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Royal Higher Institute for Defence
Center for Security and Defence Studies
Renaissance Avenue 30
1000 Brussels

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Any question, commentary or remark related to this document can be sent to the following address:
Director of the Centre for Security and Defence Studies
Royal Higher Institute for Defence
30 Avenue de la Renaissance
1000 Brussels
Or by e-mail to: +IRSD-CESD-SCVD@mil.be

The Author

Alain De Neve is researcher at the Center for Security and Defence Studies (CSDS) of the Royal Higher Institute for Defence (RHID). He completed his degree in political science (international relations) at the Catholic University of Louvain (Louvain-la-Neuve). His recent research and publications have focussed inter alia on defence technologies (missile defence, drones, military space), the armament industry and emerging/converging technologies.

Acronyms

ASWS	Autonomous Surveillance and Weapon Systems
BRIC	Brazil, Russia, India & China
CBRN	Chemical, Biological and Radioactive
DARPA	Defence Advanced Research Projects Agency
DOD	US Department of Defense
GAFA	Google, Apple, Facebook, Amazon
GDP	Gross Domestic Product
GPS	Glopal Positionning System
H^+	Transhumanism
J-UCAS	Joint – Unmanned Combat Aerial System
NBIC	Nanotechnologies, Biotechnologies, Information Technologies and Cognitive Science
NSA	National Security Agency
NT	Nanotechnology
OECD	Organization for Economic Co-operation and Development
PPP	Private Public Partnership
RMA	Revolution in Military Affairs
RSP	Revolution in Strategic Perspective
UAV	Unmanned Aerial Vehicle
UCAV	Unmanned Combat Air Vehicle
US	United States

Executive Summary

It is always difficult to envisage developments in the world in the field of security. The present study is not intended to build a futurological narrative. Rather, it will attempt to identify the major trends in current transformations that will impact on the design of future security architectures. Artificial intelligence, robotics, nanotechnologies, precision weapons are already integrated technologies within the world's major defense structures.

However, as we know, any technological break-up is not a sui generis phenomenon. It is part of a wave of social and political transformations that carries it. In other words, the technical changes that have taken place are rooted in social, demographic and political upheavals.

Through the perspective of the main changes affecting the socio-political equilibrium of the international system, our aim will be to identify the major security and technical transformations that will tomorrow alter the geopolitical equilibriums of the world.

The content of our demonstration will consist in highlighting the emergence of what we mean by "dome", that is to say the multiplication of vast technico-diplomatic ensembles based on the coalition of states brought together by a convergence in deterritorialized alliances. These domes are principally ruled by technological convergences among their members. Domes will be principally governed by private companies which are at the source of the emerging and converging technologies aimed at regulating societies and maintaining security. As it will be explained, autonomous surveillance weapon systems (ASWS) will play a key role in such a context.

Such developments will raise questions about the future of relations between the State, the private sector, society and technology. We will also question the adequacy of such technological systems with future threats.

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I. Introduction

How will technology, society and geopolitics interact in the coming decades? How will global changes[1] that are taking place in the international system impact on the way political leaders envision their place and political-military action? What will be the effect of emerging and converging technologies (nanotechnologies, biotechnologies, information technologies and cognitive sciences[2]) on global governance? Here are some of the key questions this paper proposes to answer.

Given the extraordinary diversity of variables entering into consideration in our attempt to envisage the world in 2030, specific tools are needed. Foresight and prospective (these cover different approaches) are by essence tough exercises. Yet, even though they are vitally important in the affairs of nations, organisations and individuals, they are not regularly conducted by political, economic and military leaders who are generally embedded in the management of current affairs (Godet and Mack Fall 2011). The main difficulty associated to such exercises (foresight and prospective) is to combine in a single framework several angles of analysis encompassing social dynamics, political shifts, climate change data, migratory movements, economics and technological breakthroughs (at least if we presume that such breakthroughs may occur at a given timescale[3]). It also should be noted that foresight and prospective fundamentally differ from forecast or any form of futurism. In this essay, our modest ambition will basically consist in extrapolating some of the main dynamics currently observed in order to evaluate the effects of interactions between several kinds of parameters. The limits of the exercise we intend to realize in the following pages impede us from disserting with original data that would be issued from our own inquiries. Rather, we will rely on existing facts and figures released by some of the most research reports on social, economic, migratory and demographic issues. Foresight and prospective offer remarkable tools to adopt a systemic approach that focuses both on technology and social/political/entrepreneurial factors (one cannot ignore the strategies developed by social groups, states and the private sector). Put differently (and more explicitly) Foresight intends to integrate material variables, while prospective efforts are directed towards the analysis of social factors. To put it more simply, two questions will guide our thoughts. First, in a Bowie-styled manner: "where are we now?" Second: "how do we get there from here?"

In the present essay, we will try to picture the state of the geopolitical/military balance on the basis of current trends observed in technology, demography, environment, governance and economy. Though it is an extremely difficult exercise to depict what such an unknown world will look like, a cross-sector approach is necessary in order to take into account the various dynamics and interactions that will shape the international system. In our view, we will assist at the eve of an era characterised by the spread of security domes axed around new control technologies delivered and managed by the private sector. While it can be

[1] Our approach of « global changes » encompasses climate change, demography and migration transitions.

[2] Converging technologies are also designated as NBIC according to the report published by the National Science Foundation (NSF) in 2002.

[3] We refute any form of technological determinism assuming that progress could not be stopped. Progress, in our view, does not follow a linear development but can be characterised by sudden leaps, unattended setbacks or unexpected breakthroughs.

claimed that the last two decades were characterized by the projection of forces into distant theatres in order to restore security and peace in or to overthrow a political regime (Afghanistan, Iraq), it is more than plausible that the next two decades will assist to a global retrenchment of global powers (especially the United States and its European allies). Such an evolution should induce a diminution of forces stationed abroad and an overwhelming dependence on intelligence and surveillance technologies (drones, disseminated sensors, satellites, etc.). For their protection, industrialized states will growingly rely on global defence systems, and more specifically, on antimissile systems (the recent revitalizing of the antimissile debate at the transatlantic level, and moreover inside NATO is a clear indication of that trend despite some technical and doctrinal restrictions). As we will explain, it is expected that in the coming decades the international system will be regulated by private companies: the watchers (Attali 2006). Private companies will have increasing resources at their disposal not only to influence governments but also to convince them to progressively give up more and more domains of public authority into their fold. Though we will not assist to a complete desertion of state authority in public affairs, it is more than plausible that the kind of relationship that will develop between private and public actors will affect the readability of decision-making processes in the future. The combination of these trends – the end of force projection, the development of autonomous surveillance and weapon systems (ASWS), the rise of private actors in the field of security and defence – will lead to the emergence of domes throughout the globe. The purpose of these domes, mainly based on static and mobile ASWS, will be the defence of areas of prosperity or the containment of zones of crisis where the number of human forces deployed should be limited to the minimum.

II. The Permanency of Change

Since the end of the Cold War, observers and scholars have tried to imagine what the international system could look like in the absence of a structural opposition between two or more superpowers. During more than 40 years, the ideological rivalry between the United States and the Soviet Union defined the "grammar" of international relations. It could be said that the Cold War was a period of great stability regarding the relationship between the industrialized countries that were regrouped either in the Warsaw Pact or the Atlantic Alliance. Undoubtedly, the balance of terror associated with the possession of nuclear armaments installed a rigid picture of world affairs. The ideological antagonism that structured the Cold War served as a prism in order to portray the conflicts that arose in the periphery of the two nuclear superpowers.

Since the fall of the Berlin Wall and the dissolution of the Soviet Union, the stability of the "ancient" world disappeared and opened the way to a system characterised by permanent changes in several fields: socio-economics, technology, politics, geopolitics, culture, etc.

