goals, and guidelines on the US usage of space. These are:

- The U.S. National Space Policy of 2006, signed by President George W. Bush (U.S. National Space Policy, 2006).
- National Space Policy of the United States of America of 2010 (National Space Policy of the United States of America, 2010).

U.S. National Space Policy of 2006

The U.S. National Space Policy of 2006 sets the usage of outer space around seven fundamental goals. These goals include the reinforcement of the space capabilities to aid the national and homeland security, as well as reaching foreign policy objectives; pursue the national interests of the US; implement and develop the human and robotic exploration program; and foster the science and technology base to reinforce national and homeland security, as well as civil space activities (U.S. National Space Policy, 2006, p. 2)

[5] U.S. Strategic Command (USSTRATCOM) is not included in this figure, due to it being composed by members of the other departments of the DoD (Army, Air Force, Navy, and Marines).

Thus, this policy divides the guidelines for the usage of the space medium in two: the National Security Space activities guideline, and the Civil Space activities guidelines (U.S. National Space Policy, 2006, pp. 3 - 6). Among the functions established for the usage of the space medium for National Security activities are to: develop and deploy space capabilities for gaining an advantage in both defense and intelligence activities; maintain missions for space support and control, as well as force enhancement and application; and provide launch access to the defense and intelligence sector for security purposes (U.S. National Space Policy, 2006, pp. 4 - 5).

In the case of the guidelines for Civil Space activities, the policy establishes that the Civil Space activities are to execute a human and robotic space exploration program; use civil space systems to further understand the planet, solar system, and the universe; develop environmental sensing systems; and continuing civil geostationary environmental sensing systems and programs (U.S. National Space Policy, 2006, pp. 5 - 6).

Thus the U.S. National Space Policy of 2006 established the usage of the space medium for both military and civil/research purposes. The Space Policy of 2006 was effective until 2010, when the National Space Policy of the United States of America of 2010 was enacted.

National Space Policy of the United States of America of 2010

The National Space Policy of the United States of America of 2010, just as the previous National Space Policy, established the guidelines on the US usage of the space medium. This document also divided the guidelines for the usage of the space medium in several sectors, divided into the National Security Space Guidelines and the Civil Space Guidelines (National Space Policy of the United States of America, 2010, pp. 10 - 14).

The National Security Space Guidelines establishes that the pertinent entities with the task of defending the US will develop and operate space systems for supporting the national security through defense and intelligence operations; develop and apply new space technologies for an effective response against threats; develop capabilities for generating deterrence, defense, and attack capabilities that might affect the US space infrastructure; maintain space capabilities for force enhancement, support, control, and force application missions; provide new tools and techniques for generating new information regarding foreign space activities (National Space Policy of the United States of America, 2010, pp. 13 - 14).

The Civil Space Guideline establishes the civil/research usage of the space medium for supporting human and robotic missions to generate new knowledge and understanding of the solar system and other planetary bodies; expanding the usage of the International Space System for scientific, diplomatic, and educational purposes; conduct space missions for researching global climate change and ongoing changes to the planet's land and inland surface water (National Space Policy of the United States of America, 2010, pp. 11 - 13).

Thus, the National Space Policy of 2010 is the applicable national space policy of the US. In order to further analyze the military and civil/research space program, this work first explains the *hard power space policies* of the United States, followed by the *soft power space policies*.

4.1.3 Hard power space policies of the United States

As seen in the Operationalization section, the space policies of a country are further classified as *hard power space policies* or *soft power space policies*. This section shall demonstrate the space policies of the US that classified as the former.

The *hard power space policies* are those policies that seek to generate hard power through the space medium. That is, space policies driven by a military and security need to establish the usage of outer space for enhancing the armed forces, thus using space systems for coercing other actors.

As seen in the previous section, the National Space Policy of 2010 establishes the usage of the space medium for both military and civil/research purposes. In order to understand how the military space program is applied, this thesis analyzed policies, reports, plans, and/or strategies under the National Space Policy of 2010 that foster the military usage of the space medium. These policies establish the national defense goals and objectives of the country and mention the space medium as part of the national defense (National Military and/or Defense Policies), review past objectives and outline new goals (Defense Reviews), and determine space as an aid in achieving national security objectives (National Space Security Policies).

The National Military and Defense Policies of the US show the different threats that the country faces among different areas, with the threats to the space systems included. In order to pursue the national security interests of the US, the policies assert space as a tool that aids in achieving national security objectives and projecting global power (National Defense Strategy, 2008, pp. 6, 22; National Military Strategy, 2011; National Military Strategy, 2015, p. 16; Defense Strategic Guidance, 2012, p. 4). These policies also assert that the space medium is critical for

the security and power projection of the US. As such, the US should maintain and enhance its space capabilities in order to provide self-defense options, and to maintain capabilities used to deter future and current adversaries (National Military Strategy, 2011, p. 19). In order to project this military power globally, the National Defense Policies assert that there should be extensive investment in space capabilities that allow the country to effectively project power through Intelligence, Surveillance and Reconnaissance and warning space systems, as well as missile defense technologies (National Military Strategy, 2015, p. 16). Other documents within these policies, such as the Defense Strategic Guidance of 2012, assert that outer space is ideal for deterring aggressions against the country.

The Defense Reviews assert that space systems such as those used for Intelligence, Surveillance and Reconnaissance are key instruments in the War on Terror (Department of Defense, 2006, pp. 19, 55). Establishing a flow of information attained by well-maintained space capabilities gives an advantage the national security effort. Space capabilities allow to gain more information on China, considered a threat in terms of military resources (Department of Defense, 2006, pp. 29 - 30). These documents also determine that the global power projection of the country depends on the space assets, since these enhance the missile and WMD defense capabilities of the US, thus there is a need to invest in space systems that allow the enhancement of resilience, deterrence, defense and offense capabilities (Department of Defense, 2010, pp. 13 – 14; Department of Defense, 2014, p. 20). The Intelligence, Surveillance and Reconnaissance space systems are a priority for these documents (Department of Defense, 2014, p. 37).

The National Security Space Policies assert that the US is able to project power globally, conduct operations, and conducting other activities using the space medium activities, and thus it is vital for the maintenance and enhancement of national security activities (National Security Space Strategy, 2011, pp. 1, 4). Due to these benefits, the intelligence and defense communities rely heavily on space systems for the conduction of military and intelligence-gathering missions. These policies also establish that military space activities are to be directed for the development of space capabilities that extend the battle benefits gained due to the nature of the space medium (Department of Defense, 2016). They also seek to ensure the use of space systems for supporting military operations and pursue national security objectives, and to develop space plans to defend space systems from space-enabled attacks.

It is then clear that these policies use military resources through the space medium for enhancing their armed forces and projecting global power. The use of military resources in these space

policies indicate the presence of hard power, and the determination of using outer space to generate this kind of power.

Now that the *hard power space policies* of the US space program have been listed and explained, the next section reviews the *soft power space policies* in order to effectively analyze the level of priority.

4.1.4 Soft power space policies

The policies classified as *soft power space policies* are those that determine space for generating research and using technologies for the benefit of societies. Using the elements within the concept of soft power by Nye, Jr. (2009a), this thesis explained in previous sections that those space policies that use these elements, such as technology, education, science, and the inclusion of changing political issues can be determined as policies that seek to generate soft power through space. Thus, this research considers these policies as *soft power space policies*.

How are *soft power space policies* applied? A review of the Research Policies, as well as the Earth Observation Policies, show how space is determined to be used in the civil/research branch of the US space program. The Research Policies of the US are classified as those which chart the general objectives and goals for performing research in several areas of interest to the country, while Earth Observation Policies are those that determine the civilian/research application of Earth Observation systems.

The Research Policies of the US describe outer space as a medium that allows the research of climate and environmental change (Strategic Plan for the U.S. Climate Change Science Program, 2003, p. 123). Applications affirmed by these policies unique to outer space are the usage of equipment that allows the study of the atmosphere, measuring global precipitation and fossil-fuel emissions, and generating long-term data for monitoring climate change (pp. 32, 59, 78, 126; The National Global Change Research Plan 2012 – 2021, pp. 40 - 41, 114; Report on Goals and Objectives for Arctic Research 2009 - 2010, pp. 47 – 48; Report on Goals and Objectives for Arctic Research 2011 – 2012, p. 5; Report on the Goals and Objectives for Arctic Research 2013 - 2014, p. 4; Artic Research Plan 2013 - 2017, 2013, pp. 38 – 39; NOAA's Next-Generation Strategic Plan, 2010, p. 6). Other applications detailed by the Research Policies of the US are to use space systems for measuring ice mass loss, coastal erosion, weather, marine, riverine and terrestrial resources (Artic Research Plan 2013 - 2017, 2013, pp. 24, 47 - 48). Space weather events are also deemed important phenomena in science (NOAA's Next-Generation Strategic Plan, 2010, p. 10).

