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ABSTRACT

This paper aims to contribute both to the establishment of theoretical tools for describing and explaining the evolution of national space policy as well as to the empirical analysis of changing national and multinational security space capabilities in Europe.

The theoretical framework proposed below rests on a differentiation of five ideal-type levels of state disposal of technology, indicating a state's position in the order of space powers. These *levels of control* are *utilisation*, *participation*, *cooperation*, *autonomy*, and *monopoly*. The relevance of these levels of control lies in the corresponding distribution of distinct costs (political, socioeconomic and symbolic) and their domestic and/or international repercussions. Variations in national investment and activity across military and dual-use space technologies are caused by three types of variables: 1) the availability and attractiveness of utilisation, participation and cooperation options, 2) the amount of political, socioeconomic, and symbolic costs and 3) the specific validation of these costs on behalf of political decision-makers, reflecting the specific *cost sensitivity* of a state.

Based on this theoretical framework, it is possible to empirically answer a number of questions relating to increasing capacities of European space-faring nations, independent from external, particularly American sources.

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INHALT

‘(Although) it’s not Rocket Science’: A Theoretical Concept for Assessing National Space Policies in Europe[1]

1 Introduction

For decades, Europe’s space faring nations did not regard military and dual-use assets in space as being valuable to their security policies. They refused to develop or procure military space hardware. Most of them rested on data or services provided by the US or contented themselves with the persistence of the American security umbrella, based in part on US military space capabilities. One could term this behaviour, and the structure emanating from it as a tolerated hegemony. But as the end of the 20th Century drew nearer, this situation changed considerably.

The first exception was the collaboration of European countries to develop and operate a competitive launcher on their own, beginning already in the 1960s. The first attempt, dubbed the ‘Europa’ launcher failed (Harvey 2003: 42-51), but the ‘Ariane’ launcher, agreed upon in 1973, made its maiden flight on Christmas Eve 1979 and was a success in technical and in commercial terms (Harvey 2003: 167-197;

1 This is a revised version of a paper presented earlier at the British International Studies Association (BISA) Annual Conference, 18-20 December 2006, University College Cork/Ireland. I would like to thank Stephanie Carvin, Peter Dickens, James Ormrod, Columba Peoples, Dave Webb and Nicole Hänel for their valuable comments and constructive criticisms during the panel session. Furthermore I express particular thanks to Alexandra Patin for proof-reading the manuscript and making helpful suggestions.

Madders 1997: 235-241). Britain possessed the world's first military communication satellite already in November 1969 (McLean 1992: 88), although with significant assistance from American industry. France started optical observation satellites with security applications beginning with the SPOT-Programme in 1978 (Sourbès-Verger/Pasco 2001) and decided thereafter to develop the genuine military observation system Hélios in 1986. The first Hélios satellite was operational in 1995. But it was at the end of the 20th century and the start of the 21st that the majority of significant efforts were made to develop independent European capabilities nationally or multilaterally. Nowadays, European states autonomously and collaboratively have a host of security relevant capabilities at their disposal or are on the verge of acquiring them. Aside from the Ariane launcher family, complemented by Vega in the small weight class and the Russian Soyuz in the middle, there are military/dual-use communication satellites in Britain (Skynet 4/5), France (Syracuse 3), Germany (SatcomBw Step 2), Italy (Sicral), and Spain (XTAR-EUR, Spain-SAT); observation satellites in Britain (Topsat), France (Hélios, Pléiades), Germany (SAR-Lupe, Rapid Eye, TerraSAR-X, TanDEM-X), and Italy (COSMO-SkyMed); and the joint Galileo satellite navigation system. France has conducted several programmes to test experimental signal intelligence collection assets in space, and has now entered a phase of preoperational devices (Essaim, Elint). A demonstration programme of early warning micro-satellites (Spirale) will follow in 2008. Furthermore, a few French and German installations could serve as precursors to a space surveillance system (Hitchens/Valasek 2006; Jäger/Hansel 2005).

However, comprehending this changed status of European space faring nations in analytical terms, not to mention explaining it in a coherent fashion are difficult tasks. An inventory of those scarce analyses of space policy issues supported by theoretical arguments shows that such ambitions to generalise findings and to provide analytical tools adequate for studies across time-bound and location-bound circumstances struggle with two characteristics inherent to space policy: first, space policy is usually subordinated to impulses from the major fields of state activity – security policy, foreign policy, and economic policy – a feature which undermines the assumption of a coherent and autonomous policy field (Kay 2005: 7; Gaubert 2002: 287; Hasenkamp 1996: 51; Hutter 1991: 7, 187). Hence large parts of the literature are characterised essentially by successive and descriptive enumerations of outside forces coming into play and constituting ad hoc incentives and restrictions as space policy decisions are to be made. It is difficult to avoid this tendency. But nonetheless one should strive for explanations within the space policy field as much as possible. Whereas important explanatory factors lay clearly outside the boundaries of space policy, these interventions should be systematically analysed.

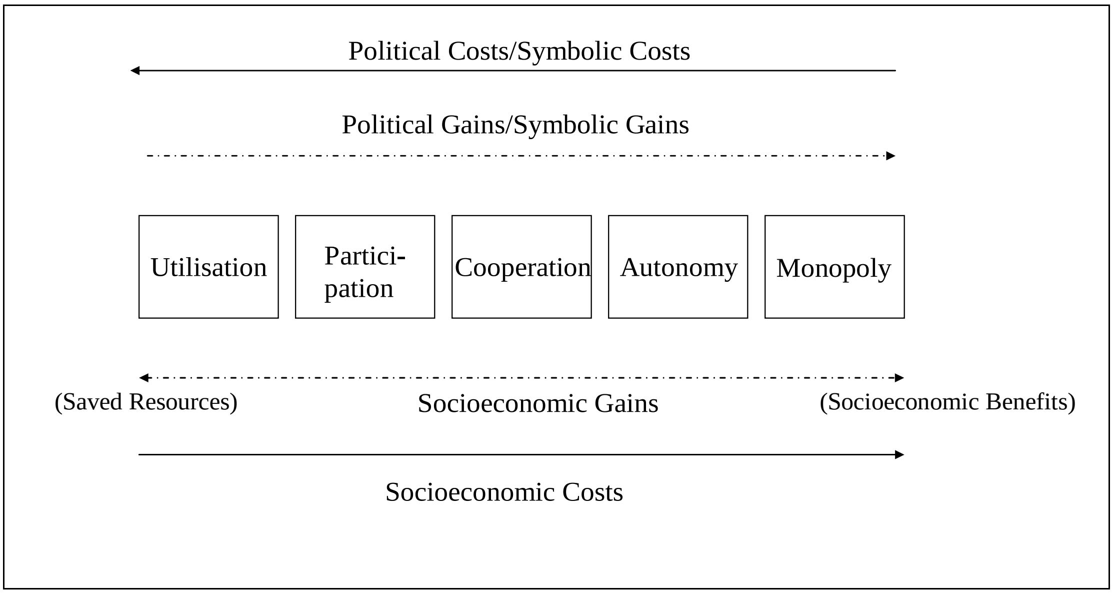
Second, space technology exhibits features, commonly understood as 'dual use', in a much more fundamental way than other technologies. Whereas almost every industrial and research capability in modern societies can be principally transformed to invent and produce devices with military applications (Buzan/Herring 1998: 22), in the case of space technology one single physical artefact could serve civil as well as military functions, provided that it fulfils military standards. For example, dual use of a navigation satellite means that the satellite guides the civilian aircraft as well as the strategic bomber with its signals. Calling this satellite military or civil depends on its current usage alone (Geiger 2005: 11). In view of the analytical consequences, our conceptual tools should simultaneously account for the separate or combined operation of a security calculus and a socioeconomic calculus when decisions are made to use, procure, or develop a specific space system. The analytical framework proposed below tries to fulfil both requirements.