Let's start with the transformations occurring in the technological field. For the past 20 years, the world has been in the midst of a global technology revolution based on advances in biotechnology, nanotechnology, materials technology and information technology. By their combination, each of these revolutions (or breakthroughs) has the potential to bring about radical changes in all dimensions of everyday life (Silberglitt, et al. 2006). The technologies of 2030 will integrate developments from multiple scientific disciplines in ways that could radically change the face of industry and contribute to the rise of new economic and political powers at a global scale (Walton 2007). Indeed, while extensive, such a global technology revolution will play out differently around the globe. In other words, not all countries will be able to acquire it. The global diffusion of a technology does not mean universal diffusion. Not every nation in the world will be able to implement, or even acquire a technology of the global revolution. In the same time, that technology revolution could be adopted and fully exploited by countries other than the nations that have invented the new technology[4] (Hundley 1999). Identifying the nations that will be capable to acquire, develop and exploit the technologies of the global revolution is a tough exercise. Within different geographical regions, countries present considerable differences that play into their ability – or inability – to fully exploit these technologies. These differences come from variations in country's physical size, natural conditions, and location. They also result from the size of the population and demographics. Last but not least, the ability of a country to develop and exploit breakthrough technologies also depends on the attractiveness of that country and the facilities given to foreign scientists. In other words: the aptitude of its government to bring foreign scientists and engineers.

To tell the truth, besides countries having a solid scientific, industrial and technological base, entire regions of the world not having the minimum of facilities required for fixing scientists will completely miss the opportunity offered by the global technology revolution of 2030. These countries will be the victims of what some observers call the next great

[4] This phenomenon has been previously observed in history and, more specifically, in military history.

divide. It is important to underline the future impact of the great divide on international security. It will not only take the form of a digital divide opposing the haves and the have-nots, but will moreover concern fields as such as agriculture, trade, industry and employment. According to Amadou Kanoute (of Consumers International), technologies derived from nano and biotechnologies, for example, will not solve African hunger (Shelley 2006). Rather the nano/bio technological revolution is about to offer more advanced countries with new means to foster their world domination through new technical standards. The next great divide that will oppose those haves and have-nots will contribute to develop an uncommon gap, largely dependent on NBIC (Nano, Bio, Information and Cognitive Sciences) technologies[5] but not only. The combination of these converging technologies with some cultural and intellectual movements will lead to diverging views about the true nature of humanity. Throughout the world – though this movement was born in the United States - one assists to the rise of transhumanist communities whose eventual goal is the transformation of the human condition through the development and the availability of technologies that could enhance human performance. The transhumanist movement (often labelled under the "H^{+}" acronym) is a way of thinking about the future that is based on the premise that the human species in its current form does not represent the end of our development but rather a comparatively early phase. More formally, it could be said that transhumanism is both an intellectual and cultural movement that affirms the possibility and desirability of fundamentally improving the human condition through applied reason, especially by developing and making widely available technologies to eliminate aging and to greatly enhance human intellectual, physical and psychological capacities.

1. The Global Demographic Crunch

The demographic variable is one of the most important indicators of the geopolitical changes that will take place in the future. Though we live in networked societies with a high level of population's mobility, demography should not be underestimated as its remains one of the constitutive basis of power among nations. For better or for worse, demography has a direct impact on the level of economic development. It is the guarantee for a state to have at its disposal a sufficient amount of tax payers that will enable the government to develop the means of its politics in several domains. Moreover, a state that can rely on its own demographic pool in order to form its own scientists and engineers will benefit from a larger autonomy in time of crisis or war.

In order to anticipate the world of 2030, demography projections made by the United Nations at the horizon of 2050 could help us to have a better vision of the weight of demography on geopolitics. As we will explain, four demographic trends will shape most countries (although these trends will not necessarily determine the future of the countries concerned[6]). Before entering into the details of these projections, it should be mentioned that in the world of 2030, the global population will reach somewhere close to 8.3 billion people (up from 7.1 billion in 2012). The world population is projected to grow to 8.9 billion in 2050. If we compare these statistics with the population of 2000, it means that we will assist to an increase of 47%. This being said, what are the four trends in question?

[5] Also labelled "converving technologies".

[6] It will depend on the politics engaged by their governments on that timescale.

These are : (a) the impact of aging population, (b) the effets of moving and migrations, (c) the development of an urbanized word and (d) the proliferation of walls and fences throughout the world.

a. The Impact of Aging

We will assist to a radical shift both for the West and for most of the developing countries as far as their age structures are concerned. In 2030, it is expected that the age's structure will range from extraordinarily youthful populations to populations with greater life expectancy. To be more precise, the median age of almost all societies throughout the world will rise, except in sub-Saharan Africa. However, this picture will present great contrasts. Some countries will have to manage an aging population and will have difficulties to maintain their living standards given a significant lowering of the number of their working people. Other, more youthful countries, could gain an economic boost if they can put the extra number of youths at work.

In high income countries of the OECD, the median age will rise to 42.8 years by 2030 (up from 37.9 years in 2010). Some countries, however, will be affected by a post-maturation of their populations. It will be the case of Japan and Germany where the population is expected to reach a median age of more than 45 years old. By 2030, some states in the world could even have a population whose median age largely overpasses 45 years old and could reach 65 years of age. By 2030, most of West-European countries will be post-mature societies and will be joined in their group by some East Asian states. In the United States and Russia, however, the advance of the median age will proceed very slowly. To explain this phenomenon, it should be underlined that in the US, a high rate of immigration and a fertility level that is near replacement (that is, close to 2.1 children per woman) contribute to slow the aging of the global population. In Russia, however, it is the high rate of death among young men that contributes to lower the median age of the population in the country.

Globally, the number of youthful countries will shrink in the coming decades. Today, more than 80 countries have populations with a median age of 25 years or less. These countries – if one considers them as a group – will have a huge impact on the conduct of world affairs. However, they do not necessarily share common views on several fields as such as international security, economy, and culture. By 2030, this group of countries (those with populations of a median age of 25 or less) will be considerably reduced to a number of 50 (or less). This will be the consequence of a lack of fertility. The youngest populations of the globe will be located in Sub-Saharan Africa and, to a lesser degree; in the Middle East (it includes the Palestinian territories, Jordan and Yemen. Other regions with a stable level of youths will include some countries of Latin America (Bolivia, Guatemala and Haiti), even as some states in the south of the Pacific Rim.

The impact of age structures upon the military and the ability for a defence organization to mobilize in time of war should not be underestimated. Though it seems very difficult to determine the low and high edges of a relationship between, in one hand, the age structure of a given society and, in the other hand, both the decision to enter into war and the choice of the means engaged, it could be said that states with older populations will tend to be less war prone than societies with younger populations. To be less war prone does not necessarily mean that these older societies will avoid war. Rather, their reluctance against war will lead to a radical shift in the choice of means dedicated to it. This shift can be depicted as a transition from "modern industrial war" (based on the models of WWI and

WWII) to "post-modern (post-industrial) war" (though the exact definition of "post-modern war" seems to depend on the Western point of view only). In post-modern wars, the central role of human bodies among industrialized states (mainly in the Western Hemisphere) tends to be eclipsed rhetorically by the growing importance of machines. Because human bodies in our "older societies" (or "societies of the elders" as we will see with more details) are sacralised given the risk to assist to a demographic decline in the coming decades, war is no more considered as a "business of killing", rather is it envisaged as a struggle of discourses and interpretations of the destructions caused by weapons and machines. In the model of post-modern war, "occupation" (that is, the deployment of a stationary force on the territory of an adversary or of a liberated country) is no more considered as a political necessity in order to re-establish order and security. Rather post-modern societies will prefer the deployment of military means allowing them to exert a distant control on defined zones of interest. Distant control does not only mean a permanent surveillance for precision-strike missions but can also provide a post-modern military power with a direct solution aiming at containing and limiting violence or the risk of a regional destabilisation.