The Earth Observation Policies of the US establish several benefits of using space-based observation systems for technology, society, and science. Monitoring climate change, resource demand, development of coastal and urban areas, weather and climate conditions, and ozone depletion are only possible through the usage of space systems (Achieving and Sustaining Earth Observations: A Preliminary Plan based on a Strategic Assessment by the U.S. Group on Earth Observations 2010, pp. 3, 12 – 13; National Plan for Civil Earth Observations, 2014, pp. 13 - 14). The publications within the Earth Observation Policies of the US affirm that the society, the economy and the environment benefit from the usage of space-based observation systems. These allow the management of water resources, coastal and marine planning, climate adaptation strategies and sustainable land use (National Strategy for Civil Earth Observations, 2013, p. 11; National Plan for Civil Earth Observations, 2014, pp. 13 - 14). Other benefits gained by the usage of Earth Observation systems are the encouragement for the practice of sustainable science for supporting and integrating different sciences, promoting technology that allows the production of sustainable products, processes and systems, supporting agriculture and forestry, conserving biodiversity, and understanding the effects of space weather events on technological systems (National Strategy for Civil Earth Observations, 2013, p. 11; National Plan for Civil Earth Observations, 2014, pp. 13 - 14). These policies also prioritize the usage of Earth Observation systems for geo-hazard, water level and flow monitoring (National Plan for Civil Earth Observations, 2014, p. 14).

Hence it can be seen that the Research and the Earth Observation Policies of the US seek to generate new technologies, perform research, and include changing political issues for the benefit of the country. These elements are considered to be part of the soft power of a country, as established by Nye, Jr. (2009a). Consequently, these policies are considered to generate soft power through space, also classified as *soft power space policies*.

After reviewing both the *hard power* and *soft power space policies* of the US, this thesis shall review the space power of the country, in order to compare the usage of military and civil/research space systems.

4.1.5 Space power of the United States

The precedent section analyzed the space power of the US in order to determine whether the US prefers to generate hard or soft power through space.

The space power of a country, according to Peter (2010), is considered to be the space systems and associated infrastructure used in, to, through and from space to achieve goals and objectives

(p. 351). Using this definition, this thesis found the space systems that are part of the space power of the US and currently deployed and used in both military and civil/research branches of the US space program. Specifically, this thesis reviewed the military and the civil/research space systems that are part of the space power of the country.

In order to explain the military budget and space systems of the US, it is necessary to briefly explain the defense budget of the US, where the resources allocated to military space activities are found.

Any military activity of the United States is conducted by the Department of Defense. The budget allocated to the DoD in the period of 2009 - 2017 was 5,572,256 million USD (See Appendix A). Within this budget are the resources allocated for military space activities. The budget allocated for military space activities is found within the area of C3, Intel, and Space (See Appendix B). However, these are a series of expenses that include intelligence, communication and space activities. These expenses are largely directed to the United States Intelligence Community (USIC). Within the USIC are two agencies (NRO and NGA) that perform military space activities. However, before demonstrating the budget allocated to these two agencies, this paper found that 655,000 million USD were allocated to the USIC (See Appendix C). This work deemed necessary to show, first, the budget of the USIC due to the classified budget allocated to each of the entities within the community.

To calculate the resources allocated to the NRO and NGA, this work estimated the percentage of the USIC annual budget assigned to these two agencies, based on information published in 2013. Consequently, this research considered that 15.2% and 6.6% of the annual budget was assigned to the NRO and the NGA respectively (See Appendix D). In conjunction with other entities that perform military space activities, this research found that the budget allocated for military space activities ranged in the amount of 307,367 million USD, representing a 5.51% expenditure of the defense budget for the period 2009 - 2017 (See Appendix D).

Seeing the yearly budget assigned for military space activities, this budget had no continuous increase or decrease throughout the years. However, while the defense budget decreased 12.55% in the period of 2009 – 2017, the military space budget has decreased 4.54%. It does not mean that the increase or decrease of the defense budget affected equally the military space budget. When the defense budget decreased by 6.04% between 2011 and 2012, the military space budget increased 0.34% (See Appendix I). And when the military space budget between

2013 – 2014 and 2016 – 2017 reduced by 0.81% and 5.09%, the defense budget increased by 0.67% and 0.41%, respectively.

As a result it can be seen that the defense budget of the US has decreased 12.55% in the period of 2009 – 2017, and the military space budget by 4.54%. The military space budget assigned for 2009 was higher than 2017, decreasing from 34,954 million USD to 33,366 million USD, bringing a total of 307,367 million USD spent for the period of 2009 - 2017. Thus the budget for military space activities has been reduced overall in the period 2009 – 2017. This expenditure has produced an amount of 93 military space systems used solely by the US government (Union of Concerned Scientists, 2017).

On the other hand, this paper determined that the civil/research space program of the United States is performed by three entities: NASA, NOAA[6], and the US Geological Survey[7]. This section introduces the budget allocated to the three entities, and the equipment used for civil/research activities.

The budget allocated for civil/research space activities is 182,616 million USD (See Appendix E). This budget is distributed to the agencies in charge of the civil/research space program described in Figure 2. The budget has augmented throughout the years, passing from 19,013 million USD to 22,037 million USD, an increase of 15.90% (See Appendix J). This increase has not been steady throughout the years, though. Between 2011 – 2012 and 2012 – 2013, the civil/research space budget was affected by a decrease of 4.15% and 4.31%, respectively. The budget that was allocated to these agencies have produced 61 current civil/research space systems (Union of Concerned Scientists, 2017).

Given that the military and civil/research space program have been analyzed, the following section analyzes this data in order to determine whether the US directs its space power for generating hard or soft power.

[6] The NOAA has a broad range of functions. In order to effectively analyze the budget for NOAA's space activities, this work used the budget allocated to the National Environmental Satellite, Data, and Information Service.

[7] In order to analyze the budget spent by the USGS in space activities, this work analyzed the area of Climate and Land Use Change within the entity, since this is the area within the USGS that uses space-based observation systems to research on changes in land and climate. Within the USGS is another program called National Geospatial Program, which is not part of the area Climate and Land Use Change, but performs similar functions. Thus, this work included both in the calculations.

4.1.6 Preliminary conclusion

This section shall first give a brief overview of the space program of the US. It will then draw the connection between the concepts of hard and soft power to the policies that were reviewed.

As seen in the National Space Policies of 2006 and 2010, the US has established that space is envisioned for both military and civil/research purposes. The entity in charge of the military space program is the Department of Defense through its components, while NASA, the NOAA, and the U.S. Geological Service execute the civil/research space program.

On one hand, this thesis found various US space policies that seek to generate hard power. The National Military and/or Defense Policies of the US determine space as a tool that achieves national security objectives, and as a medium that supports the power projection of the US (National Defense Strategy, 2008, pp. 6, 22; Defense Strategic Guidance, 2012, p. 4). Other policies ascertain that space capabilities are critical for security and military power projection, providing deterrence and projecting power (National Military Strategy, 2011, p. 19; National Military Strategy, 2015, p. 16). The Defense Reviews affirm that space is beneficial for generating intelligence on WMDs and information on US military opponents, and enhancing deterrence, defense and offensive capabilities of the US (Department of Defense, 2006; Department of Defense, 2010; Department of Defense, 2014). The National Security Space Policies ascertain that space allows the US to conduct military operations globally, projecting its power (National Security Space Strategy, 2011, p. 1), and establish space as a support system for military operations and pursuing national security objectives, allowing the US to deploy power projection capabilities (Directive 3100.10; Department of Defense, 2016).

Hence these policies seek to enhance the military power projection of the US through space by using space assets for deterrence, intelligence, and attack and defense capabilities.

On the other hand, using the concept of soft power allowed this thesis to find those policies which seek to foster research activities in and through space. These policies were classified as *soft power space policies*.

The generation of soft power through space can be seen in the Research Policies of the US. These policies designate space as indispensable for studying atmospheric changes and the effect of certain elements to the atmosphere, measuring global precipitation and fuel emissions, and tracking climate change. They also ascertain that observation systems are needed to measure long-term variables that affect the planet and execute geographical analysis. Space systems are

also an important tool for researching the impact of climate, ocean and land changes, as well as studying ice mass loss and the impact of chemicals in the atmosphere, and monitoring coastal erosion, weather and water resources. Space systems are essential for detecting climate trends, in addition to predicting space weather events and coastal wave conditions. Earth-Observation systems are necessary for observing changes in climate change, resource demand, coastal and urban areas, weather, ozone, and climatic conditions. They establish that Earth observation systems provide benefits for the economy, the society and the environment aiding in the fulfillment of long-term sustainability objectives. These benefits involve the support of science and technology for producing new sustainable products, processes and systems that will aid in the conservation of biodiversity, the prediction of space weather events and its effects, and the monitoring of climate variability, land surface, and water level (Report on Goals and Objectives for Arctic Research 2009 - 2010, pp. 47 – 48; Report on Goals and Objectives for Arctic Research 2011 – 2012, p. 5; Report on the Goals and Objectives for Arctic Research 2013 - 2014, p. 4; Artic Research Plan 2009 – 2016, pp. 24, 38 – 39, 47 – 48; NOAA's Next-Generation Strategic Plan, pp. 3, 6, 12 – 13; National Strategy for Civil Earth Observations of 2013, p. 11; National Plan for Civil Earth Observations of 2014, pp. 13 - 14).