2 The analytical framework

How does one determine the status of a specific state relating to space capabilities? I equate status with the extent to which a given state disposes over specific technological capabilities. This understanding leads to the following five ideal typical *levels of control*: A state remains at the level of *utilisation* as long as it restricts itself to the use of space affiliated data or services provided by foreign sources (public or private). *Participation* circumscribes a minor contribution to a space capability which is insignificant with respect to its realisation and functioning. *Cooperation*, on the other hand, is based on a substantial contribution to a space capability which constitutes a crucial factor in terms of its realisation and operation. Cooperative efforts are necessarily characterised by structures of interdependence between the involved states. *Autonomy* signifies a situation where a state completely controls the critical elements of a specific space capability. A *monopoly* is reached when a state is the only actor in the international system controlling a specific space capability which automatically makes it the only actor deciding on utilization and participation opportunities. In addition, a monopoly refers to a situation where a state's capabilities in a given technological field are superior to other state's capabilities in such a way that it actually devalues them.

This basic order is associated with hypothesized trends of different costs and/or gains alongside its progression or regression. Due to the unevenly distributed costs/gains, the implementation of the levels of control is often the result of balancing contrary political impulses. Levels of control as well as their costs/gains are expressed in the following scheme:

Graph 1: Levels of Control and the Relative Distribution of Costs and Gains



Political costs mark degrees of dependence upon other actors and give an approximation of the extent to which freedom to act in space is curtailed. Political gains reversely indicate the extent to which other actors depend on a state's behaviour and the amount of its remaining freedom to act in space. The impact of political costs/gains is evident in a state's interaction with other states.

Socioeconomic costs refer to the resources a state has to spend to reach a specific level of control, whether they consist of financial investment or skilled workforce. On the other hand, the distribution of socioeconomic gains can not be determined in advance because contingent socioeconomic benefits through space technology relating to higher levels of control potentially counterweight or even exceed the extent of saved resources entailed in lower levels of control. The term socioeconomic benefits subsumes conceivable profits by commercialization, provision of civil infrastructure, safeguard of jobs and taxes, technological competitiveness, spin-offs to other industries, and perhaps the inspiration which motivates young people to strive for a career in high tech research and industrial facilities. However, these benefits have to be justified against socioeconomic costs in domestic politics. Whereas political costs/gains show their effect in interstate relations, socioeconomic costs are borne domestically.

Finally, symbolic costs and gains refer to the positive and negative effects respectively inflicted on the government's domestic legitimacy and/or international prestige[2] if outside or inside forces (possibly including the government itself) succeed in credibly portraying a state's performance in a specific aspect of space flight as representative, that is illustrating a state's and society's achievements or deficiencies in general. In contrast to political or socioeconomic cost/gains, the symbolic type of costs and gains influences external and internal affairs.

With this analytical framework at hand it is possible to determine a state's current level of control in a given technology application. Based on common divisions of space applications the following fields could be analysed separately, before constructing a state's overall status in the space power hierarchy: transportation (into orbit or even into interplanetary space), communication, navigation, tactical intelligence (spacecrafts with optical, radar, infrared sensors, sigint satellites, weather satellites), strategic intelligence (spacecrafts with optical, radar, infrared sensors, sigint satellites), space control capabilities (space surveillance, ground-based and space-based ASATs), exploration/exploitation (human spaceflight capabilities, durable infrastructures in space), and space-based weapons (including as part of Ballistic Missile Defence).

2 Robert Gilpin makes a brilliant differentiation between prestige and power, consistent with the following treatment of the symbolic dimension: "Whereas power refers to the economic, military, and related capabilities of a state, prestige refers primarily to the *perception* of other states with respect to a state's capacities […] Prestige, rather than power, is the everyday currency of international relations […]" [author's emphasis] (Gilpin 1981: 31).

3 The variables influencing decisions on security space capabilities

Broadly speaking, there are three different types of variables potentially responsible for changes down or up the order of levels of control: to explain such an alteration one should analyse 1) the availability and attractiveness of levels of control beyond a state's control (utilisation, participation and cooperation), 2) the amount of political, socioeconomic, or symbolic costs and 3) the state-specific sensitivity in the face of political, socioeconomic, or symbolic costs.

3.1 Availability and attractiveness of utilisation, participation, and cooperation options and some thoughts on hegemonic politics

When we observe a state acquiring autonomous capabilities we should be careful in concluding that the decision-makers regard this outcome as the optimal balance between political, symbolic, and socioeconomic costs. Alternatively, it could be that levels of control depending on offers from external actors, like utilisation, participation, and cooperation have been unattractive or unattainable. Perhaps the state's sensitivity to political costs is much lower than we first expect by only considering the level of control reached. This difference provides leeway for hegemonic politics, as briefly explained:

Niklas Luhmann's sociological writing on power (2003 [1975]) yields several interesting aspects. From this perspective power relationships, for instance a hegemonic structure, are based on alternatives (available but not chosen) on both sides. Otherwise one actor might merely deploy coercion strategies, which drain far more resources to sustain. To establish a hegemony or to avoid its erosion, a stronger state (a state whose resources enable him to bear more socioeconomic costs) intervenes in the arrangement of options considered by a weaker by offering the most attractive option therein. Such an offer can include utilisation, participation, or even some form of asymmetric cooperation opportunities.[3] Once the weaker state has chosen this option, strong sanctions are at the stronger state's disposal to deprive the weaker of the granted goods, permitting political control at reasonable costs. Stabilizing this hegemony is a matter of anticipation skills. Offering too late or too restrictive an option to a weaker state which is already examining possibilities to improve status by enhancing domestic controlled capabilities may result in *hegemony failure* or *hegemony collapse*.

The following examples should illuminate the points made on the availability of levels of control and hegemonic politics. Since 1982 there have been talks between French and German officials concerning the joint financing and development of a system of spy satellites. Due to its non-participation in NATO's military branch, France has experienced particular difficulties in obtaining satellite data from the United States. Utilization and participation options had been severely restricted. Military motivations already figured as background factors into the decision to develop the civil SPOT system, funded in part by the French defence ministry (Dauncey 1994: 274). The French research institutions and industry gained knowledge in military useful observation technology. But an additional domestic investment in a truly military satellite capacity was necessary despite limited resources to dispose of militarily useful observation hardware. France was therefore interested in cooperation opportunities to lower the financial burden. Originally, the French had proposed nothing more than German contributions to a French system of spy satellites (SAMRO) equipped with optical sensors. But because its security concerns focused primarily on Eastern Europe, the German government was much more interested in a radar satellite system providing all-weather capability. Moreover, the German perception that information from American satellites was

3 A hegemonic calculus is seldom expressed bluntly. An exception is the public declaration from NASA Administrator James Beggs in 1983 that the aim of the Space Station programme, open to international participation, was to maintain American leadership in space and that if the USA could organize international cooperation, other countries would be spending their resources on collaboration and would not be competitors (Bizony 1997: 47).