This is not to say that only countries with a large proportion of seniors will privilege technology in place of manpower in order to conduct warfare. A growing recourse to military technology depends, first, of the type of contingency, and, second, of the degree of emotional or political implication of the state engaged in a conflict. In other terms, deploying technology rather than troops may paradoxically mean a form of "qualitative disengagement" from some theatres where a state does not want to expose its troops to risk. The question that lies underneath this statement is: what could affect the resolve of a government to project military power abroad? This question brings us to analyse the migration factor.

b. Moving and Migrations

Contrarily to demographics, migration data lack the solid foundation and long-term stability of birth and death data. Migration depends on multiple factors that have the potential to radically alter or inverse the projection curves (i.e.: environmental catastrophe, industrial disruption, armed conflict, genocide, economic crisis, etc.). Current levels of migration are rarely well known and illegal immigration can be very large. Moreover, it is possible for illegal immigrants not to be registered on counts for many years before appearing in the census. Though it is not the purpose of this chapter to address an exhaustive analysis of migration worldwide, it is important to notice that any alteration of population's distribution between ethnic groups or origins may have a long-lasting impact on the way a state will consider its place in the international system. This is not to say that migration has a deterministic impact of the conduct of state's affairs. Nonetheless, this variable – combined with demography – should not be underestimated.

Migration is likely to become more and more globalized. Indeed, the spectre of greater economic opportunities outside of local communities will be one of the biggest driver and game changer of the international world (dis)order. In the same time, the demand for both skilled and less skilled workers in new destination countries hosting migrants will tend to grow geometrically. One has to insist on the fact that, despite many expectations, G8 countries will still attract workers from developing countries (even those with fast-growing economies), no matter the relative slowing of economic growing inside the richest countries. In order to understand this astonishing allegation, it must be reminded

that age and income disparities tend to create a paradox. One would normally expect fast-growing economies to appeal migrant labour, not to send it. However, in these countries, economic growth allows more young people to acquire the knowledge and the resources to take advantage of migration opportunities. In other words, higher education and more financial means draw young people to envisage migration to countries where they think they can earn higher incomes than at home.

In the same time, recently developed countries could provide numerous opportunities for less skilled workers. Thanks to rapid urbanization in these countries, the volume of urban construction could create enormous opportunities for many workers coming from low-income countries (Sub-Saharan Africa and Southeast Asia). Numerous emerging countries, such as Brazil, China and Turkey, whose youthful populations are on decline, will find in low-income migrants a way to regenerate their young population. Here after, an instructive table describes the demographic windows of opportunity for some developed and developing countries. A country's demographic window of opportunity is estimated by identifying those years in which the proportion of children (0 to 14 years of age) in the total population is less than 30 percent, and the proportion of seniors (65 years and older) is less than 15 percent. As it results from a rapid analysis of the data contained in the table, many emerging countries will see the median age of their population approach that of developed countries populations.

Aside from classic or permanent migration, a new phenomenon will characterise the world of 2030 and will especially concern those countries with high rates of economic growth. This phenomenon can be labelled "mobility". Mobility is different from permanent migration for it concerns high skilled people who do not intend to stay permanently in the host country. Over time, governments may need to increasingly rely on mobility of high skilled people as a strategy of dynamic economic growth. Such a strategy requires from governments to be able to manage versatile population flows. The rise of more global markets will create the need for international institutions to set new standards regarding pensions, social and health benefits, etc. In that aim, it is more than probable that technology – and more specifically biometrics – will help governments and administrations to increase their capacity to control entry and departures from their territories. Greater information about labour flows will enable public administrations to regulate population. In the same time, network technologies and internet in particular will allow candidates for migration to compare countries regarding opportunities for work, social and health benefits, taxing rules, etc.

Migration, like any social-economic phenomenon, is a double-edged sword. In one hand, it can be apprehended as a threat endangering the so-called native culture of a country. Migrants, though they may be invited or incited to assimilate host country's culture, traditions, laws and way of life, tend to upset established both the systems of beliefs and the dominant vision of a society. In the other hand, migration – especially for the developed world – has the potential to reshape the population's age structure. History has demonstrated the power of migration. In the best case scenario, migration can help harmonize the very different economic and demographic conditions that will be experienced by countries as the world moves toward its peak population. In the worst case scenario, migration can be driven by economic failure. In each case, migration is a factor of deep changes and turbulence for any society. And the way a government manage it also depends on the tools it has at its disposal.

Table 1: The Demographic Window of Opportunity

Country	Median Age, 2010	Median Age, 2030	Demographic Window of Opportunity
Brazil	29	35	2000 to 2030
India	26	32	2015 to 2050
China	35	43	1990 to 2025
Russia	39	44	1950 to 2015
Iran	26	37	2005 to 2040
Japan	45	52	1965 to 1995
Germany	44	49	Before 1950 to 1990
United Kingdom	40	42	Before 1950 to 1980
United States	37	39	1970 2015

c. The Urban Growth

Today, roughly 3.5 billion of the world's 7.1 billion inhabitants live in urban agglomerations. It is traditionally expected that this number will climb to 4.9 billion in 2030. These respective percentages represent a complete inversion of the repartition of world's population in the fifties. Between now and 2030, demographers expect urban population to grow most rapidly where rates of population growth are highest and where the urban population remains relatively low, especially in Sub-Saharan Africa and in South Asia. According to UN's projections, by 2030, there will be an additional urban population of 276 million in China and 218 million in India. The cumulative population of these two countries will together account for 37% of the total increase of populations in the cities worldwide. Moreover, nine other countries will contribute to 26% of the urban growth: Bangladesh, Brazil, Democratic Republic of the Congo, Indonesia, Mexico, Nigeria, Pakistan, the Philippines and… the United States!

Cities will be mankind's most enduring and stable mode of social organization, outlasting all empires and nations over which they have presided during history. Today cities have already become and will remain the world's dominant demographic and economic clusters.

As the sociologist Christopher Chase-Dunn has pointed out, it is not population or territorial size that drives world-city status, but economic weight, proximity to zones of growth, political stability, and attractiveness for foreign capital. In other words, connectivity matters more than size. Cities thus deserve more nuanced treatment on our maps than simply as homogeneous black dots.

Within many emerging markets such as Brazil, Turkey, Russia, and Indonesia, the leading commercial hub or financial center accounts for at least one-third or more of national GDP. In the UK, London accounts for almost half Britain's GDP. And in America, the Boston-New York-Washington corridor and greater Los Angeles together combine for about one-third of America's GDP.

By 2025, there will be at least 40 such megacities. The population of the greater Mexico City region is larger than that of Australia, as is that of Chongqing, a collection of connected urban enclaves in China spanning an area the size of Austria. Cities that were once hundreds of kilometers apart have already effectively fused into massive urban archipelagos, the largest of which is Japan's Taiheiyo Belt that encompasses two-thirds of Japan's population in the Tokyo-Nagoya-Osaka megalopolis.

China's Pearl River delta, Greater São Paulo, and Mumbai-Pune are also becoming more integrated through infrastructure. At least a dozen such megacity corridors have emerged already. China is in the process of reorganizing itself around two dozen giant megacity clusters of up to 100 million citizens each. And yet by 2030, the second-largest city in the world behind Tokyo is expected not to be in China, but Manila in the Philippines.

America's rising multi-city clusters are as significant as any of these, even if their populations are smaller. Three in particular stand out. First, the East Coast corridor from Boston through New York to Washington, DC contains America's academic brain, financial center, and political capital (the only thing missing is a high-speed railway to serve as the regional spine).

From San Francisco to San Jose, Silicon Valley has become one continuous low-rise stretch between I-280 and US-101 that is home to over 6,000 technology companies that generate more than $200 billion in GDP (with a San Francisco–Los Angeles–San Diego high-speed rail, California's Pacific Coast would truly become the western counterpart to the northeastern corridor. Elon Musk's Tesla has proposed an ultra-high-speed "Hyperloop" tunnel system for this route).

Finally, the Dallas–Fort Worth metroplex, the largest urban cluster in the American South, houses industry giants such as Exxon, AT&T, and American Airlines in an economy larger than South Africa's and is poised to get a high-speed rail to the oil capital Houston, based on plans rolled out by private developers Texas Central.

Great and connected cities, Saskia Sassen argues, belong as much to global networks as to the country of their political geography. Today the world's top 20 richest cities have forged a super-circuit driven by capital, talent, and services: they are home to more than 75% of the largest companies, which in turn invest in expanding across those cities and adding more to expand the intercity network. Indeed, global cities have forged a league of their own, in many ways as denationalized as Formula One racing teams, drawing talent from around the world and amassing capital to spend on themselves while they compete on the same circuit.