Therefore these policies seek to use the space medium for the development of new technology and the inclusion of different political issues that include observing and monitoring climate change and the usage of resources, classifying them as *soft power space policies*.

Nevertheless, these policies determine that the US determines the usage of outer space for generating both hard and soft power. In order to answer whether the US seeks to generate hard or soft power through space, this thesis used the budgets and the hardware used for both purposes. This is done in order to show the application of hard or soft power through the space power of the US.

Comparing the military space budget and the civil/research space budget of the US, it is seen that the military budget is higher than the civil/research budget (See Appendixes D and E). However, the military space budget has seen a 4.54% decrease throughout 2009 – 2017, while the civil/research space budget has seen an increase of 15.90%. However, both budgets have not seen a steady increase or decrease during this period (See Appendixes I and J). Even though the military space budget has been reduced and the civil/research has been augmented between 2009 and 2017, the military space budget still surpasses by 68% the civil/research space budget, having an expenditure of 307,367 million USD vs. the 182,616 million USD of the

civil/research budget (See Appendix D and E). Thus it is shown that the budget allocated for military space activities is higher than the civil/research space program, with the military space budget having a tendency to decrease and the civil/research budget with a tendency to increase. There is also a difference at the equipment placed in outer space for both activities. The military space program has deployed 93 space systems, compared to the 61 used by the civil/research space program (Union of Concerned Scientists, 2017).

Conclusively it can be seen that the US seeks to generate both hard and soft power through its space power. Its *hard power space policies* seek to enhance its armed forces for a global military presence, more specifically through the Intelligence, Surveillance and Reconnaissance missions. They also determine that space is an ideal tool for projection the (military) power of the US globally. On the other hand, the *soft power space policies* determine that space is ideal for performing research/civil activities that will permit the research of climate variability, track the usage of resources and their effect on the atmosphere and the environment, monitor space-weather events and their repercussions to technologies, the development of new technologies and products that are beneficial to the society, and that will subsequently pave the way to explore reach and explore the rest of the Solar System. Looking at the budgets allocated for both branches of the space program of the US, and the space systems placed in outer space, it can be seen that the US fosters both the generation of hard and soft power through its space power.

Even though the military space budget has seen a decrease in this period and the civil/research space budget has seen an increase, the review of the space policies, the budget and the number of space systems show that the US assigns a higher priority to the military branch of the space program.

Thus, this research's preliminary conclusion is that the main driver of the space power of the US is to generate hard power. It shall analyze the UK space program next, and determine whether the UK directs its space power for the generation of either hard or soft power.

4.2 Overview of the United Kingdom space program

4.2.1 Brief history of the space program

In order to analyze the UK space program, this section first summarizes the history of the UK space program.

Just as the US and the URSS, the UK space program began after WW II (Hill, 2012, p. 1). However, it did not receive the attention the US and the URSS had. The projects that were handled in the beginning of the UK space program were less ambitious and with a financial constraint (Hill, 2012, p. 1). The UK space program was driven by the military need, more than the civilian effort. This is where the history of the Blue Steel project begins.

Blue Steel was a rocket designed to deliver nuclear payloads (Hill, 2012, p. 11). The Blue Steel project began in the 1950s as an alternative to the usage of bombers that were thought to become more vulnerable in the near future. In 1955, the project Blue Streak was conceived (Hill, 2012, p. 11). Blue Streak was conceived as a ballistic missile capable of reaching Soviet territory. However, due to the effects of WW II in the UK economy, the financial will to fund rockets was unstable (Hill, 2012, p. 13). It was due to this financial constraint that it was decided to launch the UK's first satellite, Ariel 1, in a Thor rocket belonging to NASA (Massey & Robins, 1986, p. 74). The Ariel 1 was launched in 1962, with the last satellite of the Ariel program, Ariel 6, launched in 1979 (Millard, 2005, p. 9).

Military satellites were developed at the same time. Skynet, a group of military communications satellites, was being developed by the British Ministry of Defense (MoD) (UK Military Space Programmes, 1996, p. 32). The Skynet family of satellites was being developed since the end of the 1950s, with its first launch in 1969 on an American Delta-M rocket. The first satellite functioned only for 18 months (UK Military Space Programmes, 1996, p. 33). Launches of the Skynet satellites continued until 2012, when Skynet 5D was placed in outer space.

The Blue Streak project was cancelled in 1960, with its design later used as a basis for the project Black Prince (Hill, 2012, p. 13). The objective for the Black Prince project was to become a satellite launcher. However, the project did not receive support from the military in the UK, since most of the intelligence that the military needed came from the US, and thus did not feel the necessity to launch satellites (Hill, 2012, pp. 13 - 14). The civilian and research sector seemed interested in the project, but lacked the funds. Hill (2012) points out that this is the time when a decision was taken: to include other nations with the hope of sharing the costs (p. 7).

Thus the European Launch Development Organization (ELDO) was born (Hill, 2012, p. 7). ELDO developed the Europa rocket, designed to launch satellites into space. The main developers of this rocket were the United Kingdom, France, and Germany (Hill, 2012, p. 7). However, the rocket did not perform as it was expected, and the project died, along with the organization.

At the same time, project Black Arrow was being developed (Hill, 2012, p. 7). This project was based on a previous rocket, Black Knight, which was used for researching and testing navigation equipment in rockets. The Black Arrow project was designed as a satellite launcher, and its development continued during the 60s, only to be canceled before its final launch in 1971, which launched the UK's second satellite, Prospero 1 (Hill, 2012, p. 7).

After the Black Arrow project was canceled, the UK relied on the Skylark family of rockets for performing research in outer space (Hill, 2012, p. 7). The Skylark family of rockets were used to perform all types of space science and research (Massey & Robins, 1986, p. 28). The first launch of these type of rockets began in November 1957, during the International Geophysical Year (IGY), and continued until the public funding was cancelled in 1977. Despite public funding being cancelled the Skylark family of rockets continued to perform under private companies until 2005, when the MASER-10 was launched on a mission for the ESA (European Space Agency, 2005).

During the 70s and by the beginning of the 80s it was decided that the UK space expenditure would focus on channeling it into a European venture: the European Space Agency (Millard, 2005, pp. 5 - 7). The space efforts of the UK would then be channeled by a coordinating body called the British National Space Center (BNSC). However, in 2010, the BNSC was transformed into the UK Space Agency (UKSA), who currently undertakes all the civil/research space activities of the UK.

Since the BNSC was created, and its subsequent replacement UKSA, the UK has been among the top five contributors to the ESA[8]. Thus, just as the UK has played an important role in the ESA since its conception in 1975, ESA has, as well, played a key role in the development of the UK space program.

[8] The variability in the contributions since the creation of the ESA have changed. The BNSC and subsequent UK Space Agency have contributed a major part of its annual budget to the ESA, between 65% and 95% of its total budget. This represents a contribution to the budget of the ESA between 7% at its lowest and 23.18% at its highest.

In 2003, the UK launched Beagle-2, a Mars lander, aboard the ESA's Mars Express mission (ESA/UK, 2004, p. 3). It was designed to explore the surface and sub-surface of Mars. However, all contact with the lander was lost upon landing on Mars (ESA/UK, 2004, p. 9). There was no further information on the status of the lander until January 2015, when NASA's Mars Reconnaissance Orbiter discovered that it landed safely but failed to deploy its solar panels (Knapton, 2015).

A brief summary of the history of the UK space program was provided. The research now turns to explaining how the UK government performs its space activities.

4.2.2 United Kingdom government space program

This segment explains how the UK space program has been performed since 2009. It shows how the space program of the UK was organized before and after the creation of the United Kingdom Space Agency in Figures 3 and 4.

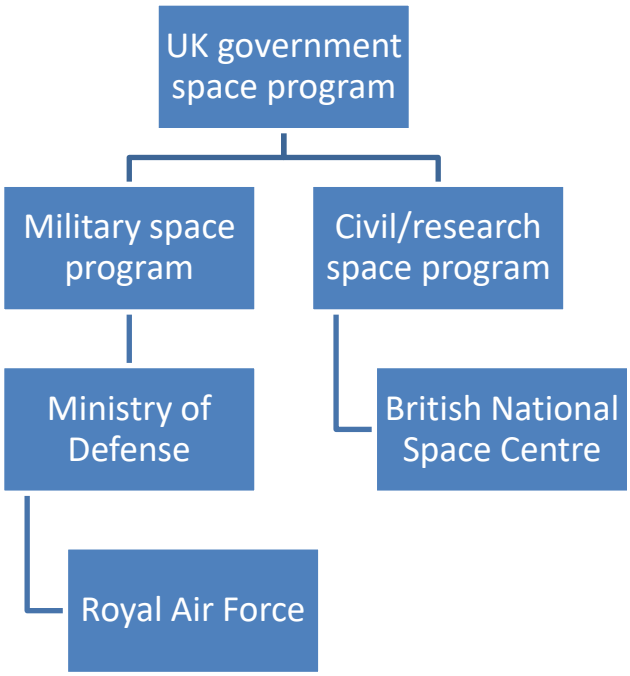

Figure 3. UK space program before the creation of UKSA.