sufficiently channelled through NATO was still present. For that reason the prospects for a joint project were limited from the beginning. Eventually France decided on a military optical system (Hélios) with minor Spanish and Italian contributions (Hasenkamp 1996: 423-425). In the 1990s the French plans for a follow-on system were much more open to a combination of optical and radar satellites. In conjunction with changing German security goals and strategies (see below) the prospects of a Franco-German cooperation were improved. Both sides agreed in principle on the development of a system of optical satellites, led by France (Hélios 2) as well as a complementary system of radar satellites (Horus) provided primarily through German efforts. This time Germany was really close to becoming an international actor disposing of independent capabilities to collect military useful (radar) satellite data. And this time American intervention was considerable, as Franco-German talks on high levels went on: The American government offered Germany participation in a joint system thereby introducing a participation option in the range of possible options available to Germany. Moreover, they improved the attractiveness of this option by successively reducing the participation fee (down to just 6.5 Mio. Dollar) (Reinke 2004: 411). These efforts were accompanied by a personal visit by CIA director Deutsch in Bonn and identical letters from the American President, the Secretary of Defence, and the Senate Majority Leader trying to convince the Germans to abstain from an European Satellite Observation System (Sueddeutsche Zeitung 1995; Faligot 2001: 204). Not without effect: whereas Chancellor Kohl stayed with the French largely for foreign policy reasons, key figures in the German decision-making process, like the chair of the defence committee in the German parliament Rose and officials in the Ministry for Defence, indicated serious doubts concerning the reasonability of an independent Franco-German system confronted with this new situation (Reinke 2004: 411; Hasenkamp 1996: 450). Ultimately, the Germans did not formally abandon the talks, but they refused to provide any funds for the project, announcing that their involvement had to be delayed (Reinke 2004: 411-412). The American intervention distracted the

Germans long enough to avoid any decision and thus stabilized the hegemonic structure. That the German government did not opt to durably participate in an American system, either, was negligible for the time being.

Whereas within this time frame the hegemon showed decisive capability to anticipate events and maintained the hegemonic structure in relation to its German ally, US restrictions on satellite data transfers, increasing towards the end of the century are responsible (inter alia) for the later hegemonic failure. During the war in Bosnia the German intelligence service received image intelligence (imint), perhaps including satellite intelligence, from the American ally, but often four to five days after a German request, making the data outdated for the purpose of assessing critical situations (Wiebes 2003: 319). That few satellite intelligence was shared with most European NATO members caused complaints on behalf of European officials. But diplomats expected tough opposition against more comprehensive data sharing from the US intelligence community and Congress (Wiebes 2003: 334). The transfer of processed imagery or finished intelligence was notably disrupted during covert US military assistance to Croatia and Bosnia in 1994. Even British troops were cut off from US intelligence (International Institute for Strategic Studies 2000). Afterwards, the United States, when reducing its forces engaged in the western peacekeeping efforts in Bosnia, redirected its reconnaissance satellites, leaving the Europeans without helpful data to monitor compliance of the former civil war fractions (Lambakis 2001: 61).

But it was not until the Kosovo war that the once satisfying utilisation option was declined in such a way that most European governments' decision bases seemed to have fundamentally altered. During the air campaign, U.S. ambassador John C. Kornblum declared publicly that American generals had decided that "the photo satellite reconnaissance results over the terrain in Kosovo should not be given to the governments of the other NATO member states". In response, the undersecretary at the defence ministry in Berlin, Walther Stützle announced that this refusal represented a reason to support activities towards independent satellite intelligence capabilities (Schmidt-Eenboom 2001: 153). Apparently, the political cohesion inside the NATO alliance had diminished. The Americans still continued to discourage Germany and other European states from investments in independent spy satellites, arguing they should prioritize to remedy deficiencies in areas like transport planes and precision guided ammunition (Keohane 2004: 5) and referring to the availability of commercial images. Indeed, attractive utilisation options, with resolutions of down to 0.6 meters exist today (Harbich 2006: 42). But the state, under whose regulatory jurisdiction the commercial providers operate, could exercise shutter control under critical circumstances. For instance, US regulations concerning the commercial images market allow the prohibition of image sales if they run counter to national security or foreign policy objectives (Harbich 2006: 50). In addition, one can not rule out that by buying images from foreign companies information about what national security institutions regard worthy of observing can find its way to a foreign government (Johnson-Freese/Erickson 2006: 16). Overall, the commercial utilisation option was not convincing enough, either. A committee, installed by Chancellor Schröder in 1999 to elaborate recommendations concerning the reform of the German military and chaired by former President Richard von Weizsäcker, declared on 23 May, 2000, the requirement for independent and unfiltered access to current and comprehensive information and thus for improved technical intelligence capacities (BMVg 2000: 49). The government agreed on a system of military radar satellites called SAR-Lupe to enable independent assessments of political and military situations, which will be operational in 2007. Based on similar considerations Italy will also possess its own dual-use system of radar satellites, dubbed COSMO-SkyMed by the end of 2008. Both systems are complementary in relation to the second generation of the optical Hélios system (higher resolution, protection and infrared sensors added) and the dual-use optical Pléiades system respectively (which will be deployed in 2008) and data sharing is guaranteed through bilateral contracts.

Instead of controlling all major space power's satellite image sources with the exception of France (which would have only optical satellite capability) through the continuous provision of data/intelligence products (utilisation offer) or participation opportunities, the US will soon face three allies supporting their decisions with their own intelligence assets in space, with Britain being the only exception within the leading space faring nations in Europe.[4] Therefore, observing transatlantic relations in the space observation field a few years after 2000 we can conclude: American hegemony is lost.

Not only that satellite intelligence was provided sporadically at best, scarce information allegedly based on satellites was not thought as reliable by European governments when it came to support decisions and implementing their security strategies. This further pulled out utilisation and participation options from the range of attractive options. Based on data from their first Hélios satellite series France dissociated itself from the US air campaign against targets in Iraq 1996, concluding that American information was 'questionable', i.e. it asserted massive Iraqi troop movements not confirmed by the French images (Pasco 2004a: 22-23;

4 The British utilisation options in respect to American satellite data sources are presumably far more attractive than the offers from which continental European states could usually choose, due to the close Anglo-American relationship in intelligence affairs (Istituto Affari Internazionali 2003: 107-108; Richelson 1990). Accordingly, British interests concerning satellite observation for security purposes are widely limited to the value of small satellites in military operations at best, and do not refer to its contribution to independent political decision making as a strategic tool. Documents (Royal Air Force/Army/Royal Navy 2006: 4) and the small TOPSAT programme (Adams et al. 2004: 41; Royal Air Force 2006) indicate this. As long as the attractiveness of utilisation and participation options associated with the 'special relationship' remains constant, major policy shifts towards cooperation or autonomy are barely plausible (Hayward 1996: 36). Dissatisfactory from the perspective of other European space powers, Britain consequently stood apart from the collective efforts to support, coordinate, and streamline future reconnaissance capabilities in Europe, particularly the Common Operational Requirements (COR) agreement signed by France, Germany, Italy, Belgium, Spain, and Greece. As a ministry of defence spokesman illuminated recently they "weren't ruling out cooperation on principle, but we haven't seen anything to interest us that we can't get from the U.S. or ourselves" (quoted in Chuter 2006: 14). Further illustrating the British position is the earlier commentary by a British official as to possible future space observation systems in the institutional framework of the European Union: "If the EU tried to replicate what we get from the US or what is available to the EU via NATO, it would be very expensive and of lower quality" (quoted in Istituto Affari Internazionali 2003: 108). The British preference for utilisation and participation offers provided by the USA is clearly formulated: "Collaboration with the US will continue to be fundamental to equipping the UK's Armed Forces with leading edge space capabilities" (British National Space Centre 2003: 15).