The rise of emerging market megacities as magnets for regional wealth and talent has been the most significant contributor to shifting the world's focal point of economic activity. McKinsey Global Institute research suggests that from now until 2025, one-third of world growth will come from the key Western capitals and emerging market megacities, one-third from the heavily populous middle-weight cities of emerging markets, and one-third from small cities and rural areas in developing countries.

There are far more functional cities in the world today than there are viable states. Indeed, cities are often the islands of governance and order in far weaker states where they extract whatever rents they can from the surrounding country while also being indifferent to it. This is how Lagos views Nigeria, Karachi views Pakistan, and Mumbai views India: the less interference from the capital, the better. These can be deemed as predatory cities which are indifferent to the links that are supposed to exist with the country to which they formelly belong.

It is, of course, very difficult if not impossible to neatly disentangle the interdependencies between city and state, whether territorially, demographically, economically, ecologically, or socially. That is not the point. Across the world, city leaders and their key businesses set up Special Economic Zones and directly recruit investors into their orbit to ensure that their workers are hired and benefits accrue locally rather than nationally. This is all the sovereignty they want.

To that end, entire new districts have sprung up around airports to evade urban congestion and more efficiently connect to global markets and supply chains. From Chicago's O'Hare and Washington's Dulles to Seoul's Incheon Airport, such sites have become the fastest-growing economic geographies, underscoring the intrinsic value of connectivity. For companies moving their headquarters into an aerotropolis, the airport is the gateway to world markets while the nearby city, no matter how large, is just another sales destination. Recreating the world map according to the three dozen megacities therefore tells us much more about where the world's people are and money is than conventional maps of 200 separate countries.

In Africa and Asia, rapid urban formation will certainly drive constructive developmental trends. There, this phenomenon could lead to an urban-centred economic growth that will destabilize the traditional family model based on large groups of relatives living together.

Urbanization at the eve of 2030 will take radically new forms and will be very different from the urbanization model of the twentieth century. Megacities formed in the former century, though they will continue to rise, will be confronted with physical and geographical limitations. Moreover, these agglomerations will be burdened by vehicular congestion. These elements will combine to give birth to a new trend: the development of "peri-urban zones" (also known as "rurban zones"). Peri-urban zones will grow far much faster than existing megacities. These could lead to the emergence of urbanized regions that will not fit with the existing international borders separating states. New kinds of "allegiances" will rise based on new types of economic convergences between the cities belonging to these peri-urban zones.

As a result of the new social and economic demands linked to the development of peri-urban zones, demand for power in some regions could literally explode. In China, it is expected that the need for power and resources could double from today's level and will account for nearly 20 percent of global energy consumption. China will not be the only "mass energy consumer" of the world. Its neighbour, India has also an ambitious demand level. Beside energy, water will be a critical parameter of the prosperity of the new peri-urban zones. Indian cities will need 94 billion litres of potable water. The only problem is that such a demand will not be sustainable on the long term without any agreement about the future of water sharing.

Nonetheless, urban centres will be engines of productivity and will generate roughly 80 percent of the global economic growth. The main challenge for future government will reside in their ability to tax the value of such productivity because of the temptation of many workers living in the peri-urban zones to evade from their tax obligations. As a consequence of this phenomenon, in 2030 urban politics might feature confrontations between government authorities on the one hand and tax-evading entrepreneurs or workers on the other hand. A solution imagined to avoid such a scenario resides in the advice given by the Asian Development Bank arguing that the management of future megacities in the coming decades will need a better financing and, first of all, a long-term planning based on a visionary leadership. Moreover, in order to reach these objectives, it will require from national governments the ability to decentralize power and responsibility.

d. A Walled World

In spite of the great hopes that followed the end of the cold war and the advent of a "then supposed" multipolar international system based on the liberty of movement, one has to admit that we live in world of borders and fences. Thus, far from the optimistic representations that flourished in the aftermath of the East-West confrontation, the contemporary world is characterized by the increasing enclosure of territories between sovereign states through the construction of walls and fences (Jones 2012). Undoubtedly, the world of 2030 will confirm that trend. Walls and fences are not only made of bricks and barbed wire. They rely on new forms of control and surveillance systems. Enclosure does not mean a complete closing of frontiers. Instead we assist to a hardening of borders, be they virtual or physical. This hardening attempts to filter out bodies and goods that are marked in some way as unacceptable. In that aim, sophisticated biometric systems utilise the data on millions of cross-border movements to identify an unusual pattern that signals an unwanted flow. Such a "hardening" is based on the building of any kind of closure system. Today's world is characterised by the development of barriers on international borders. It is very doubtful that this tendency could lower in the next decades. On the contrary, an acceleration of such a phenomenon is to be expected. Different methods of calculation are used to evaluate the total length of these closed borders. Experts differ – but never diverge – about the exact amplitude of wall's deployment throughout the globe. According to the French geographer Michel Foucher, it is estimated that nearly 18,000 km of the world's terrestrial borders are closed by walls or barriers (the term "barriers" includes virtual methods of control and surveillance). Scholars of the Chaire Raoul Dandurand made a different calculation and estimate the length of the walled frontiers of 20,000 km long.

Considerations regarding the exact extent of walled borders are not as important as questions about the deep root of what should be called "teichopolitics" (Rosière et Jones 2012). This neologism, imagined by Ballif and Rosière, is associated to the notion of biopolitics – proposed by the French philosopher Michel Foucault. In other words, teichopolitics designates both the practice of modern states and their regulation of individual lives and populations through "an explosion of numerous and diverse techniques for achieving the subjugations of bodies and the control of populations". Teichopolitics, it could be alleged, describes the politics of building barriers on borders for various security purposes, but not only.

Though barriers have been largely developed on frontiers, separating national territories, it has to be expected that future walls will also concern cities or delimited autonomous zones, without regards to the legitimate authority that is supposed to regulate these zones. Barriers could also be implemented in the intimacy of the body of citizens. As we shall explain in a next point, converging technologies emanating from combined advances in nanotechnology, biotechnology, information technology and cognitive sciences will provide political bodies with new means of control and surveillance. In other words, individual's origins could well be contained in some identifier micro-agent without the knowledge of the concerned person. These kinds of stealthy nano-markers would thus accompany every individual all along his life such that frontiers would be located in the intimacy of the body.

III. The Retreat of States

It is more than probable that future post-modern societies will abandon large portions of their ability to project security. A country's recruitment base is generally proportional to the size of its young (mostly male) cohorts. Yet, numerous qualifying parameters have to be taken into consideration when evaluating the impact of population on the state of a military organisation. However, states with older populations will tend to growingly rely on private security corporations (contractors) – even non-national – as a tool of foreign policy. The aging of the rich countries will absorb a great fraction of their overall income and budgets. Savings in public expenses will certainly not suffice to provide the state with a margin of manoeuvre to invest in private security companies. It is more than probable that a sustained pressure will concern public budgets in the coming decades.

At the same time, one can observe that scientists and engineers involved in the development of border control technologies (originally for CBRN detection purposes), due to the specific nature of their activities, are blurring the lines supposedly existing between the sphere of science (based on expertise and experimentation in laboratory) and that of security (which is linked to sovereign decision-making). By doing so, private laboratories interfere in decisions that are normally produced by states and their representatives. Today, we see scientists and engineers perform many of the discretionary decisions that ultimately constitute the sovereign decision to permit or exclude at the border. This phenomenon is leading to a transformational shift of power from political-military leaders to those corporations mastering the current technologies used for border control.

The building of the security fence, as well as the apparatus of surveillance – for example the drones, used to patrol US-Canadian territory – all participate in creating an economy of security and surveillance – the Security Industrial Complex. Also referred to as the Surveillance-Industrial Complex – it is described as one of the recession-resistant sectors of the defence industry with Governmental spending on products and services for homeland security was forecast to reach $141.6bn worldwide in 2009 (Visiongain Market Research, 2009). Paul Craig Roberts views the War on Terror as a marketing campaign for security industries and terrorism experts with the latter "pulling in the consulting fees and the former are rapidly inventing new products that enable "our" government to watch our every move and to know our location at every moment" (Roberts s.d.)