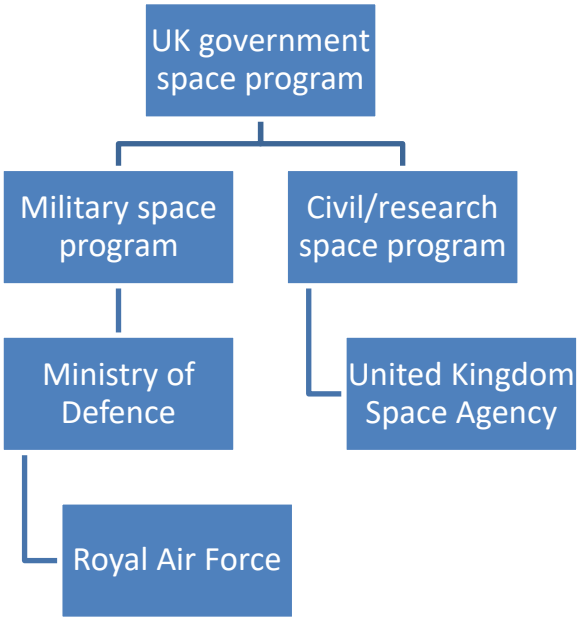

Figure 4. UK space program after the creation of UKSA

After the creation of the UKSA there was a change in how the UK conducts its space activities. In the National Space Policy of 2015, which will be later described, the conduction of both military and civil/research space activities are coordinated by the recently created UKSA.

National Space Policy of 2015

In this policy document, importance of the usage of space is highlighted as a national priority for the country. It is done so due to the space sector becoming an important part of the British economy (United Kingdom Space Agency, 2015, p. 4). It also delineates the importance on the usage of space systems for both national security and scientific and innovation purposes (p.9). For national security purposes, the National Space Policy sustains that the international security interests of the UK are heavily dependent on space systems, and will continue to use them to enhance the UK's national security. It also draws importance to the joint use of intelligence and defense cooperation with the United States (p. 9).

For science and innovation purposes the National Space Policy points out the vantage point that outer space offers in terms of producing scientific research and technological developments (United Kingdom Space Agency, 2015, p. 9). In order to perform research, it will support space programs in collaboration with the ESA.

This National Space Policy is the most recent policy published by the UK government. However, before this policy, several space policies were published. These policies have established how space is envisioned within the within the entities of the UK. The following paragraph analyzes the military space activities.

4.2.3 Hard power space policies

As seen in the US *hard power space policies*, the space policies that seek to use the space medium for conducting military operations, projecting power, and/or enhancing the military forces of a country are classified as such due to the elements present in the concept of hard power. This thesis also found indicators of *hard power space policies* within the UK space policies. So how do these policies seek to use the space medium for generating hard power?

The *hard power space policies* of the UK explain that the space power of the country can aid in the achievement of political and military outcomes (Ministry of Defence, 2009, pp. 8 - 9). These documents also highlight the importance of the usage of outer space systems for the success of military operations, since space has a unique environment that aids with the delivery of information through intelligence and surveillance. It also states the reliance of the armed forces of the country in space systems that have communications, surveillance, reconnaissance, and navigation functions (Future Air and Space Operating Concept, 2009, p. 1 - 2). They also state that the global reach of the UK is heavily dependent on space systems and there is a need to invest in a European space system (Future Air and Space Operating Concept, 2009, p. 1-9; Future Air and Space Operating Concept, 2012, pp. 20, 27). They acknowledge the dependency of projecting military power through outer space, due to the usefulness of this medium for conducting defensive operations such as intelligence, surveillance, and reconnaissance operations (Future Air and Space Operating Concept, 2012, p. 52). These policies also establish that space is increasingly important for military and defense communication purposes, which allows the UK to respond to global trends (The National Security Strategy of the United Kingdom: Security in an interdependent world, 2008, pp. 53 - 54).

Space plays a key role in society as well, due to the critical role that space technologies have in both military and civil functions such as the communication and navigation space systems (National Security Strategy of the United Kingdom: Update 2009, pp. 13, 104; National Security Strategy and Strategic Defence and Security Review 2015: First Annual Report 2016, pp. 19 - 20, 46). Other priorities established by these documents are for using space systems to accomplish national security interests and defense operations of the UK in order for the armed

forces to maintain a global reach (National Security Strategy and Strategic Defence and Security Review 2015, p. 46; National Security Strategy and Strategic Defence and Security Review 2015: First Annual Report 2016, pp. 19 - 20, 46). Space capabilities play an important role in the economy and the national security of the UK (National Space Security Policy, 2014, p. 2). The UK has a need for enhancing its resilience against disruptions of its space services and capabilities, due to its usefulness in achieving the national security interests of the country, and the support that space systems can provide to different sectors of the society. The policies also assert that in order to achieve the national security interests through space, the country has a need to continue their alliance with the US, due to vital information gained for security interests[9], to develop counter-space programs, cooperate with other allies, to monitor and incorporate future dual-use European space programs, and to contribute and support NATO in identifying space related risks and vulnerabilities that might harm the national security interests of the UK (National Space Security Policy, 2014, p. 14).

Thus it can be seen that these policies seek to use military resources through space in order to project power. By using military resources through space, these policies are classified as space policies that seek to generate hard power using outer space. For this reason, these policies are classified as *hard power space policies*.

Now that the *hard power space policies* of the UK were reviewed, this thesis now reviews the *soft power space policies*.

4.2.4 Soft power space policies

As shown in previous sections, the *soft power space policies* are those policies that enhance the soft power of a country through space. The elements that were found within these policies determine the usage of space for performing research, advancing science, inclusion of changing political issues and fostering new technologies for the benefit of society.

The *soft power space policies* of the UK state that civil/research space activities in the country are to be directed for increasing the UK's participation in the global space market, deliver space systems for studying changes in the planet, exploring the universe, incorporating space technology for the benefit of society, and developing skills linked to space as part of the critical infrastructure of the UK (Wilmouth & Sivalingam, 2008, p. 90). They prioritize the development of Earth observation systems that will benefit the country by forecasting the

[9] The cooperation between the two countries provides the UK much of the intelligence, surveillance, and reconnaissance information gained through US space-based capabilities.

weather and monitoring possible natural disasters. The commercial aspects of space are also highlighted in these policies, since they contribute to the growth of the space sector within the country while also performing research and managing global challenges (UK Space Agency Civil Space Strategy 2012 - 2016, p. 4). Scientific challenges, such as researching possible planets that can sustain life, can drive innovation in the space sector. Finally, these policies state that a membership to the ESA will enable the space industry and academia to develop technologies and science missions that will benefit the country in the long-term (UK Space Agency Civil Space Strategy 2012 - 2016, p. 5).

The seek to perform research through Earth observation and remote sensing satellites for measuring the environmental change on a global scale (Next Generation Science for Planet Earth: NERC Strategy 2007 - 2012, p. 18; The Business of the Environment: our Strategic Direction, 2013, p. 11). They also aim to use space assets for measuring the melting of polar ice and to comprehend the effects of space weather events, (The Business of the Environment: our Strategic Direction, 2013, p. 6, 11). Earth observation systems are also determined for understanding the global system of the planet (Strategy for Earth Observation from Space 2013 - 2016, p. 1). They seek to monitor climate and environmental change, and to maximize the returns of scientific research and economic growth through the European space program (Strategy for Earth Observation from Space 2013 - 2016, p. 7). These policies seek to convert the UK a leader in the analysis and visualization of climate data, use space technologies for natural hazard and civil resilience, and to increase the number of low-cost missions.

Hence the *soft power space policies* seek to foster new technologies, perform research, advance science and include changing political issues such as environmental change. All these elements are part of the soft power of a country, as affirmed by Nye, Jr. (2009a).

Now that both *hard power* and *soft power space policies* of the United Kingdom have been reviewed, this thesis shall continue to present the space power of the United Kingdom.

4.2.5 Space power of the United Kingdom

Using the definition of space power by Peter (2010, p. 351) this thesis found the related budget and space systems that support the astronautic capabilities of the United Kingdom. These are hereby presented in order to be analyzed in the next section. This section shall first show the space power directed for military purposes, later followed by the civil/research branch of the UK space program.