International Institute for Strategic Studies 2000).[5] The controversy surrounding weapons of mass destruction allegedly possessed by the Iraqi leadership and dubious satellite images publicly showed by the Americans will certainly encourage European states to proceed with efforts already underway aimed at independent satellite intelligence capabilities (Pasco 2004b: 284-285).

These instances of *hegemonic failure* are not without historical precursors and current parallels from other space application fields: the American refusal to offer launch services to European commercial satellites was one important motivating factor leading to an independent European launcher programme (Sebesta 1996). The French were most likely the only nation determined to strive for autonomy in launchers anyway; other financially and technologically potent states, notably Germany, hesitated considerably to be involved in that effort and would have certainly accepted an attractive American utilisation offer. Given the lack of technologically capable and politically acceptable alternative partners it is reasonable that without the contributions from European partner states France would have had serious difficulties in ending American hegemony by reaching the levels of cooperation or autonomy.

Emerging international cooperation efforts in human space flight give a current example: President Bush reinvigorated exploration as the primary goal of the US civil space programme as he declared the resumption of human space flights to the moon and the possible extension to Mars (Sietzen/Cowing 2004). Substantial budget and programmatic shifts were induced and a timetable, technical specifications, and study contracts for spaceships and launchers exist. But opportunities for foreign contributions, only roughly comparable to the

5 Non-European allies did express similar dissatisfaction. Japan complained about the lack of shared information on potential missile attacks during North Korea's missile test in 1998 and during the 2002 World Cup. Consequently, Japan launched its own observation satellite in 2003 (Pasco 2004: 23). However, according to other sources the Japanese government, shocked by the vulnerability demonstrated by the Taepo Dong launch, felt a need for independent observation despite timely and sufficient information from the US Department of Defence (Johnson-Freese 2004). Instead of a reduced utilisation option this story supports the conclusion that the events fuelled a process of increased sensitivity to political costs, a concept explained below.

International Space Station programme, are to a large extent precluded. A European contribution to critical and seminal technological elements out of sight, and the American retreat from the International Space Station a few years away, European states involved in human spaceflight (first and foremost France, Germany, and Italy) concentrate their resources on their own burgeoning Aurora exploration programme. More substantially they are on the brink of deciding whether to cooperate with the Russians on a human spaceship capable of flights to the ISS and (in an improved version) to the moon, now studied as the Advanced Crew Transportation System (ACTS) (Rayl 2006). Considering the European states' and Russia's strained resources serious doubts surround the feasibility of this project; even a minimalist European-Russian effort, however, contradicting the American leadership in space flight could have repercussions in public opinion not foreseen. The next decade will show whether there is another instance of hegemonic failure or another instance of successful hegemony building, resembling transatlantic relations in the ISS program.

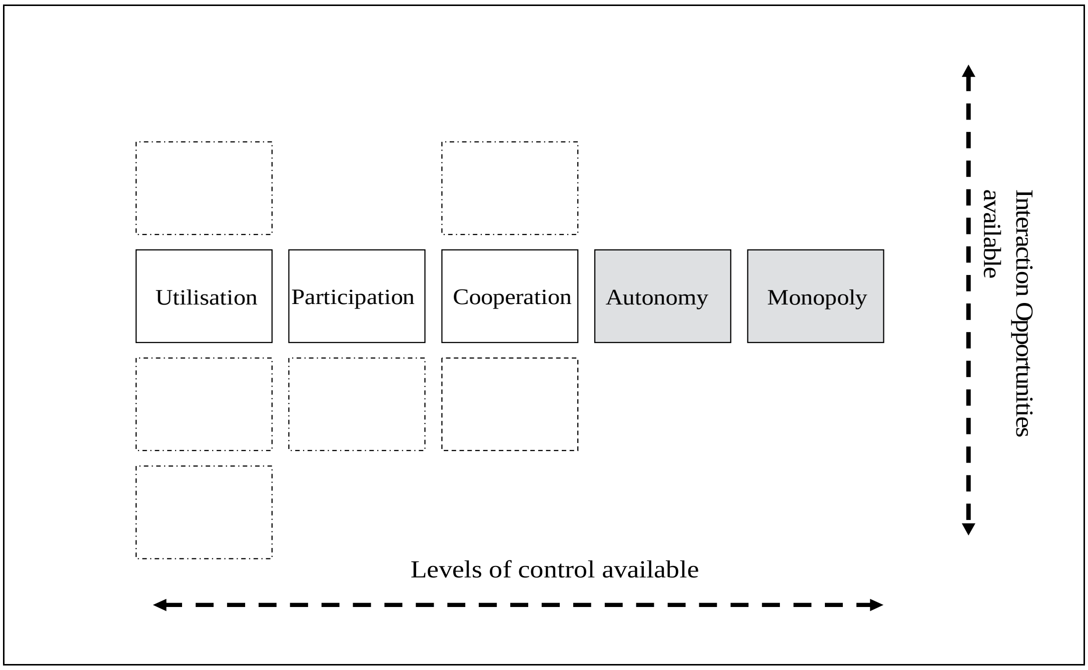
3.2 Calculating the amount of political, symbolic, or socioeconomic costs (and gains)

Graph 1 (see above) expresses assumptions on the relative distribution of costs between levels of control. A further estimation as to costs, varying according to technological applications is required. An example illustrates the plausibility of this differentiation: The increase in socioeconomic costs associated with the level of autonomy relative to the level of utilisation partly explains the fact that there are more states using communication services than states disposing of communication satellites autonomously. In contrast, the fact that there are more states able to afford their own communication satellites than states able to conduct a human spaceflight programme is (partly) explained by the application-specific amount of socioeconomic costs diverging between autonomy in satellite communication and autonomy in human spaceflight. The application-specific political, socioeconomic, or symbolic costs thus have their own explanatory power.

3.2.1 Political costs

To calculate the amount of political costs one state has to bear internationally one must consider more than the level of control reached alone. In their works on interdependence Robert O. Keohane and Joseph S. Nye suggest that in order to determine degrees of dependence we should focus on existing relationships and the availability and costliness of alternative options, calling the second aspect the vulnerability of actors (Keohane/Nye 1977: 13). The following graph complements the chart above in terms of political costs, which does not illustrate this additional factor:

Graph 2: Alternative Options as Indicator of Vulnerability



The more actors possess dual-use space capabilities, the greater the chances of utilisation, participation and cooperation opportunities on the side of weaker actors, even when one or few capable states refuse to provide them. An abundance of alternative opportunities in turn lower the political costs associated with utilisation, participation, and cooperation remarkably. Formulated from the perspective of stronger states, the more states equal in autonomous capabilities and inclined to make them available to other states, the fewer the chances to control states remaining on the level of utilisation, participation, or cooperation. To briefly depict a few examples: Originally there were only two states, the USA and the Soviet Union, capable of launching satellites. Currently several countries (USA, Russia, China, Japan, India, European states) marketing launch services are in intense competition, constituting a much more comfortable situation with fewer political risks for countries without their own launching devices. Obviously, political control is diminished where several autonomous states try to simultaneously reap the socioeconomic gains as much as possible.