A Panel on the Security Industrial Complex chaired by Julien Saada, a political scientist affiliated with the Observatory of the Middle East at the Raoul-Dandurand Chair, numbered 450 specialized enterprises in territorial surveillance worldwide often headed by former state security and defence officials. This leads us to question that perhaps we should begin to reflect and envision how these enormous budgets extracted from taxpayer's contributions might be otherwise allocated to development projects that could participate in building a more just, balanced and secure world?

On the eleventh of April 2015, the Stockholm International Peace Research Institute (SIPRI) revealed the figures for military spending worldwide in 2014. Though still on the rise to as much 1,630 billion dollars, the growth is slowing down and even regressing in Europe. However, according to calculations made by the International Peace Bureau, this is still five times more than the 329 billion needed to fulfil the millennium development goals and therefore, all basic human needs.

The EU's external security agenda, and the creation of new Limes at the borders of Europe (Limes is used to designate the fortified borders of the Roman Empire) can also be questioned. Since the creation of the Schengen Space, the EU member states have begun to coordinate their national policies to propose technical solutions to illegal immigration and undesirable visitors, with the creation of a border agency (FRONTEX), a Border Surveillance System (EUROSUR), as well as a new checking system on entry and exit to and from the EU based on biometric data. Since 2013, the EUROSUR project is using satellites, drones and other intelligence – all integrated into one comprehensive network – to monitor Europe's borders from the Baltic Sea to the Canary Islands.

An important structural transformation of the nature of states has occurred since the cold war; this phenomenon has led to the unbundling of sovereignties and the denationalizing of territories with disturbing repercussions for distributive justice and equity (Sassen 1996); the recalibration of regional central government relations from vertical coordinative and redistributive to horizontal, competitive and developmentalist; the information communication revolution that suggests a fundamental transformation of the relationship between politics and market forces: "spaces of places" and "spaces of flows" and the loss of sovereignty of the modern nation state bypassed by global networks of wealth, power and information. While States are transforming structurally, their numbers are also increasing - from 69 Sovereign States in 1919 to 195 Sovereign States in 2011. This expansion results in an increase of borders, which are also transforming their nature and structure. Such an increase implies an exponential development of new technologies aimed at defending the borders.

1. The Advent of Post-Modern Era: the Future of War, Technology and Soldiers

Several factors will interact in the future to allow emerging and converging technologies to play an increasing role in the conduct of world affairs. In the world of 2030, characterised by unprecedented global flows, a rapid economic development of emerging powers and one of the most demographic crunch since the end of the 19th century, it will be difficult to get away from new control technologies. The rapid advances in information, communication and surveillance technologies will provide governments with new means to fill a governance gap that finds its sources in two phenomenons. For industrialized countries confronted with a demographic crunch and unable to mobilize their aged populations on foreign crisis, to rely on standoff military technologies could constitute a substitute for troops and help these states to secure strategic zones anywhere in the world. Yet, though human soldiers will become too precious to be sent on every war front, machines, though equipped with the first AI systems, will still reveal too dumb for the complexity of battle. It is thus expected that future soldiers will reside on hybrid forms of combatants: cyborgs (Gray 1999).

What will make post-modern wars so complex is the paradoxical forms of violence to which we will assist in the coming decades. Hybrid forms of violence will develop in every zone of the planet, including those belonging to the so-called "post-industrialized world". The high level of complexity characterizing these types of violence could overcome the ability of state institutions to catch with the new reality of security and defence. Future wars, in the vision of rich countries, will oppose regular forces (emanating either from the army or the police) to more chaotic and networked forms of contestations. Crisis on distant territories will have a direct impact on those countries that near or far are

implicated in the management of that crisis. Forthcoming military interventions (be they conducted by regular defence organizations or by private military companies mandated by states) will no more reside in the projection of forces aimed at interceding between the belligerents. Rather, such military interventions will be focused on the instauration of a minimal level of violence that would be tolerated by foreign powers. Any form of intercession in internal affairs will be excluded as a viable strategy. "Power demonstration" will substitute to "force projection". In that sense, strategic preclusion, that is the deployment at short notice of technologies aimed at regulating a situation of crisis anywhere around the world, will be the preferred strategy of aging states[7].

Another question that deserves to be examined is whether states and societies characterised by a notable population growth could be keen to engage more frequently in inter-state wars. According to recent studies, it seems clear that population growth by itself does not cause war, not even a sudden increase in overall population density (Thayer 2009).

2. From Labs to Fields: The Rise of Private Research and the Anticipation of Control Border Practices

To the public opinion, border control technologies are supposed to be developed on the express request of state representatives looking for efficient solutions aiming at preserving a territory against external threats or undesirable people. It is generally admitted that security devices are first a product of science and then a tool of security in which "science and technology" decisions are supplanted by political "sovereign" decisions relating to border control. Actually, technical solutions developed by scientists and engineers in order to supply political authorities with new tools aimed to control borders and territories (should they be domestic or afar, i.e. in the context of distant operations theatres) generally includes political representations about the threats and risks they are purposed to tackle with. More exactly, prevailing assumptions about threats, dangers, and enemies are always present, but are mostly unsaid – an ambivalence that powerfully shapes the emergence of sovereign decisions in dedicated laboratories and scientific practices located far away from the frontlines of geopolitics.

3. Converging Technologies and the New Great Divide

In the coming decades, a new global technological revolution will drastically alter the state of the world system and international security. The root of this new revolution has to be found in the science of the very small: nanotechnology (NT). Nanotechnology – and especially nanotubes – will become a key component of AI systems. Since a nanotube is essentially a sheet of graphite that is one atom thick, it is vastly smaller than the silicon transistors on an integrated chip. It must be added that a nanotube is far more durable than silicon and handles heat much better than current transistors. Given the multidisciplinary nature of nanotechnology, it will influence every dimension of human affairs. Nanotechnology comes to public attention at an interesting time characterised by

[7] An interesting study about the U.S. Global Defense Posture between 1783 and 2011 can be found on the website of the RAND Corporation: Stacie L. Pettyjohn, *U.S. Global Defense Posture, 1783 – 2011*, RAND Corporation, Santa Monica (Calif.), Report prepared for the United States Air Force, 2012.

revelations about the role played by meta-structures as such as the National Security Agency (NSA). Questioning the link between democracy and nanotechnology supposes to explore a twofold issue. First, one has to address the democratisation of nanotechnology: that is the availability of NT (and, by extension, converging technologies) by the greatest number of states throughout the world. The fear of a new wave of proliferation associated to nanotechnology (and, to be honest, the possibility to assist to the emergence of new science superpowers) could lead current dominant powers to limit the availability of such a technology in a first time. On the long term, such an "embargo" would be extremely difficult to maintain given the very nature of NT (detection of transfers of NT would be very striving given the fact that the tracking of nanoscaled devices would be quasi impossible). In other words, the question that could be asked is "who will benefit from advances in converging technologies?" Today we talk of the digital divide as something that we should attempt to correct (Benatar, Daar et Singer 2003). Will converging technologies, tomorrow, become the new great divide that will structure the world? Technology and development are intricately linked and what at first appears to be very 'high-tech' and costly and therefore perhaps irrelevant for developing countries, in the end might come to be of most value for those same developing countries. Thus NT might ultimately be of most value for the poor and sick in the developing world. At the Johannesburg summit, the main issues for developing countries were poverty reduction, energy, water, health, and biodiversity. NT has the potential to make a positive impact on all of these if its risks either do not materialize or are appropriately managed. The poor could benefit from NT, for example, through safer drug delivery, lower needs for energy, cleaner energy production, and environmental remediation. It is also possible that health could be improved by better prevention, diagnosis, and treatment. It is more than probable that techniques developed in the context of the "Global Technology Revolution" will not be directed towards the resolution of endemic societal, economic or political issues throughout the world. Instead, the risk is to assist at the emergence of a two-tier world of an unprecedented form. The first tier – formed by the most *scientific advanced countries* – would largely benefit from the implementation of converging technologies in every aspects of collective living and could even redefine, to some extent, the meaning of Humanity (at least among countries that would have succeeded in mastering each of the great Convergence technologies). This group of countries, however, will be very heteroclite.