The UK's military space budget is found within the UK defense budget. Therefore, this thesis shall first show the UK defense budget, followed by the budget allocated to military space activities. Finally, it shall show the number of military space systems possessed by the UK and currently deployed.

The Ministry of Defence performs all military-related tasks in the UK. The budget allocated for Defence between 2009 and 2017 was of 527,999 million USD (See Appendix F). Within the budget used by the Ministry of Defence is Skynet, the UK military communications group of satellites.

This group of military communications satellite is the only military space system deployed by the UK government (Union of Concerned Scientists, 2017). The cost of the Skynet group of satellites is 3,262 million USD since the signing of a Private Finance Initiative (PFI) in 2003 until 2018 (Rose & Marlow, 2004, p. 40). Hence Skynet is the only military space system belonging to the Ministry of Defence.

In order to determine the military space budget of the UK, this work divided the overall cost of the PFI by the number of years passed since the signing of the contract. Then, this thesis summed the yearly cost between 2009 and 2017 in order to calculate the military space budget. The result of this calculation is 1,957 million USD spent in military space activities in the period of 2009 – 2017 (See Appendix G). Since the signing of the contract, there has been a continued presence of the military communications satellite in outer space. As of now, seven Skynet satellites are currently deployed (Union of Concerned Scientists, 2017).

Now that the military branch of the UK space program has been shown, this thesis now turn to describe the civil/research aspect of the space program.

As Figures 3 and 4 indicate, the structure of the UK space program changed in 2010, with the creation of the UKSA and the disappearance of the BNSC. As it can be seen, the budget assigned for civil/research space activities for the period 2009 – 2017 was 3,044 million USD (See Appendix H). The budget assigned for 2009 was 351.729 million USD, while the budget used for 2016[10] was 456.617 million USD, an increase of 29.82%. The increase has not been steady, as in the years 2009 – 2010, 2011 – 2012, and 2013 – 2014 there was a reduction in the budget of 13.35%, 7.41% and 1.95% respectively. It is noticeable that for the year 2012 – 2013

[10] The year 2016 is used in this case, since the budget of 2017 of the UK Space Agency will be published in June, 2018.

there was an increase of 35.84%, which overlaps with the publication of the National Civil Space Strategy of 2012.

However, the UK is a member of the European Space Agency (ESA). By being a member of the ESA, the UK participates in different missions that have numerous objectives, whether it is for launching an Earth Observation system or a system used for exploring the Solar system.

Thus, a part of the civil/research space budget is transferred to the ESA, as part of the obligations entailed by the members of the ESA. This is a benefit gained by the members of the agency, who will then share the costs and augment the space systems of the ESA that will directly benefit them.

Looking at the number of space systems owned by the UK government, three are used solely for civil/research activities (Union of Concerned Scientists, 2017). However, since the UK is also a member of the ESA and thus assigns a large share of its civil/research budget to the ESA, this thesis found eighteen satellites currently deployed where the UK has had an active participation. Thus, this research considers that the UK has twenty one satellites placed in outer space for civil/research purposes.

Now that the space power of the United Kingdom has been presented, this thesis will give a preliminary conclusion on the drivers of the space power of the UK.

4.2.6 Preliminary conclusion

This section will first review the space policies of the UK. It will then link the concept of hard and soft power with the space policies. It will finally compare both branches of the UK space program, and shed a light over the driver for the space power of the UK.

As it can be seen in Figures 3 and 4, the Ministry of Defence is in charge of the military branch of the UK space program, while the United Kingdom Space Agency is in charge of the civil/research branch.

Why did this thesis consider these military space policies as *hard power space policies*? The policies that were reviewed seek to determine space as a tool for enhancing their national security and/or military forces, and to project (military) power globally. They describe the benefits of using space for achieving political and military outcomes, using the medium for intelligence and surveillance operations. Other policies state that the armed forces of the UK rely on space systems for communications, navigation, surveillance and reconnaissance. They

also confirm a dependence of the UK on external US space systems, and thus recommend the investment in European space systems for maintaining its global reach and its ability of projecting power through intelligence, surveillance and reconnaissance space systems. The *hard power space policies* also determine space essential for military and defense communication purposes for the UK. The policies also state that space systems are essential for both military and civil functions in the UK, and to achieve international security interests and defense operations of the country. Finally, the *hard power space policies* of the UK also assert that there is a need to incorporate dual-use European space systems (Air and Space Power Doctrine 3000, pp. 8 – 9; Future Air and Space Operating Concept 2009, pp. 1 – 2; Future Air and Space Operating Concept 2012, pp. 20, 27, 52; National Security Strategy of 2008, pp. 53 – 54; National Security Strategy of the United Kingdom: Update 2009, p. 104; Defence and Security Review 2015, pp. 19 – 20, 46; Defence and Security Review of 2016, p. 17; National Space Security Policy of 2014, pp. 4, 14).

Hence, the documents reviewed seek to enhance the armed forces of the UK through intelligence, surveillance and reconnaissance missions, and maintaining the military communications that space systems facilitate, in order to maintain a project power globally. These policies, since they seek to enhance the armed forces and the global power projection of the UK, are considered *hard power space policies,* due to their determination in generating hard power through the space medium.

In the case of *soft power space policies,* these establish the space medium as a tool that allows the exploration of the solar system and the universe, and the study of changes in the planet, such as climate and environmental change. For example, these state that civil/research space activities are to be implemented for increasing the UK's participation in the global space market, produce space systems that allow the study of the planet, explore the solar system and the universe, developing Earth observation systems that allow the weather forecasting, develop and incorporate new space products and technology that benefit the space industry, academia and society, and to develop new skills and recognize the importance of the space infrastructure for the country (Wilmouth & Sivalingam, 2008, pp. 90 – 92; National Civil Space Strategy 2012 – 2016, pp. 4 – 5, 8). These policies recognize space as a medium that allows research activities that are essential for researching climate and environmental change, monitoring the melting of polar ice, and for comprehending the effects of space weather. Space is also seen as a tool for understanding the global system of the planet, monitoring climate and environmental change, exploit new technologies and data for natural hazard and civil resilience, and to

maximize returns of scientific research and economic growth through the European space program (National Civil Space Strategies of 2008 – 2012, 2012 – 2016; Next Generation Science for Planet Earth: NERC Strategy 2007 – 2012, pp. 2, 18; The Business of the Environment: our Strategic Direction, pp. 6, 11; Strategy for Earth Observation from Space 2013 – 2016, pp. 1, 4 – 5, 7).

Therefore it can be seen that the policies include other political issues than military ones. They seek to develop new space technologies and products that will benefit the society, the industry and academia. Moreover, the policies state the importance of the space medium for researching space weather and climate and environmental change, and to launch more scientific missions that will seek to understand the formation of stars and to explore the Solar system and the Universe. Thus, this research considers the policies within the civil/research branch of the UK space program as *soft power space policies*.

The review of the space policies of the UK shows that the government is aware of the advantages of the space medium for generating both types of power. However, this thesis shall analyze the budget and equipment assigned for both branches of the space program, in order to determine whether the UK prefers the usage of space for generating hard or soft power.

The difference in the budget allocated for the same period of time is 55.54% more for civil/research space activities. Hence there is a sizeable difference between the budget assigned for military space activities and civil/research space activities, where the UK prefers to assign more for civil/research activities, and with a tendency to increase.

Looking at the space systems owned by the UK that are currently in place, this research found that there are sevenof military space systems belonging to the UK, compared to the three civil/research space systems. However, since the UK is an active member of the European Space Agency, a part of the budget that is assigned for civil/research activities are then transferred to the agency, which develops space systems for the benefit of all the members. Thus, this thesis deems necessary to consider the space systems where the UK has participated as part of its civil/research space program. Hence this work found that the UK has an active participation in 18 space systems within the ESA, augmenting the number of civil/research space systems to 21 (Union of Concerned Scientists, 2017).

Then, considering the budget assigned to both branches of the UK space program, and the equipment currently deployed in space, this research found that the UK prioritizes the usage of

outer space for studying the planet, the Solar system and the Universe, foster new technologies and products, and to study the environmental and climate change. Conclusively, and by looking at the space policies, budget and equipment of the UK, this thesis concludes that the UK seeks to direct its space power mainly for the generation of soft power.