This is also the case in the field of earth observation. Several states are trying to commercialize data from their observation networks or allow the private marketing of earth observation services. This competition results in a tendency to offer or permit pictures with increasingly better resolution despite security concerns. Currently data with resolution down to 0.6 meters (Harbich 2006: 42), appropriate for some security applications, are available on the open market, provided from different sources, with coordinated shutter control exercised by all states not being very plausible.[6] In terms of the theoretical framework, it is possible to utilize earth observation technologies associated with lower political costs, compared to earlier costs, thereby reducing incentives to invest in nationally controlled systems in the future.

On the providing states' side the socioeconomic calculus is successively overlaying the security one. A similar trend is now emerging in the realm of satellite navigation. Instead of only one operable system, the American GPS, a regenerated Russian Glonass system, the European Galileo, the Chinese Beidou, and an Indian

6 The American military employs a much more effective strategy. During the campaign in Afghanistan the military bought almost all available images from that region, thereby precluding other actors (most notably the media) from comparative situational assessments (Hitchens 2004). Therefore, political costs associated with the utilisation option are probably much higher than first estimated: commercial options can be reduced to zero if there is one financial superior buyer, outrivaling all other interested parties.

navigation system are already available or expected to be deployed in the next few years. Indeed, a key point in the dispute between the US and Europe about the Galileo system is American concerns that hostile powers could dispose of navigation signals from other sources still available in the theatre of war even after the US ensure sole control of GPS signals (James 2001). US documents clearly spell out the loss of control caused by proliferation:

> Space capabilities are proliferating internationally, a trend that can reduce the advantages we currently enjoy. For example, the European Galileo network of navigation satellites will provide capabilities comparable to our GPS network; however, we will have no control over who has access to the Galileo signal or the accuracies provided (Air Force Space Command 2003: 5).

Additionally, the US government vehemently criticized the participation of countries not allied with the West, especially China in the development of Galileo, cautioning against sensitive technology transfers (Geiger 2005). American security concerns will probably be reinforced by the recent announcements of Russian officials that signal restrictions concerning the Glonass system will be removed in order to exploit commercial opportunities and that Russia is in talks with other countries on privileged access to the system (RIA Novosti 2006a; 2006b). Technology diffusion and commercial competition in many space applications, driven by the quest for sharing investment costs and reaping socioeconomic gains by the capable actors is a vital factor in reducing the slope in political costs alongside the order of levels of control.

3.2.2 Socioeconomic costs

The more private funding could be mobilized, supplementing public spending, the lower the amount of socioeconomic costs in a given application of space technology. On the other hand, the greater the socioeconomic benefits (exemplified above) connected to specific space technologies, the greater the socioeconomic gains, mitigating, or even overlaying the socioeconomic costs.

Many burgeoning space capabilities in Europe offering advancements to security policies would not been acquired had there been no costs shared with private investors and/or socioeconomic benefits reaped other than security applications. To give a few examples: As aforementioned France entered into satellite observation technology with the SPOT system, serving both as an independent tool to support strategic decision making and as an opportunity to realise profits in the future satellite image business. The investment could be partly regained by commercializing the system (Sourbès-Verger/Pasco 2001). This technological experience was used later to develop the purely military Hélios satellite system. Several dual-use observation satellite systems (TerraSAR-X, TanDEM-X, Rapid Eye) now developed or deployed in Germany are financed in collaboration with commercial enterprises, using the management schemes known as public private partnerships (Ripple 2005). Market forecasts estimating that the global demand for navigation services and related products could reach €275 bn in 2020, thereby creating 100.000 skilled jobs (European Commission 2003: 12), decisively encouraged European governments to support the Galileo satellite navigation system, whose security implications are as evident (Geiger 2005; Lindström/Gasparini 2003) as disputed (Castle 2006; Mennessier/Vanlerberghe 2005). Originally it was expected that private investors would contribute two thirds of the deployment and almost all of the operating costs (Ripple 2005: 112). Admittedly there are serious doubts now as to these estimates and commitments (see below). To generalize the evidence: in technological fields where a vital and expanding market exists or is expected to emerge, with cost sharing and commercialization opportunities abundant, socioeconomic costs associated with the higher levels of control (cooperation, autonomy, monopoly) are reduced and socioeconomic gains elevated considerably. Nevertheless, the involvement of private interest in space technology is usually quite restricted. Strictly speaking there is only one application of space technology where market forces outbalance state efforts: communication satellites. Although customer bases and private enterprises exist in the fields of observation and navigation these sectors remain dependent on government support to varying degrees, whether as public R&D

funding or stable public procurement (Pasco 2003: 19). This applies even more to space transport. The origination of space tourism as a new market (Madrid/Hastings 2006; Webber/Reifert 2006; Mean/Wilsdon 2004: 58-61) could reduce socioeconomic costs conjured with the levels of cooperation and autonomy in space transport capabilities in the long run. To sum up, diminishing amounts of socioeconomic costs due to the involvement of private interests and rising socioeconomic gains primarily by commercialization opportunities, realisable in connection with security applications are important factors responsible for the gradual erosion of the hegemonic structure in transatlantic relations regarding space policy.

3.2.3 Symbolic costs

According to Murray Edelman's classic work (Edelman 1985 [1964]: 8-9), remoteness from day to day experience, overstretching the cognitive capacities of the uninvolved individual, is a necessary condition for an issue to become adequate for symbolic politics. In the case of spaceflight, especially rockets and manned space exploration, remoteness is coupled with fascinating and spectacular events. It suggests a reality in terms of a society's mobilisation, innovation, and organisation skills which does not necessarily reflect the average, fragmented, and dry performance of its regular activities, often buried under statistics. Illustrating this point are Representative Victor L. Anfuso's remarks on symbols of preponderance in February 1960:

> The average person still jumps to the conclusion that one side or the other is superior – not on the basis of analysis, but from what are taken to be symbols of superiority (quoted in Werth 2006: 96).

Impressive demonstrations in space are thus not just literally hundreds of miles away from the reality on earth. However, exploiting this gap to pursue symbolic politics depends on historical circumstances:

A prerequisite for any assault on a state's domestic legitimacy and international prestige as well as any conscious symbolic politics aimed at furthering legitimacy and prestige based on existent or lacking space capabilities is a certain degree of attention societies devote to technology and space issues. Otherwise the society or societies would not be receptive to any symbolic politics supported by space technology at all. General attention to technological issues is therefore necessary for symbolic politics to operate. For example, prior to the 'Sputnik Shock' and the 'Space Race', American society was already very enthusiastic about technological issues for historical reasons (Werth 2006: 38-39; Kay 2005: 47). As for the distribution of possible high stakes, i.e. high symbolic costs/gains additional factors come into play. In a society convinced of its own technological leadership, symbolic costs could be relatively high, whereas possible symbolic gains are clearly limited. Indeed, with the launch of Sputnik the strong belief in America as a world leader in technology turned out to be an illusion, at least in the eyes of western populations. The Russian government, on the other hand, succeeded in attacking US prestige abroad but failed to enhance domestic legitimacy due to a population already convinced that Soviet industrial and research capacities were superior (Sergej Krushshev in an interview with Die Welt 2006). After the moon landing a complete American retreat from human space flight would have involved massive symbolic cost, based on the media coverage and the now unambiguous perception in world opinion that the USA is the leading power in space:

> Rather than symbolic acts that *earned* the United States prestige, the human spaceflight program continued because shutting it down […] would cause the United States to *lose* prestige (Day 2006).