The remaining tier – *scientific lagging countries* – would be dissociated from the so-called "Global Technology Revolution". They will tend to be at the bottom of the development ladder. The populations of these countries will lack the access to clean water and basic sanitation. These harsh conditions of living will spur massive urban migration and discontent. Essential resources, such as water or arable land, will be frequently misused.

A second aspect of the link between democracy and nanotechnology is about the control that could be exerted by representatives of the nations both on the development and the engineering of such a technology and its by-products. As Jean-Jacques Salomon put it, since the aftermath of the Second World War, science and politics have been merged in order to provide political authorities with new means of implementation of their decision. In the same time, science considers politics as an instrument of its own development through subsidies and vast financed programs (Salomon 1989). History of science since WWII has been a succession of huge investments projects (the Manhattan Project, Star Wars and its Strategic Defense Initiative, the Genomic Project, the National Nanotechnology Initiative, etc.). To sum up, it could be said that science is characterized by internal contradictions for it is situated within a matrix of values and socio-political

forces (Wynne 1995). In the coming decades, public support to fundamental research and technology could drastically be reduced due to the scarcity of public finances after years of crisis. Even if one makes the hypothesis that such a crisis could be a temporary one, private actors could well take the lead in financing new waves of innovation. Moreover, future innovations in converging technologies will not be conducted by historical scientific powers as we know them today. Scholars as Dale Walton suggest that we could assist in the coming decades to a genuine Revolution in Strategic Perspective (RSP). Such a revolution should not be confused with Revolutions in Military Affairs. It is not to say that such an RMA did not occurred after the Cold War. Numerous technology breakthroughs such as GPS, precision guided missiles, networks and information technologies drastically transformed the way modern powers wage wars and conduct military operations. Yet, it is unusual to see states that develop technology breakthroughs able to remain the sole powers conserving the exclusivity of these technologies. Instead, other states in a mimetic process succeed in importing external technologies to give them new developments and original ways of expression: that's a true RSP. At the difference with RMA, an RSP supposes the emergence of a geopolitical vision that is in accordance with the new technology. It is the reason why Revolutions in Strategic Perspective are a much rarer event than are RMAs. Successfully adapting to an RSP requires policymakers to radically alter the way they think about politics. In the Dale Walton's view, the last RSP occurred because of the European breakout and the Age of Discovery (largely depicted by Paul Kennedy's rise and fall of great powers). Following the post-Columbian hypothesis of Alford Mackinder, Dale Walton seems to suggest that the European/Western era progressively comes to an end. The emergence of new industrial nations as Brazil, India, China or regions as East-Asia and South-East Asia is a clear sign of the transition period to a post-Columbian epoch (Walton 2007).

However such a transitory phase toward a new political-military balance will be accompanied by destabilizing effects and new sources of division.

4. Toward a Post-Human Future?

A new kind of divide that could progressively endanger the stability of world politics is the possible emergence of new forms of humanity or, let's says, the development of several kinds of "humanities", depending on NBIC technologies availability and affordability. The application of genetic engineering and biotech implants resulting from the advances in NBIC technologies will undoubtedly shape the future evolution not only of human behaviour but moreover of the very notion of what it is to be human! The application of such technologies will certainly enhance human capabilities and performance and overcome innate fundamental physical and cognitive limitations. However, NBIC is judged to be a technology potentially disruptive (Herd et Till 2010). The prospect of a genetic drift within the human species is expected. By destroying the biological equality upon which human rights are based, the implementation of NBIC technologies (even in order to control and regulate populations in a "walled globalized world") could put into question the uniqueness of human identity. Homo sapiens, in other words, would become a sub-species largely surpassed by individuals with augmented capabilities. Such a scenario has to be linked with the future emergence of domes (cf. infra) where political authorities of tomorrow could divide the international system into delimited defence zones. What if political and military decision-makers of tomorrow will also be those that will mainly benefit from the advances in NBIC technologies? Would

their vision and everyday decisions be taken according to prevalent international security imperatives or be served by some "cast" interests?

Such questions have recently led some experts to address the issue of the emergence of new powers in a completely novel light. According to Goldman Sachs projections, it is highly probable that states belonging to the BRICs (Brazil, Russia, India and China) could benefit from the new revolution that resides in the mastering of NBIC technologies. Such a scenario alleges that the real engine of the emergence of new international powers could find its fuel in the intellectual capital these countries have at their disposal throughout the presence of their nationals across the centres of excellence and laboratories of existing scientific poles (United States, European states). Future leaps in NBIC technologies could thus benefit to BRICs countries and lead them to guide the future of science and technology. Even though it should be hazardous to allege the future demise of American primacy, it is likely that we could assist to an erosion of the US's role as the "prime player" in the world of 2030. Yet, such a scenario remains vague at this moment. To address more precisely these questions we must identify which states will possess the capacity to acquire NBIC applications and which will encounter barriers. Answers to these questions will largely depend on the size, composition and quality of their scientific and technological bases. It will also be function of their institutional, human and physical capacity to develop drivers for implementing technology applications.

IV. Domes, Global Surveillance and the Future of International (In)Security

In the coming decades, robots may become a critical maiden of modern military organisations. They could drastically influence the way our societies will consider and wage warfare. To a certain extent, it could be argued that this is already the case. Recent military campaigns in Afghanistan and Iraq, even as controversial covert anti-terrorist operations in Yemen, Mali, Afghanistan and Pakistan have been used as experiments for the deployment of autonomous surveillance and weapon systems (ASWS)[8] – mainly composed of unmanned aerial vehicles – against Al Qaeda activists and the so-called "associated forces". As a result, in the United States, ASWSs have earned a so-called "foundational" place in the organizational structure of the armed forces. This foundational place contrasts with the lack of consensus among roboticists on what a robot is… or is not (Lin, 2010). In terms of law, observers point out that the legal status of war robots remains unclear. This lack of clarity is complicated by the fact that robots can see their status evolve. For example, while the RQ-1 Predator was developed as a reconnaissance platform, it was subsequently equipped with Hellfire missiles and thus renamed MQ-1 (where M stands for Multipurpose). It must be underlined that the MQ-1 was never approved as a weapon! The reason is somewhat surprising and is as follows: because the bare RQ-1 was not considered as a weapon and the Hellfire missile has already been approved separately as a weapon, the combination of both systems into a unique weapon system did not need a special endorsement.

Today, killing with robots is no more a science-fiction scenario (Weber, 2009) but a reality not only for the armed forces of those states (the United States and Israel) that deploy drones for targeting missions, but also for those countries which have to endorse repeating violations of territory and whose populations have to endure the collateral damages associated with the remote killing of terrorists hidden among civilians. As we will see, geopolitical and ethical considerations about the use of robotics in warfare scenarios don't impede the armed forces that are equipped with such systems to envision the automation of warfare for 2030 (the US Air Force deadline that figures in many official and doctrinal documents of the Pentagon). Yet, "automation" is a generic term that should be manipulated with caution for it is often linked to futuristic pictures in people's mind. For the time being, "automation" should not be assimilated to any supposed ability of the machine to take its own decision in the conduct of operations (Sparrow, 2007)… well, not yet. Rather, automation refers to pre-programmed missions encoded by humans. Concretely, an "autonomous military system", in today's configuration, is "just" a "fire & forget" machine capable of determining its own trajectory or pursuing its target to some limited extent.

[8] The term Autonomous Surveillance & Weapon System will be preferred in order to encompass a wide variety of platforms ranging from uninhabited (or unmanned?) aerial vehicles to smart sensors. Today, there is no clear definition of an autonomous weapon system. Different qualifications are attributed to label the large heterogeneity of devices deployed by the armed forces.