5 Comparative Chapter

	Hard power space policies	*Soft power space policies*	Space power
Similarities	• Conduction of intelligence, surveillance and surveillance operations • Projection of global military power • Achievement of national security interests and political outcomes	• Researching climate and environmental change • Develop new space technology and science products • Monitor ice variations, weather, space weather events	
United States	• Generating intelligence on WMD and military opponents (China)	• Study the atmosphere, and space weather events • Measure global precipitation, fuel emissions, • Monitor coastal erosions, weather, water resources, climate trends, coastal wave conditions, resource demand • Conservation of biodiversity	• 307,367 million USD for military space activities • 93 military space systems • 182,616 million USD for civil/research space activities • 61 civil/research space systems
United Kingdom	• Seeks to invest in dual-use European alternatives, due to dependence on US systems • Focused on maintaining communication space systems • Using a form of Public Private Partnership for operating military space systems (Private Finance Initiative in the Skynet satellites)	• Generation of data for natural hazard and civil resilience • Exploitation of research while spurring economic growth • Usage of European space program for spurring economic growth	• 1,957 million USD for military space activities • 7 military space systems • 3,044 million USD for civil/research space activities • 21 civil/research space systems

Table 4. Similarities and differences between the US and UK space programs

The review of the US space policies, budget and equipment determined that the space power of the country is currently directed for generating hard power, while the UK determines its space power mainly for the generation of soft power. Thus this chapter will focus on determining the reasons why each country directs their space power for the generation of one type of power.

So why has the UK focused on generating soft power through space? It is important to point out that since its origins, the British space program was the subject of financial constraints, political vacillation, and the lack of a need for performing either military, commercial, or research space activities (Hill, C.N., 2012, p. 9). The Cold War played an important role in the development of the British space program, where other actors within the Cold War (namely United States and URSS) had a greater amount of resources needed for researching and maintaining national space programs, which the UK did not have after the economic damage it suffered during WW II (p. 10). The launch of Sputnik had little to no repercussions within the UK, since the country did not considered itself part of any technological race or threatened by a satellite flying over the territory (Gray, 1996; Hill, 2012; Barnett, 2013; Kay, 2013). However, the US saw Sputnik as a threat in technological, military and political terms, due to its geopolitical and ideological conflict with the URSS, while the UK did not considered itself a prominent actor within this conflict.

The lack of a political and financial will affected the formulation of space policiy within the UK, which in turn affected the British space sector and the development of a national space program (House of Commons, Science and Technology Committee, 2016, p. 30). It was only in 2015 that the first British National Space Policy was published. Thus the space sector in the UK has suffered, since its conception, a lack of strategic direction and purpose (p. 32). Even with the presence of these constraints, the UK has benefitted from military space systems due to the alliance with the US for gathering and performing intelligence, reconnaissance and surveillance missions that allows the UK to project its power (Hill, 2012, pp. 13 – 14). However, this alliance has also affected the need for developing independent British military space systems within the UK due to: 1. Benefits already gained by this alliance; 2. The lack of an ideological and geopolitical conflict during the Cold War, and; 3. The resources needed for developing a national military space program, which the UK lost after the effects that WW II had on the British economy. Within the *hard power space policies* of the UK it can be seen that the alliance with the US is acknowledged due to its strategic importance, but they also state that there is a high level of dependency. In turn, these policies recommend an investment in dual-

use European alternatives, where the costs and responsibilities in space technologies are shared, with the benefits and usage shared among the participants.

The lack of a financial will for developing military space systems within the UK can also be seen in their Skynet communication space systems. Through a Private Finance Initiative has the UK found a way to develop independent British military space systems, where the Government pays for the usage of the Skynet group of communication satellites to a company. It can then be inferred that the UK has started to invest in independent military space systems, following the recommendations stated in their space policies for reducing their dependence to US military space systems.

Knowing that the country lacks the resources needed for developing military space systems, the UK has focused in using its space power for generating soft power. The constraints present since the early stages of the UK space program has shifted the space activities of the UK into those for research and economic development purposes. The research activities have provided the benefits to academia, the Government and the space industry, acknowledged by the British *soft power space policies* as the areas where the UK has retained a prominent position globally, especially in the space economy. The *soft power space policies* of the UK bring a unique perspective to a joint usage of space for research and economic development. By maintaining its membership to the European Space Agency, the UK plans to bring the research and economic benefits provided by a joint European space program.

In the case of the United States, the development of the space program has been closely linked with Operation Paperclip, which was executed during WWII in order to acquire scientifc developments attained by German rocket scientists before the Soviet Union. These developments were meant to be used for acquiring an advantage over the URSS by combining the uses of atomic weapons and rockets (Hill, 2012). Nevertheless, in 1958, the Soviet Union launched the Sputnik satellite, perceived as a threat by the Americans (Gray, 1996; Hill, 2012; Barnett, 2013; Kay, 2013). Hill (2012) states that Sputnik was perceived by the US as an overtake by the URSS in political defense, and technology terms (p. 13). It was also seen as hostile aircrafts flying in their territory. It is thus inferred that military motives dominated the development of the US space program, most of the time disguised in civilian programs (Hill, 2012, p. 9). Thus the US space program, in its early stages, was directed for the generation of hard power. The analysis of the space policies and space power of the US in the period 2009 – 2017 has shown it is still so.

Previous chapters have shown that the *hard power space policies* of the US maintain that American space activities and systems should be used for projecting military power and influence globally. These activities are used for enhancing the armed forces of the country by performing intelligence, surveillance and reconnaissance operations that allow the US to pursue its national security and defense interests. It can also be seen that these policies address the need for using military space systems for generating intelligence on the closest opponent in military terms, China.

It has been indicated that the early stages of the American space program was focused on gaining an advantage over geopolitical conflict with the US closest opponent, URSS. After the disband of the URSS in 1990 however, it was perceived that the US did not have a close opponent that might have compited against the country in terms of geopolitical influence, since other contenders such as China and Russia were not considered a global actor (Keohane, 2015, p. 92; Nye, Jr. J. , 1990). However, China is seen now as a global challenger to US global influence (De Santibañes, 2009; Keohane, 2015, p. 93).

It can be seen in the *hard power space policies* of the United States that China is perceived as the closest opponent to US global influence, especially in military terms. Within these policies it can be seen that the country is aware of the potential that China has in military competition against the US, and the potential that the opponent has in fielding technologies that may disrupt strategic advantages. One of the technologies that the *hard power space policies* refers to is counter-space technologies, namely Anti-Satellite weapons (A-SATs). The policies state that space systems, such as those used for intelligence, surveillance and reconnaissance operations, are meant to be used for generating intelligence against perceived contenders of the US ability to project power.

Thus the analysis of the space policies of the US seem to indicate that American space activities are to be directed for gaining an advantage over the US closest geopolitical opponent, just as in the early stages of the US space program. The long-term growth of China in economic, political and military terms is acknowledged by the policies of the US as a threat to the ability for the global projection of the country. Hence the *hard power space policies* of the United States seek to use all the resources and domains at hand to gain an advantage over possible opponents, including outer space.

Thus it can be seen that the United Kingdom determines its space power for the generation of soft power due to constraints since the early stages of its space program, and the lack of a

strategic vision and political will to further develop its space power. The analysis of its space policies indicate that due to the historical alliance with the United States, the British government has not perceived a necessity for developing an independent military space program. However, acknowledging the dependency on foreign space systems, the policies state the country should start investing in affordable alternatives, namely European dual-use space systems.

The United States, on the other hand, perceives China as its closest geopolitical opponent. Its space program began with the objective of achieving an advantage over the URSS, its geopolitical opponent at the time. The launch of the Sputnik satellite further enhanced the need for the country to invest in its space program, focused in the military aspects of outer space. The early stages of the American space program is characterized by the development of both civilian and a military space program. However, the American space program was also characterized by civilian space operations serving as a façade for the military objectives behind the purposes of the mission. Nowadays, with the perception that the United States emerged 'victorious' from the Cold War, the space policies of the country seek to maintain and enhance the global power projection that the United States has, perceiving China as a threat to its power projection.

6 Conclusions and Limitations

6.1 Conclusions

This research has analyzed the space programs of the United States and the United Kingdom in order to determine the drivers of their space power.

By reviewing the space policies, budget and space systems of the UK, this thesis concluded that the UK space power is driven to generate soft power. The budget allocated for civil/research activities increased in the period 2009 – 2017, with the military space budget constant. Even though the UK prioritizes the usage of outer space for civil/research purposes, it seems that the dependency of external military space systems have shifted the priorities in the UK space program.

In the case of the United States, the space policies, the budget and the space systems deployed show that the US has a preference for military space activities, although the military space budget decreasing between 2009 and 2017 and the civil/research space budget increasing. Hence, this thesis concludes that the space power of the United States is primarily driven to generate hard power.

Both the US and the UK have common goals objectives in the usage of outer space for both military and civil/research activities. The *hard power space policies* of both countries state the importance of outer space for performing intelligence, surveillance and reconnaissance operations that allow the global projection of military power. The *soft power space policies* designate the space medium as a tool that allows the development of new technologies and products and research of climate and environmental change, monitoring of space weather events, and tracking of ice loss, resource uses, and natural hazard events.

The *hard power* and *soft power space policies* were classified as such using Nye, Jr.'s concept of hard and soft power. Hard power is the display of traditional elements of power, such as military resources, to coerce another actor to act in a certain way they would normally not do so. Soft power is defined as the ability to attract other actors to desire what you want.