Overall, current receptiveness to technological and space issues as well as estimates relating to assumed levels of control (relating to technology in general), characteristic for world and domestic opinion, let us surmise the costs and gains aligned to conceivable symbolic policy measures.

Because the amount of symbolical costs basically relates to societal attention devoted to technology in general the symbolic dimension of space policy in current European states is arguably of relatively little importance, given the populations sceptical attitude towards technology.

3.3 Sensitivity to costs

Identifying shifting amounts of political, socioeconomic, and symbolic costs is not sufficient to explain changing space policies in Europe. The analytical focus should also include the perception of these costs by decision-makers.

3.3.1 Sensitivity to political costs

In order to estimate a state's sensitivity to political costs an assessment of how existing or anticipated space technologies fit in the state's security policies is required. Whether specific space technologies are understood to be a valuable contribution towards reaching a state's security aims depends on the nature of perceived threats, the intensity as well as geographical range of its security measures, and the degree of its integration in international security institutions. Whether a state is merely interested in monitoring treaty compliance and arms control agreements or is involved in high intensity warfare; whether the direction of its policies follows local, regional, or global imperatives; whether the primary menace stems from state or non-state actors; and whether a state strives for situational awareness and capabilities to act in conjunction or independently from other states are important differences.

The observation of rising sensitivities to political costs in Europe in the aftermath of the bipolar system tells a different story concerning the strengthened efforts to acquire independent security space systems; different but nonetheless complementary to the above analysis restricted to the changing availability of utilisation and participation opportunities.

The impressive performance of US space capabilities in the second Gulf War (Handberg 2000: 87-107), sometimes referred to as the "First Space War" (Anson/Cummings 1991), the Kosovo Air Campaign (Covault 1999) as well as the War in Afghanistan (Scott 2002) forced European Governments to react in order to regain or maintain political influence in coalition operations. For example, a contribution to the essentially political decisions on possible targets depends on information, not sufficiently available to European forces in these conflicts.[7] The experience of insufficient situation awareness and a restricted scope for action in specific conflicts served as a catalyst to aspire to higher levels of control. German minister of defence Scharping demanded a national or European strategic satellite reconnaissance system early on in the Kosovo conflict. The French delegate in charge of armaments, Helmer, also expressed concerns about the conjunction between information shortfalls and a restricted decision and action capability (Pfoh 2000: 78, 80).

Following the end of the bipolar confrontation, European military interventions increasingly took place on a global instead of just regional range, necessitating instant access to C4ISR (Command, Control, Communications, Computers, Intelligence, Surveillance and Reconnaissance) devices with minimal infrastructure requirements on the ground. For example, after its involvement in UN operations in Somalia – a country cut off from any communication infrastructure – in 1994, the German military saw the need for its own satellite communications (International Institute for Strategic Studies 2000). The intensity of operations with European forces involved has increased significantly, now including not just monitoring but also peacekeeping and even peacemaking efforts in highly asymmetric and complex conflicts. Furthermore, these operations have been undertaken under similar, if not even greater domestic pressure as in the United States, to keep civilian casualties and deaths among the country's own soldiers low. This particularly high "sensitivity to casualties" (Buzan/Herring 1998: 140), associated with open and democratically organized societies requires the operational speed, information superiority, and precision strike capability, which depend considerably on communication, observation and navigation satellite services.

As to the institutional context: the more European states aspire to be able to act outside the NATO alliance and without the participation from the USA, if need

7 Transatlantic differences over targeting during the Kosovo motivated– among other things - French decision-makers to continue with observation satellite programmes (Pasco 2004b: 284).

be, the more they will be pushed to acquire independent capabilities, i.e. reach higher levels of control. Divergence of threat perception and interests to the point of a transatlantic divide encouraged European governments to strive for those levels of control in the field of satellite observation which enable independent detections and assessments of threats and crisis around the globe, as an informational prerequisite for political decision making. Particularly the controversy on alleged weapons of mass destruction under control of Iraqi leadership encouraged European efforts already underway. Similar events could have a comparable catalytic function in the future. As the "Panel of Experts on Space and Security", assigned by the European Commission put it, when it comes to deciding on options provided by the US, "Europe can no longer assume a fortuitous coincidence of interests with the USA" (Panel of Experts on Space and Security 2005: 38). The analytical point here is not the perceived availability and reliability of American information (as discussed above) but the basic willingness on behalf of European decision-makers to depend on foreign information sources, regardless of their accurateness, when a situation of diverging political assessments and interests arises. To be more precise, whereas the aforementioned changes in European military operations generated an interest in space based capabilities in the first place (showed in the tendency to implement at least the level of utilisation), the concerns about political influence within coalition bargaining and operations and particularly the diverging threat perceptions, interests, and eventually separate military interventions and security measures cause the implementation of higher levels of control.

A complementary criterion for assessing a state's sensitivity to political costs focuses on competing technologies. The capacities of space technology to fulfil specific functions associated with the security policies sketched above are adequately understood only relative to the benefits of ground-based, naval, or aerial alternatives. For instance, although the idea to orbit artificial satellites for global coverage was articulated as early as 1945, attributed to an article by science fiction author Arthur C. Clarke (Clarke 1945), the United States did not prioritize the satellite intelligence program until the Soviet Union implicitly agreed on the principle of legal over-flight by launching Sputnik 1, thereby establishing a fundamental difference in the legal conditions under which space vehicles and airplanes operated respectively. The shooting down of the American U2 spy plane on May 1, 1960, further devalued the option to gain knowledge about the Soviet Union using planes instead of satellites, and as a direct result initiated the reorganization of military satellite programme management, notably through the establishment of the secret National Reconnaissance Organization (NRO) (Wirbel 2004: 21). Satellite systems for information gathering and communications are still competing with planes, but also with sophisticated Unmanned Aerial Vehicles (UAVs), also possessed by numerous European states (Adams et al. 2004).

3.3.2 Sensitivity to socioeconomic costs

A State's sensitivity to socioeconomic costs is basically determined by three factors: 1) The limits of public spending imposed by a state's resource base, 2) possible sunk costs consisting in already existing capabilities, and, finally, 3) the principles guiding a state's innovation policies.

To begin, a fundamental reduction or expansion of the resource basis seldom takes place. But tendencies to economic stagnation and the financial restrictions connected to the European Monetary Union since the early 1990s forced European governments to be extremely cautious where decisions on public spending are made. Institutionally this diminished resource base resulted in strict supervision on decision-making in technology policy, constituting remarkably higher sensitivities to socioeconomic costs in space policy. In the case of reunified Germany this tendency was moreover aggravated by the financial commitments made to support economic recovery in the eastern parts of the country (Suzuki 2003: 121-129).