1. Will ASWS Change the Face of International Relations?

A first question that comes to mind is whether ASWSs – and, let's say, future unmanned combat aerial vehicles (UCAVs) – could change the face of international relations. In other words, do unmanned systems form a disruptive technology with the potential to alter the global military balance among great powers? Prior to any answer, one should first distinguish, inside the ASWS family of systems, UAV[9]s from UCAVs. UAVs as we know it first appeared at the end of the 1980's, thought the first generation of systems date from the 1970's (uninhabited aerial vehicles have been used for surveillance and reconnaissance since the Vietnam War). Today, ASWSs constitute a combat-proven family of systems that is equipping most of the armed forces of the industrialized states; the vast majority of military robots in existence today are UAVs. These systems occupy a vital part in modern air force. To such an extent that the US Air Force has become dependent on Global Hawk spy planes, for example. These systems offer the military with a permanent surveillance capability associated to information gathered by satellites. To give an idea of the importance UAVs have acquired in the US military system, it suffices to recall that over $3 billion have been invested by the Department of Defense (DoD) in UAV systems between 1990 and 2000. Between 2000 and 2010, that amount reached $4 billion.

Only some states – the United States and Israel – have equipped their UAVs with lethal payloads (*Hellfire* or *Stinger* missiles for the US). To be true, Israel and the United States have been the pioneers in the development of uninhabited military systems. Such a combination (a drone equipped with a lethal payload) does not suffice to transform a UAV into a UCAV. UCAV development supposes a different approach that is more largely investing in researches aimed at reinforcing the "autonomy" of the platform. Another difference between UAVs and UCAVs resides in the fact that for the latter lethal payloads are natively integrated in the platform. However, UCAVs are only in an experimental phase. Some technological demonstrators of that type have been developed in the United States since 2000, before being terminated and… revamp through a US Navy project. For example, the Joint-Unmanned Combat Air System (J-UCAS) was developed by the US Air Force, the US Navy and the Defense Advanced Research Project Agency (DARPA) in order to test the feasibility as well as the desirability of an aerial sensor able to assume intelligence, surveillance and reconnaissance (ISR) missions and bombing operations (De Neve & Wasinski, 2011).

One should also remember the specific context in which unmanned systems have been deployed since the 1990's. In their vast majority, until now unmanned systems have served ISR deployments. Since 2002, UAV equipped with air-to-surface missiles (*Hellfire* missiles) have been operated against Al Qaeda activists in Afghanistan, Pakistan and Yemen.

Despite the increase of civilian victims (some of them killed) by ASWS, the armed forces all over the industrialized world are pushing the development of military robotics with growing autonomy. It is estimated that more than 50 countries are working on the development of uninhabited systems. Such an evolution is significant for it is the expression of a deep rooted transformation of international security: states – at least in the western hemisphere – are progressively leaving a "projection posture" to evolve toward a "defensive stance" based on the dissemination of sensing technologies and stand-off

[9] Unmanned Aerial Vehicle.

military platforms as such as ASWS (unmanned aerial vehicles, unmanned combat aerial systems, etc.). Yet, though they might imply effects on the way the political and the military perceive war, ASWS alone – in their current form – will not considerably change the face of international security. Rather, it is the future combination of ASWS and emerging/converging technologies (nanotechnologies, biotechnologies, information technologies and cognitive sciences) that might lead to a radical transformation not only of warfare but of geopolitics too. More exactly, it is expected that future advances in the fields of cognitive science and advanced computing technology could allow tomorrow's ASWS to make their own decision to kill combatants or destroy material military targets in some precise contexts of operations.

These advances in military technology lead us to assert that the world is on the eve to assist at the dawn of a new era in the way states – and private actors – will control the territories and their populations. At the eve of 2030, the novel combination of ASWS with converging technologies in a context of global reluctance to project troops on distant theatres given the important "strategic fatigue" among western powers, will contribute to the emergence of what we envisage to label the "dome era". Here are some of the characteristics of the domes.

1. **Domes will essentially consist in the development of zones of opportunity** (essentially characterized by a high level of prosperity) to defend or to handle. They will not specifically depend on geographical repartitions of areas of influence or territorial delimitations. These domes will be orientated in order to guarantee the protection of the main populated regions, especially the most urbanized ones. They will also be erected to contain political-military crisis in a delimited "grey zone". The search for a political compromise that could temporary resolve a crisis situation will no more be preferred. Rather, rapid interventions with limited forces (preferably autonomous systems) on a short period of time will be attempted each time a located crisis threat to spill over or, in worst case scenarios, burst.
2. **Domes will rely on a wide array of technologies and infrastructures**. These will essentially be based on unmanned systems dedicated to these tasks. These will incorporate mobile and static systems – all operating inside a global surveillance grid. The abovementioned systems will consist in the deployment of drones, smart walls combining electronic and physical fences, missile defence systems and, possibly, smart sensors (either embarked in mobile devices such as smartphones or to a lesser extent integrated in bodies though invasive agents). All these technologies will be conceived and distributed in order to regulate and manage populations. The necessity for public authorities to rely on such regulatory apparatus will be link to the new forms of nomadism of future societies. It will be one of the paradoxes of the future world we will live in: extreme mobility of populations will lead authorities to develop surveillance, control and social regulations technologies. If global flows remain the nightmare of governments, administrations and security agencies, they will form the basis for private companies' future profits and will allow providers of surveillance and control technologies to take a growing part in the decision-making process to manage these flows.
3. **Domes will be progressively placed under the control of private companies** (principally those specialized in the development of regulation technologies). Providers of technologies will have the mandate to assume the maintenance of the controlled zones on behalf of states under the control of parliaments. In other words, technology providers will also operate as service providers.

4. **Domes will reside on evolving structures through space and time**. Depending on the nature of interests to defend or the identity of the threat to cope with, domes should be able to exclude some territories or integrate new ones. Rather than building on structures inherited from past alliances, domes will be based on contractual services (such an evolution is intimately linked to the fact that private companies will be the main actor in such a framework). Agreements of services contracted between public authorities and private companies will evolve in accordance with the nature of the threat or the localization of risks. The other face of the coin could be the emergence of private companies' interests. In such a context, private contractors could develop geopolitical visions that would result from their own economic interests and search for profits. It should not be excluded that private contractors interests in one hand and government's goals in the other hand could eventually enter into conflict.
5. **Automation will be a key feature of domes**. Automation does not mean autonomy. Human intervention will still be required for strategic decisions. However, everyday tasks linked to surveillance and control could be "assumed" by ASWS.

2. ASWS: A "Contextual" Technology?

Though ASWS continue to earn the support of most of the defense organizations in the industrialized world, it should not be excluded that the prominent role of ASWS in the military – even in the US defence organization – may be starting to fade. Such an assertion seems to be paradoxical given the considerable use of these systems in current military operations. Yet, a closer look at the origins and development process of UAVs in western arsenals allow us to have a better view of the limits of these systems. For several observers of military affairs, it is more than probable that we will progressively assist to a "cooling-off period" in most of governments funding in favor of UAV. This evolution can be explained by two main reasons. The first one is the precise geostrategic environment in which UAV have been developed since the end on the 1990's. It should be noticed that ASWSs have mainly been employed in the context of "dissymmetric warfare" scenarios against an enemy unable to challenge western armed forces technological superiority. As the afghan experience reminds us, this is not to say that a superior technology alone can help defeat an enemy. Nonetheless, it must be recognized that the fight against terrorism has been a catalyst for the use of UAVs and armed UAVs. Tomorrow could be quite different and could put the future of these systems on a shaky ground. Pentagon's recent strategic shift to the Asia-Pacific region could lead the US Air Force to cope with an adversary a little bit different of those encountered during more than ten years in the Middle East and Central Asia in that it will take the form of a peer competitor. Such a peer competitor (and one thinks mainly of China) could well develop military systems and defence programs that could allow it to rival with the United States (except in a scenario – that should not be underestimated – wherein the two competitors would use peripheral small contingencies as wars by proxy). One of the main threats that China could pose to the US – and against which UAVs, even UCAVs, could not necessarily offer an answer – resides in the proliferation of cruise missiles and surface-to-air missiles. More generally, existing UAVs and armed UAVs are ill-equipped to survive in contested air environments.