Space power, according to Peter (2010), was conceived from a military perspective. A comprehensive space power theory should include the other uses of space and the effects it may have, since space is not used solely for military purposes.

The concept of space power is drawn from the concept of air power, as first described by Lupton (1988), Pfaltzgraff (1998) and Hays (2003). Hence, the concept of space power uses elements of the traditional concept of power within International Relations.

6.2 Limitations

This thesis encountered limitations while performing its analysis. First, some budgets of public entities tasked with national security functions are classified. Due to this limitation, this work solved this problem by calculating its budget based on published documents in order to see the allocation of resources for military space activities. Consequently, the budget that was calculated was based on an assumption that tried to approach the budget allocated as close it could. Second, while reviewing the military space budget of the UK, this thesis calculated the budget allocated for military space activities by dividing the cost of the contract for the Skynet group of military communication satellites. It was done in order to have an approximate budget of the military space activities of the United Kingdom. Third, while analyzing the policies of the US and the UK, this research found that some space systems, such as navigation (GPS), Earth observation, and communications, might be of dual-use. That is, these systems can be used for both military and civil/research purposes. Since this research could not determine whether they were used predominantly for military or research purposes, this work used the original function of the space systems to determine their type of activity. That is, the initial purpose for the development of a specific space system. For example, if an Earth observation system was developed and launched, initially, to research climate and environmental change, it was included in the civil/research classification.

6.3 Reflections

So why are these findings important for academia and society? For academia, this work helps addressing the gap that the civil and research space activities play as part of the space power of a country. Peter (2010) affirms that the concept of space power is conceived from a military perspective, and circumvents the civil and research aspect of outer space. By linking the concept of soft power and space power together, it can be seen that using the space medium for activities other than military strengthens the presence of the actors in the international arena. The United Kingdom is an example of the leadership position it seeks to acquire in the fields of space research and the presence of its space industry. The results of directing space power for generating one type of power or the other can be useful for determining the importance of conventional IR concepts in the contemporary world.

For society, determining the drivers of the space power of a country may describe the benefits that society gets from using outer space. Currently, space is seen as part of the critical infrastructure of most countries. The disruption of space systems and the services provided solely through the usage of outer space will affect societies and governments alike. The preference for the determination of using space assets for military or civil and research purposes may affect society in the future, whether by monitoring the atmosphere or predicting the effects of space weather that may affect a society, or allowing the armed forces of the country to respond to perceived threats by that society.

The usage of the space medium is increasing. The presence of more space-faring countries is changing geopolitics. Space was seen as the ultimate frontier, where only the most economically strong countries were capable of developing their own space program. Countries, such as Ghana, have launched their own space systems, with China and India developing anti-satellite weapons to deny access to unique functions granted by outer space. It is then important to see what are the goals of each country, whether to gain a military advantage over other actors or to use space for the benefit of humanity.

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8 Appendix

Budget in millions (USD)										
	2009	2010	2011	2012	2013	2014	2015	2016	2017	**Total**
DoD	666,344	690,967	687,022	645,494	577,552	581,439	560,436	580,300	582,702	**5,572,256**

Appendix A. DoD Budget in the period 2009 – 2017 (Department of Defense, 2016b, pp. 23 - 24)

Budget in millions (USD)										
	2009	2010	2011	2012	2013	2014	2015	2016	2017	**Total**
C3, Intel, and Space	99,520	100,021	103,519	100,123	86,367	85,562	85,246	88,123	79,621	**738,532**

Appendix B. DoD's expenses in space activities (Department of Defense, 2016b, p. 104)

Budget in millions (USD)										
	2009	2010	2011	2012	2013	2014	2015	2016	2017	**Total**
USIC	76,200	80,100	78,600	75,400	67,600	67,900	66,800	70,700	71,700	**655,000**

Appendix C. USIC budget (Office of the Director of National Intelligence)

Budget in millions (USD)										
	2009	2010	2011	2012	2013	2014	2015	2016	2017	**Total**
NRO[11]	11,582	12,175	11,401	10,411	10,300	10,320	10,153	10,746	10,898	**97,986**
NGA[12]	4,572	4,806	5,227	5,041	4,900	4,515	4,442	4,701	4,768	**42,972**
MDA	9,000	7,900	8,500	8,400	7,600	7,600	7,800	8,300	8,200	**73,300**
USAF	9,800	11,000	10,400	11,800	9,900	10,000	9,300	11,409	9,500	**93,109**
Total	**34,954**	**35,881**	**35,528**	**35,652**	**32,700**	**32,435**	**31,695**	**35,156**	**33,366**	**307,367**

[11] In order to estimate the budget of NRO between 2009 and 2017, this work calculated the estimated 15.2% of the United States Intelligence Community budget, and applied it to every year. The percentage is a calculation that is based on the allocation of resources in the 2013 USIC budget. As aforementioned in this work, the budget of the USIC is publicly available, but not the specific allocation of resources to the members of the USIC. Thus, in order to be able to analyze the expenditure on space applications, this work used the 2013 percentage.

[12] In order to be able to estimate the budget of the NGA between 2009 and 2017, this work also used the 6.6% percentage that was allocated to the NGA in the 2013 USIC budget.

Appendix D. Military space budget by entity (information gathered in defense.gov, nga.gov, mda.gov, saffm.hq.af.mil)

Budget in millions (USD)										
	2009	2010	2011	2012	2013	2014	2015	2016	2017	**Total**
NASA	17,782	18,724	18,448	17,770	16,865	17,647	18,010	19,300	19,508	**164,054**
NOAA	1,178	1,398	2,015	1,852	1,904	1,889	2,247	2,379	2,352	**17,214**
USGS	142.780	143.940	153.442	137.999	138.205	143.372	137.535	173.262	177.441	**1,348**
Total	**19,013**	**20,266**	**20,616**	**19,760**	**18,907**	**19,679**	**20,395**	**21,852**	**22,037**	**182,616**

Appendix E. Budget of entities in charge of the civil/research space program in the period 2009 – 2017 (information gathered at nasa.gov, noaa.gov, and usgs.gov)

Budget in millions (USD)										
	2009	2010	2011	2012	2013	2014	2015	2016	2017[13]	**Total**
MoD	65,610	64,230	61,518	58,896	56,408	54,938	53,862	54,217	58,320	**527,999**

Appendix F. UK defense budget 2009 – 2017 (Stockholm International Peace Research Institute, 2017; HM Treasury, 2017)

Budget in millions (USD)										
	2009	2010	2011	2012	2013	2014	2015	2016	2017	**Total**
MoD	217.466	217.466	217.466	217.466	217.466	217.466	217.466	217.466	217.466	**1,957**