Investments already made, usually known in economic literature as sunk costs, induce lower sensitivities to socioeconomic costs, provided that only fresh investments will help to maintain the knowledge and hardware already accumulated. For instance, the British decision to join other European nations in their effort to build a European launcher, later called Europa, was motivated to large extent by the threat of wasted sunk costs. After the British missile programme was abandoned in 1960, the British government "in a wonderful example of political opportunism" proposed to transform its Blue Streak rocket into the first stage of the future European launcher. Britain even agreed to make the largest single contribution, 39 per cent of the cost, to Europa 1. "It was the first and last time Britain would take the lead in Europe in space" (Marsh 1991: 195-196).

Finally, to analyse the sensitivity to socioeconomic costs we should take variations in the principles governing a state's involvement in technological innovation into account. Usually there are some references in space policy documents as to the preferred role of a state – liberal, interventionist or dirigist – in terms of technological advancement. Broadly speaking, Germany, Italy, and to a certain extent even France successively adopted elements of the liberal and selective approach, traditionally pursued in Britain[8], which emphasizes concrete, 'down to earth' benefits (Mean/Wilsdon 2004: 18-21), i.e. particularly civil infrastructures and commercial applications conforming to existing demands. To take Germany as an example again: in 1996 the Christian Democrats, Social Democrats, and the Liberal Democrats of Germany reached a comprehensive political consensus to restructure the national space program oriented around greater cost sharing with the private sector, commercialization potentials, and applications responding to identifiable user demands, accompanied by a very critical view on the strong financial commitment Germany had made to the ISS (Reinke 2004: 354-355). These principles were gradually implemented by the new Red-Green Coalition in the years following 1998 and expressed in the German Space Programme in 2001:

> Future projects will be given priority if they offer concrete solutions to specific problems. They will have to form part of an identified value-added chain […]. The 'end user' must in all cases be identified. Actual demand and utility will be the governing criteria rather than a project's technical attraction (Federal Ministry of Education and Research 2001: 13).

8 strongly reconfirmed in the UK Space Strategy (British National Space Center 2003; Cooper 2003).

Similarly, the Italian “Piano Spaziale Nazionale 2003-2005” also called for more applications and complained an organisational culture insufficiently focused on commercialisation opportunities (Agenzia Spaziale Italiana 2002: 3-4). Not surprisingly this process of converging principles, legitimising the state’s involvement in the development of space capabilities only where user demand is already observable, is reflected in European documents, as well (European Commission 2003), and welcomed by British officials as favourable to European cooperation (Sutcliffe 2004: column 4). To sum up, there are rising sensitivities to socioeconomic costs exhibited particularly by Germany and Italy, and increasingly resembling the British case, which raised the threshold of dual-use space technologies supported by the civil budgets of these countries. But market developments in satellite navigation and imaging apparently fulfilled these criteria, so that German and Italian institutions were eager to participate in Galileo and showed sufficient interest in the funding of dual-use observation systems. Hence the levels of cooperation and autonomy in terms of technological capabilities with security applications were reached *despite* the increased sensitivities to socioeconomic costs.

In addition, innovation and industrial policy guidelines are embedded in national procurement policies to varying degrees. The British and French’s decisions to contract out their satellite communication systems to national company led consortia were partly motivated by the fact that this would ensure that roughly 80 per cent of all socioeconomic benefits in terms of employment would fall into domestic hands. Traditionally, France is especially sensitive to socioeconomic gains in the form of stability in the domestic space industry’s workforce.

3.3.3 Sensitivity to symbolic costs

Contrary to the potential amount of symbolic costs and gains (see above) a state’s sensitivity to symbolic costs depends on actual and successful claims that a state’s level of control regarding space technology is representative of its general performance and achievements. These strategies could consist of either outside attempts to damage a state's legitimacy and prestige or governmental efforts to augment legitimacy and prestige. Anyway, to qualify such an attempt as successful, space issues should be *salient* (Soroka 2003) in the media and public opinion at least in the targeted society. Furthermore, where space issues are mentioned they should be embedded in precisely those *frames* (Entman 1993) previously employed in the symbolic policy efforts, provided that these efforts included verbalized claims. As with the remarks on calculating symbolic costs, the prime example illustrating a state's sensitivity to the symbolic dimension is the 'Space Race' between the USA and the SU. The Soviet Union seized a unique opportunity created by American society's attention towards technology in general combined with a conviction on part of the population of the United States and its allies that the US was the world leader in technology, resulting in potentially high symbolic costs and gains to be redistributed (see above). The launch of Sputnik as the world's first satellite in 1957 and the flight of Yuri Gagarin in 1961 were accompanied by Soviet claims attributing this success to their allegedly superior form of government and society, explicitly or implicitly purporting that the causes of American backwardness concerning space capabilities could be found in the inferiority of capitalist government and society. According to the *Pravda*, Gargarin's flight

> testif[ies] to the scientific, social, economic, and moral superiority of the Socialist system (quoted in McDougall 1985: 244).

And according to the Russian *International Affairs*, the real secret of Soviet success in spaceflight was

> rooted in the specific features of Socialist society, in its social structure, its planned economy, the abolition of exploitation of man by man, the absence of racial discrimination, in free labor and the released creative energies of peoples. Our achievements in the field of technology in general and in rocketry in particular are only a result of the Socialist nature of Soviet society (quoted in McDougall 1985: 245).

In reality the American capabilities were not significantly lagging behind the Soviet research and engineering achievements. But the USA had consciously decided not to *demonstrate* their capabilities, thereby allowing the Soviet Union to give the impression of a temporary monopoly and a technological preponderance in the long run. The American secret satellite intelligence program, unknown even to officials inside the Eisenhower administration, was considered as more important. A Soviet satellite launched first was advantageous because it constituted a precedent to establish the principle of legal over-flight.[9] But with domestic confidence and international prestige seriously injured, with further 'Soviet firsts', particularly the flight of Gagarin successively aggravating the situation by demonstrating a monopoly even in human spaceflight, the US government was forced to implement a war-like mobilization effort.[10] This resulted in gargantuan programmes (Mercury, Gemini and Apollo) and the largest institutional realignment after World War II (approximately equalized only recently by the creation of the Department of Homeland Security). Consider the domestic aspects of American sensitivity to symbolic costs in a quote from the 1961 House Committee on Science and Astronautics:

> […] our standing in the eyes of the Nation very definitely goes up or down depending on how we come out of this contest (Representative David S. King, quoted in Werth (2006: 24)).

The impending breakdown of international prestige was probably regarded as even more dramatic. As Lyndon B. Johnson warned:

> Failure to master space means being second best in every aspect, in the crucial arena of our Cold War world. In the eyes of the world first in space means first, period; second in space is second in everything (quoted in McDougall 1985: 8).
>
> This country should be realistic and recognize that other nations […] will tend to align themselves with the country they believe will be the world leader – *the winner* in the long run. Dramatic achievements in space are being increasingly identified as a major indicator of world leadership (quoted in Kay 2005: 74).

9 „the military intelligence definition of space policy was so deeply entrenched within the administration that air force secretary Donald Quarles actually argued […] that the USSR had ‚done us a good turn, unintentionally' by establishing the concept of freedom of international space" (Kay 2005: 48-49).

10 cf. Werth (2006), who interprets the space race as an substitute for war in superpower relations.

In his famous speech, announcing an attempt to land an American on the moon, President Kennedy himself referred to the symbolic dimension of spaceflight as he emphasized[11]

> the impact of this adventure on the minds of men everywhere, who are attempting to make a determination of which road they should take (quoted in Werth 2006: 49).