3. Will AWS Lower the Violence Threshold and Increase Terrorism?

Besides these general considerations, one of the most pressing concerns regarding ASWS has to do with their impact on the decision process to start a war. For many observers and analysts, war will be domestically (at least) perceived as easier not only at the logistical level but also at a political standpoint. The guarantee for one side to have fewer casualties in case of war (*Jus in bello*) will certainly lower the violence threshold. Put differently, autonomous robots will affect the *Jus ad bellum*. Consequently, there will be no need for a state having ASWS to be aggressed on its core national interests before engaging a war against an adversary. The advent of ASWS participates to a qualitative depreciation of the motives of entry into war. A state whose armed forces are equipped with autonomous robots will tend to consider any form of provocation or aggression as a justification to wage war. Just because war conduced with robots will be less lethal for one side. Put simply: "if we have robots on the ground and in the air that can carry out an important military operation with few or no friendly casualties, why wouldn't they be engaged?" Some observers argue that if future autonomous weapons were technically capable of respecting legal rules as well as or better than a human operator, the use of such a weapon could be not only legally permissible and acceptable, but perhaps an ethical imperative. There is currently a real technology race aimed at proving that evolved artificial intelligence systems could in the future answer to the dictates of public conscience and be more reliable than humans to address security issues, even at a tactical level.

Another fear that could be linked to risk-free wars is that AWS could increase terrorism for this kind of action would be the only possibility for an adversary to strike back at a country who uses mainly robots in wars to attack its citizens. Put simply, and though this could be discussed, a "technologically less advanced" side may consider terrorism as a morally acceptable means to counterattack.

Conclusion: Ordering the Global Disorder with Converging Technologies?

Our study led us to depict an international environment marked by tectonic shifts in the redistribution of power, threats and "responsibilities" among states and private actors. The coming years will form a transitory period characterised by numerous changes in the way we will envision some supposedly elementary and immutable concepts as those as "international security", "humanity", "state", "international organisation", etc. Such changes are also the results of profound economic and social transformations of societies throughout the world. The demographic transition that will take place in a world characterised by more and more mobile populations will lead, paradoxically, to the proliferation of walls and fences aiming at controlling flows of men and goods. The depletion of current state power will lead to an increase of new international actors and thus participate to the growth of borders and frontiers. Though the legitimate use of force is presumed to be the realm of the state, during this coming century the private sector's role in security will mushroom. A burgeoning transnational market for force will develop alongside the system of states. The presence of private companies providing military services is not entirely new. In the period before the rise of the modern state, military contractors were common. Even in the modern period some states, such as the United States, have outsourced many services. What is new is the number of contractors working for states. Converging technologies dominated by advances in nanotechnology will provide the new forces of intervention (mainly private security companies) with autonomous surveillance and weapon systems. In that context, force projection will be substituted by the deployment of "domes". These new defence structures will not necessarily fit with traditional alliances and multilateral regimes that emanated during the Westphalian era. They could announce the beginning of new kinds of political dependence and hierarchies that would destabilize the traditional forms of power.

Future international actors will be tempted to rely on such converging technologies in order to establish new forms of biopolitics. These will implies controls that not only reside on a classical territorialicist vision of human communities but also supposes that control technologies have to invade the intimacy of individuals. In other words, people will no more reside on their territories. Territories will reside inside them. Such a shift of view will be a radical consequence resulting from the expansion of nano, bio and information technologies. Domes will be integrated inside the biology of individuals. Nanotechnology, for instance, will eventually enable supercomputing on a very small scale, detection of minute amounts of substances, rapid analysis of genomes, and implantation of microchips into humans. We can expect these technologies to be highly beneficial in promoting economic progress, health, and environmental preservation. But these technologies may also come with a darker side: they can open new opportunities for governments, individuals, and private interests to violate privacy. How NBIC technologies will affect our privacy, and what actions governments should take, are important issues that need to be resolved before nano-surveillance becomes ubiquitous and its control difficult. Without careful consideration, thought, and possibly new policy action, "Big Brother" may end up being very, very small.

Surveillance and security will be of prime importance in an increasingly globalized society confronted with new challenges as those emanating from demography and migrations.

NBIC technologies will have a role to play in protecting citizens and states from myriad malevolent forces, such as organized crime or terrorist acts, and in responding, as well as preventing, both natural and man-made disasters. Research and development in these fields often focuses on certain broad areas, including security of infrastructures and utilities; intelligence surveillance and border security; and stability and safety in cases of crisis. The applications for intervention range across many sectors including transport, civil protection, energy, environment, health, and financial systems. However… While we must be aware of menacing forces from without, within our country these technologies could be harnessed for not-so-benevolent purposes: invasion of and hampering of individual privacy and security in ways so stealth is more than a little unnerving. While nanotech is being developed and researched under the pretense that it will be used for good, there is reason to believe that governments and private actors in charge of the deployment of these systems could be able to use it to invade our personal lives. Domes, should they be real or virtual in their nature, will not only constitute an external relatity. They could also rule our biology.

Recommandations

1. A first recommendation would be the preparation of an academic survey about the deep changes (society, demography, inequalities, etc.) that could affect the future of world order in terms of security. Beyond the factual aspects linked to the balance of powers in terms of military capacities, some profound transformations could have a concrete impact on security. For example, the urbanization phenomenon and, as a consequence, the development of megalopolis on the terroritory of states could have an impact of the way resources, raw materials, energy, water would have to be desserved to the population. Any supply disruption could engender social consequences that could affect the both the security and the stability of a region of economical importance. The way defence organizations would, in the future, manage such phenomenons (that could be assimilated to intrastate conflicts) will be of critical importance and would rely on methods that are certainly different from those currently adopted to counter threats like terrorism. Deep rooted transformations that are not on the radar for the time being could reveal themselves highly complex if we are not prepared to cope with.
2. A second recommendation is to maintain a technology watch regarding converging and innovative technologies, especially regarding artificial intelligence and big data. There is a large consensus among the scientific community about the global effects of nanotechnologies and biotechnologies on the future of our economies and societies. NBIC technologies will provide new means of production and of… destruction. They will affect the global strategic stability and redefine the art of war. Associated to the progresses in artificial intelligence, a domain largely dominated by private commercial companies (Google, Apple, Facebook, Amazon – the GAFAs) and by leading chinese companies dedicated to innovative technologies, such a combination of disruptives techniques could durably alter the future of our security frameworks. Such advanced systems will integrate future armements. It is thus mandatory to keep in mind that states will have to preserve for themselves a capacity of understanding of future weapon systems. Otherwise, states would lose their ability to maintain a control of such evolved systems. Even at a rudimentary or minimal level, or through a private-

public partnership (PPP), state contribution to R&T programs will be of strategic importance. Acquisition off the shelf could not suffice anymore.

3. This statement lead us to our third recommendation. So far, the privatization of security has largely consisted for private companies to assume tasks previously undertaken by classical military organizations. These tasks were largely of a logistical nature. Such missions assumed by private companies could change in the future and gain in importance. Big data, largely fed by our daily practice through social networks, economical activities, give today to the private sector great resources to develop technological tools specifically dedicated to the monitoring of population and, more specifically, to the surveillance of target groups. Such an evolution will undoubtedly jeopardize the role of state institutions in the fields of security and defence. It is thus mandatory for defence organizations, in combination with the different public actors associated to security affairs, to further develop the legal frameworks allowing these private companies to contribute to state efforts to guarantee the security of citizens.
4. Responsible authorities should seek for more legal advice in using NBIC technologies. Unmanned technologies, combined with stealth techniques including the miniaturization of swarms robotics, will have a huge impact on both the jus ad bellum and the jus in bello. In the future, it will be very difficult to identify an adversary or the origin of an attack. It also will be harder to determine whether a state has entered into war. The request for legal advice when using these technologies will become more important.
5. Develop a cyber-risk management framework related to the integration of NBIC technologies in controlling security as part of a global cyber security strategy. More globally, the advent of domes – as these have been described in our study – will certainly affect the security frameworks largely inherited from WWII. Global alliances, security regimes as they may have existed during the Cold War and in the aftermath of the bipolar world, is expected to moulder. Segmented alliances, based on technology standards communities, or regrouping states with similar levels of development in some disruptive technologies (AI, NBIC technologies) could progressively substitute to westaphlian security communities. Domes will not only rely on state actors. They will also associate the private sector inside frameworks that still have to be defined. Managing the use of NBIC technologies should be part of a global cyber security strategy.

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Institut Royal Supérieur de Défense
Centre d'Etudes de Sécurité et Défense
30 Avenue de la Renaissance
1000 Bruxelles