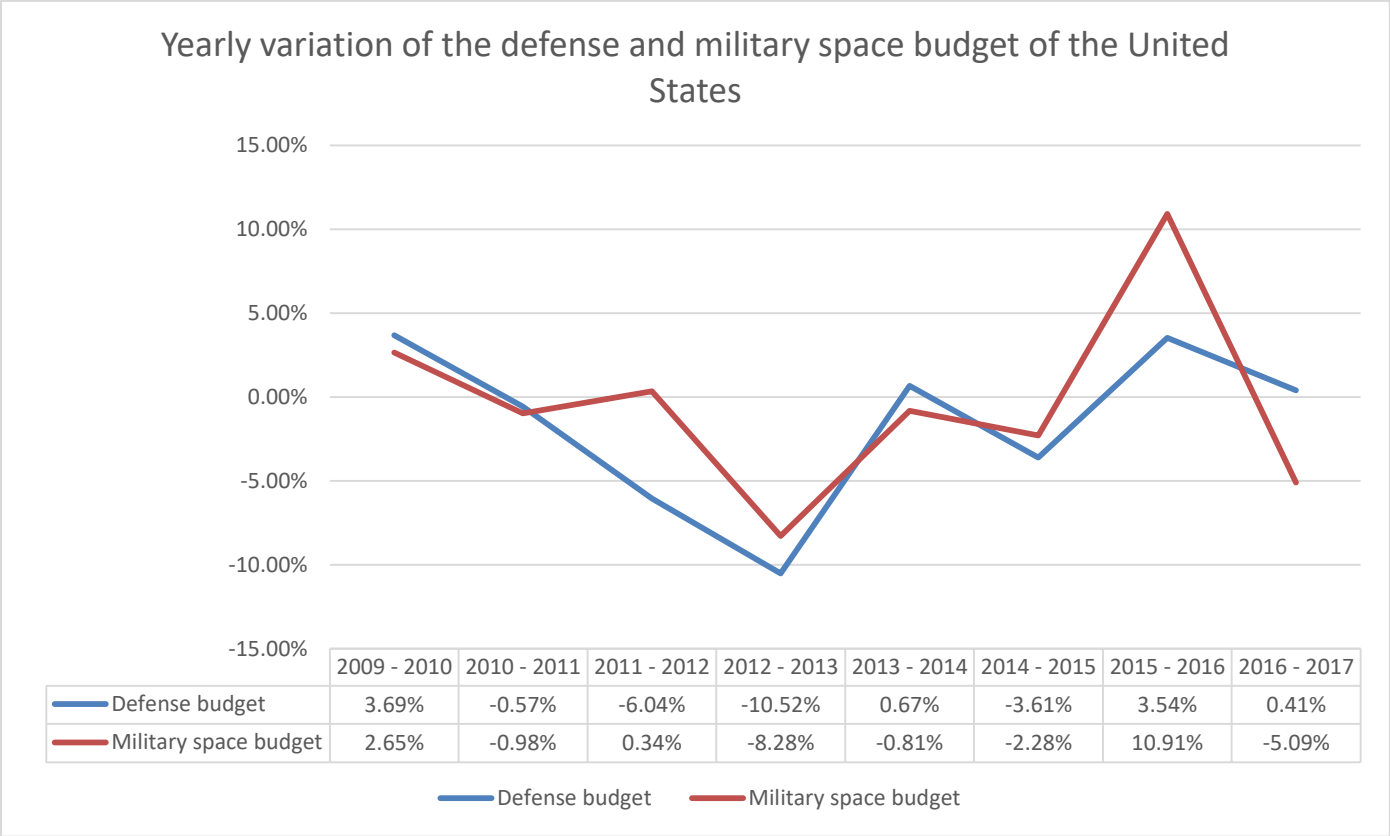
Appendix G. UK's military space budget

Budget in millions (USD)										
	2009	2010	2011	2012	2013	2014	2015	2016	2017	**Total**
BNSC	351.729	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	**N/A**
UKSA	N/A	304.747	334.099	309.316	420.196	411.964	455.809	456.617	N/A[14]	**3,044**

Appendix H. UK civil/research space budget (Pagkratis, 2011, p. 43; UK Space Agency, 2012 - 2017)

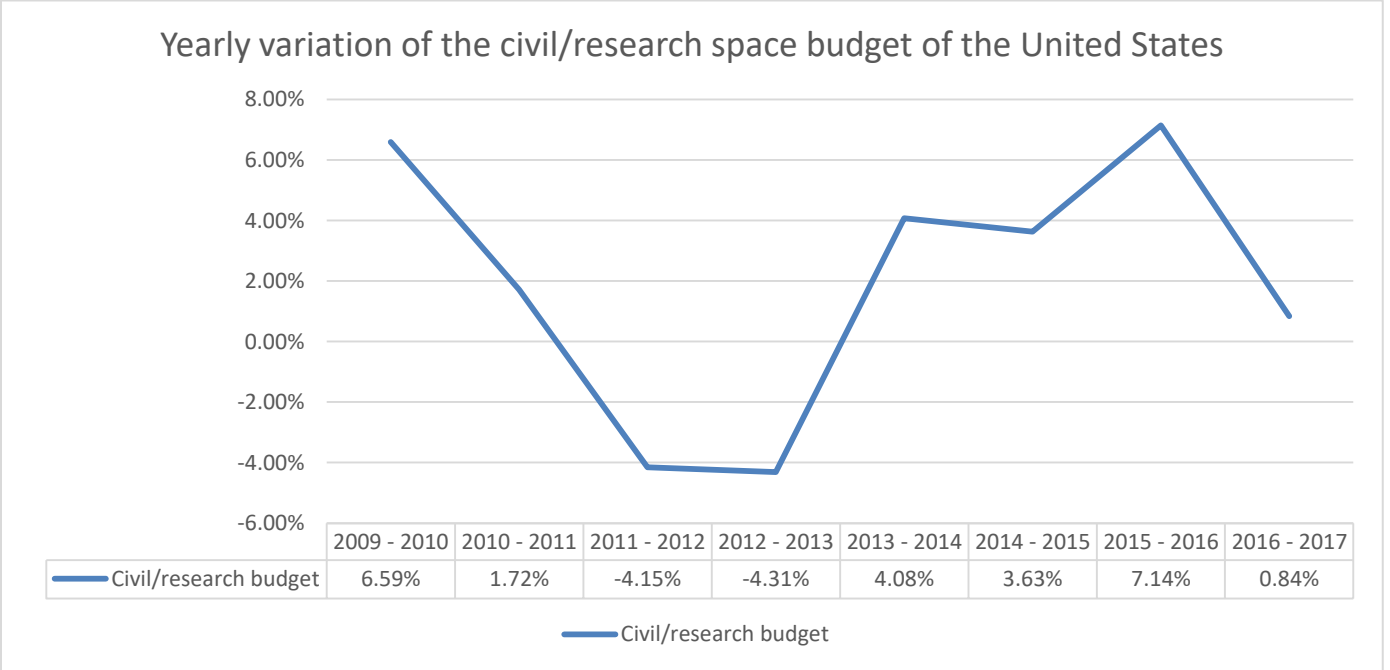
[13] Planned budget (HM Treasury, 2017).

[14] The budget of the UKSA is published every year, by the end of June. Thus, the budget of the UKSA for 2017 will be published in June, 2018.



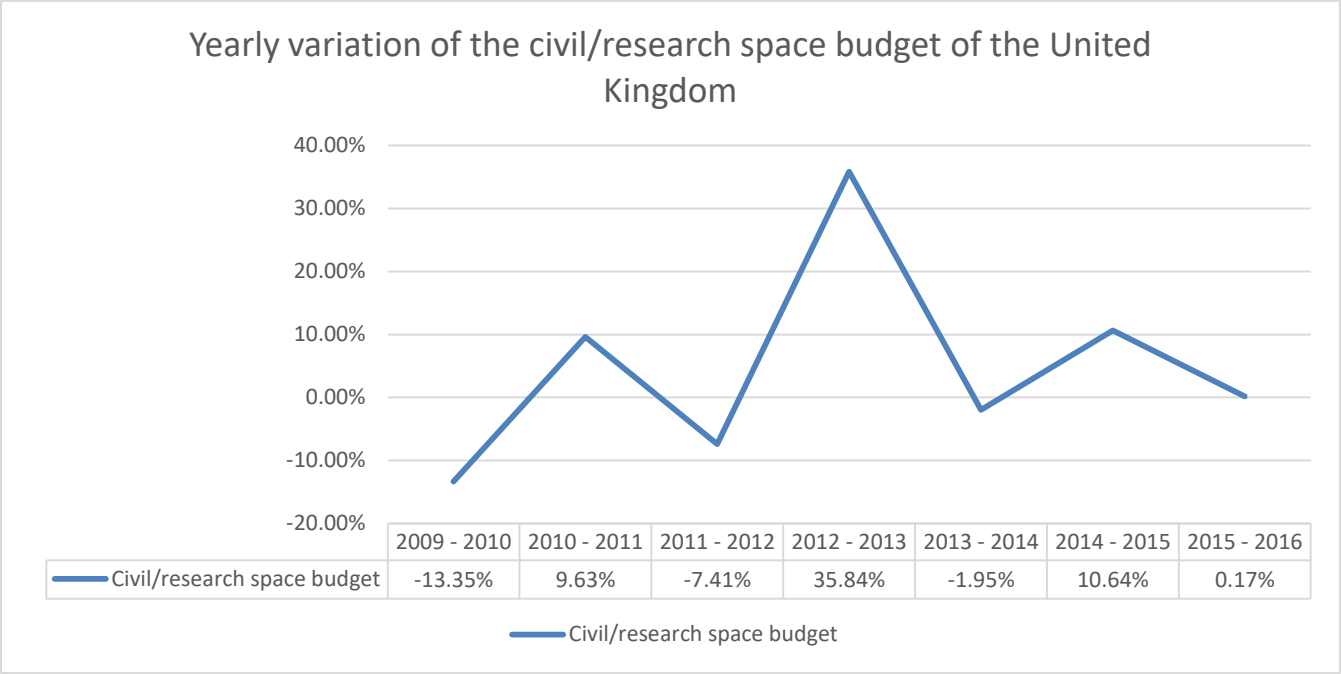
	2009 - 2010	2010 - 2011	2011 - 2012	2012 - 2013	2013 - 2014	2014 - 2015	2015 - 2016	2016 - 2017
Defense budget	3.69%	-0.57%	-6.04%	-10.52%	0.67%	-3.61%	3.54%	0.41%
Military space budget	2.65%	-0.98%	0.34%	-8.28%	-0.81%	-2.28%	10.91%	-5.09%

Appendix I. Yearly variation of the defense and military space budget



	2009 - 2010	2010 - 2011	2011 - 2012	2012 - 2013	2013 - 2014	2014 - 2015	2015 - 2016	2016 - 2017
Civil/research budget	6.59%	1.72%	-4.15%	-4.31%	4.08%	3.63%	7.14%	0.84%

Appendix J. Yearly variation of the civil/research space budget



Appendix K. Yearly variation of the civil/research space budget of the United Kingdom