Indeed, a study conducted by the United States Information Agency (USIA), made public in October 1960, showed growing convictions in foreign public opinion that the Soviet Union would be the leading power of the future, resulting in subtle reservations by allies and neutrals (Werth 2006: 56). After remarkable American successes were achieved, foreign public opinion changed accordingly: In a 1965 USIA report, three-quarters of Nigerians surveyed in May 1965 felt that the USSR was leading in space, but by September more than half was convinced that the USA had the lead. This reversion of perceptions was certainly caused by the successful Gemini 4 and 5 missions (Kay 2005: 102). In the end, after American successes climaxed with the Apollo moon landing in 1969, the United States won the symbolic tournament in space.

Of course there is nothing comparable to the importance of the symbolic dimension in the 'Space Race' of the Cold War period. Current sensitivities to symbolic cost are very low in Western States. Particularly in Europe, space policy making is predominantly pragmatic, with German principles converging more and more with the traditional British 'utilitaristic' approach, emphasizing societal benefits (Cooper 2003; Mean/Wilsdon 2004: 18-21). The British position, indicating no sensitivity to symbolic costs is clearly formulated with reference to prestige factors:

> […] we will continue to focus on programmes which promise commercial benefits, represent excellence in science or provide key public policy information and will avoid national prestige projects which do not (British National Space Centre 2003: 4).

11 Behind closed doors President Kennedy admitted that the human spaceflight programme was solely a political instrument created for one purpose: "The Soviet Union has made this a test of the system. So that's why we're doing it" (quoted in Werth 2006: 68).

In Europe only France is an exception, at least historically, as the concept of 'Grandeur' is closely linked to technology policy aimed at furthering the state's legitimacy and prestige (Dauncey 1994: 26-33). However, I presume that the symbolic dimension is nevertheless marginally present at least in huge cooperative projects like the Galileo satellite system, where independence from the US is not only achieved but also demonstrated. President Jacques Chirac's rhetoric, cautioning that without Galileo France would take up a "vassal status" is possibly an example (James 2001).

We have to shift our focus to Asia to detect more than marginal sensitivities to symbolic costs in space policy. The vital human spaceflight program in China is, in addition to plenty of other motivations, clearly inspired by a desire to enhance the international prestige of the Peoples Republic and to initiate a "positive public-rallying effect" (Johnson-Freese 2003: 260) domestically to strengthen the unity and loyalty of the Chinese people. The latter element of symbolic politics is enlisted alongside pragmatic goals in official documents:

> China considers the development of its space industry as a strategic way to enhance its economic, scientific, technological and national defense strength, as well as a cohesive force for the unity of the Chinese people, in order to rejuvenate China (Information Office of the State Council of the People's Republic of China 2006: 2).

The wide-spread impression that China increasingly represents the leading technological power in Asia, indicated by singular human spaceflight capabilities, raises concerns particularly in Japan (Frederick 2005) but presumably also in India. Scenes as described below are unthinkable in Europe:

> Every launch resonates deeply in patriotic nerve centers and causes celebrations throughout the country. Some cities fire off so many fireworks the sky stays thick with smoke for hours. In other places, people pray for the success of the mission in temples and mosques. They may not know what's on board the rocket, but its liftoff certainly lends credibility to India (Carney 2006).

To conclude, whereas a global analysis must devote attention to sensitivities to symbolic costs, explaining European space policies can neglect this dimension, save for a few major collaborative efforts (Galileo, Ariane) with a small chance of being noticed by public opinion.

4 Conclusion

Rising sensitivities to political costs, the reduced availability and/or attractiveness of utilisation and participation opportunities and lesser socioeconomic costs paired with the expectation that socioeconomic gains will increase all result in growing European capabilities in security relevant space systems. On the other hand, increasing sensitivities to socioeconomic costs supposedly prevent more comprehensive capabilities. Symbolic costs and sensitivities to symbolic costs turn out to be of marginal importance at best. The following table summarizes the variables analysed and their hypothesized influence on European security space capabilities primarily in France, Germany, and Italy:

Variable	Estimated value/ trend	Hypothesized effect
Availability and attractiveness of utilisation and participation options	low/ diminished	+ +
Amount of political costs	middle/ diminished	-
Amount of socioeconomic costs	middle/ diminished	+ +
Amount of symbolic costs	very low/ unchanged	no effect
Sensitivity to political costs	middle/ enhanced considerably	+ +
Sensitivity to socioeconomic costs	high/ enhanced considerably	- -
Sensitivity to symbolic costs	very low/ unchanged	no effect

+/++ indicating effects supportive of levels of cooperation and autonomy
-/-- indicating effects unfavourable to levels of cooperation and autonomy

The collective effect of the variables identified clearly motivated the development, consolidation, and improvement of security space capabilities in France, Germany, and Italy. But two factors demand caution when extrapolating this trend in the future:

First, as explained above, based on high sensitivities to socioeconomic costs many European efforts rest on the commercialization potential of space technologies and derived services, representing socioeconomic benefits which mitigate or even outbalance socioeconomic costs. But in the case of two major programmes, the Ariane launcher and the Galileo satellite system, where Europe collectively reached or will reach the level of cooperation, it is increasingly doubtful that socioeconomic benefits of the magnitude originally expected exist. With the deployment of the Galileo satellites delayed, initial advantages will possibly disappear as improved GPS satellites are announced. Furthermore, market forecasts should be fundamentally revised as Russia and China augment their own navigation systems and as India has decided to build yet another satellite navigation system (Dinerman 2006a; 2006b). The market in Asia alone will therefore be highly competitive. Moreover, the mass production of receivers and software will most likely take place in Asia (Gow 2006; Triebe 2005). As a result, the European industry seems reluctant to provide two thirds of the deployment costs and is calling for more public spending (Hegmann 2005).

Structural overcapacity and fierce competition in the launcher sector combined with only moderate demand are responsible for Ariane's profitability being unlikely in the foreseeable future. The breakdown of the commercial satellite market caused a severe crisis in the launcher business, and due to low labour costs and/or massive subsidies outside of Europe, it will be extremely unlikely that Europe will keep up with Japanese, Indian, Chinese, and Russian launch prices. But European decision-makers apparently adhere to that illusion of profitability, declaring an end to public subsidies in 2009 (Schwentker 2005).

These predictable shifts in the crucial variable of the amount of socioeconomic costs vs. gains seriously reduce the likelihood that Europe will maintain their independent capabilities in the long run. Although there is a growing willingness in Germany and Italy (Taverna 2006) to generally increase government spending in space research, only sufficient sensitivities to political costs in combination with the existing sunk costs will probably guarantee levels of cooperation in launchers and satellite navigation.

Second, there are the American doctrines, organisational and programmatic measures to establish space control, reflected in various documents (Office of Science and Technology Policy 2006: 1-2; United States Air Force 2004; Air Force Space Command 2003: 21-26). An American capability to effectively control the medium of space would devaluate the acquired space capabilities by European and other states and counteract the *pluralisation trend* observable in recent decades. Whereas in today’s day and age a true monopoly on space capabilities is impossible to erect, denying the application of space systems and transportation assets would constitute a *quasi-monopoly*, overlaying the order described in this paper. If the United States realise space control in the future, the levels of cooperation and autonomy achieved by European states would become successively meaningless.

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