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Prospective analysis

Nuclear deterrence in 2030

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NUCLEAR DETERRENCE IN 2030

A French perspective

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This study is a prospective analysis of the long-term future of nuclear weapons, and particularly the future of French nuclear deterrence after 2015. The selected time period is 2025-2030. The principal objective is to reflect on what the "nuclear world" might look like during the first part of the XXIst century, beyond the modernization decisions already planned or envisaged, and to draw conclusions for the future of the French deterrent.

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1 – The French arsenal

At the moment there are about 12 000 nuclear weapons in the world, most of them being American and Russian (about 5 500 weapons for each country). Therefore, the "nuclear world" is very much marked by the inheritance from the Cold War.

Nuclear arsenals in the world can be divided arbitrarily into three categories, although this division has an important symbolic value; the first category includes the United States and Russia that have several thousand weapons, the second is composed of France, the United Kingdom and China with arsenals said to be of the order of a few hundred, and the third category includes arsenals of the "new nuclear nations" (Israel, India, Pakistan) that have tens of weapons.

France has probably dropped from the third to the fourth position in the number of nuclear weapons possessed, as a result of the growth of Chinese nuclear forces combined with French reductions made since 1991. French Leaders considered this symbolic question of rank to be very important during the Cold War – at the time it was important to affirm the credibility of the national nuclear plan so that our country could make itself heard on the European strategic chessboard. This logic is no longer valid, and it is difficult to imagine that this probable change of France from the third to the fourth position could create a political or strategic disadvantage.

This intermediate position of France means that it can be perceived as having a "respectable" nuclear force (assured secondary strike capacity, flexibility of use due to the diversity of launchers and penetration methods), while remaining relatively protected from disarmament debates. **In this respect, the increase in China's nuclear power provides a political advantage for France** – despite Peking's opaqueness in this field.

As for the United Kingdom, France affirms that that the procurement of its forces is based on the principle of sufficiency (the French version of “minimum deterrence”). Like the United States and the United Kingdom, it maintains most of its operational arsenal on submarine carriers. These are the only three countries to have maintained a permanent presence at sea principle uninterruptedly since the end of the Cold War.

2 – The French doctrine

The French nuclear doctrine is not very different from the doctrine of its partners, despite what is sometimes read and heard.

The United States and the United Kingdom share France's concept that nuclear weapons should be used politically, for deterrence rather than as war-fighting weapons. The three allies also recognize that nuclear weapons are not the only military means that can play a deterrent role. France has thus agreed with its partners on a common concept of nuclear deterrence, described in the Alliance Strategic Concept (1999).

The three western nuclear powers differ from the other countries in several respects. They have very much reduced the position of nuclear weapons in their defense strategy since the end of the Cold War – while the opposite trend is generally true in the rest of the world (see China, India, Pakistan and Russia); thus, **the role of nuclear weapons as a means of deterring conventional aggression has become almost obsolete in the doctrines of these three States**, at least for the moment. However, neither London nor Paris nor Washington has adopted a concept of no first use concept, unlike the case of Peking and New Delhi, at least officially. The three western countries see deterrence essentially as a means of dissuading aggression using NBC means and as life insurance to protect against the risk of resurgence of a major threat[1].

Admittedly, there are some significant differences between the French concept and the concepts of its allies.

The United States and the United Kingdom have extended an explicit nuclear guarantee ("extended deterrence") to members of the Atlantic Alliance, through NATO; France only recognizes that its deterrence force contributes to global deterrence of the Atlantic Alliance and the security of Europe. The use of American and/or British nuclear forces within the framework of NATO would be planned within the integrated military structure; France remains outside this structure. The United States makes a distinction between "strategic" and "non-strategic" forces and according to their doctrines, the non-strategic use of nuclear weapons could be repeated; France considers that all its nuclear forces are strategic and that any use of the weapon would be strategic in that it would induce a profound transformation of the nature of the conflict. The United States and the United Kingdom have got into the habit of applying deterrence against an NBC threat by the promise of a "proportional" response, without specifying its nature; France emphasizes that any aggression of this type would fall into the field of nuclear deterrence, if it threatens its "vital interests" as seen by its political authorities. France has never explicitly threatened an adversary with a nuclear response in the case of use of NBC weapons against its armed forces in a regional conflict. Finally, France explicitly places its deterrence within

[1] From this point of view, the Israeli doctrine can be considered to be similar to Western doctrines, even though the deterrence function against conventional aggression is theoretically relevant for Israel due to its geographic situation. Note also that the Israeli nuclear force is not based on the existence of a submarine nuclear force (although it is possible that the country, who has acquired *Dolphin* class submarines and, has provided them with missiles carrying nuclear warheads).

the framework of article 51 of the United Nations Charter that recognizes the natural right of legitimate defense.

Therefore, France maintains **some specific elements** that differentiate its doctrines from its allies' doctrines. These specific features have three potential consequences. Firstly, changes now being made to the American nuclear doctrine, and particularly its perception in other countries and in public opinion, emphasize the "defensive" nature of the French doctrine. Secondly, the concept of threats to vital interests as an explicit criterion for crossing the nuclear threshold – that only ourselves and Russia use – continues to be the subject of questions and even incomprehension, particularly because if our "survival" is not involved, it could no longer be a question of "vital" interests. Thirdly and finally, if the three nuclear powers exercise deterrence in common, this difference could be an advantage and an obstacle at the same time; it is an advantage in terms of complementary presentations of deterrence, and also potentially an obstacle to the three capitals reaching an agreement about a concerted decision about crossing the nuclear threshold.

Finally, France differs particularly from the United States for some aspects of its nuclear policy. For Paris and London, nuclear deterrence remains the ultimate basis for the country's security and in their opinion the best response to proliferation; particularly since the *Nuclear Posture Review* in 2001, the United States considers nuclear deterrence as only one aspect of a much wider concept that in particular encompasses conventional deterrence and anti-missile defenses. France does not exclude the possibility of threatening the power centers of an adversary, but does not accept the logic of disarming or "counterforce" nuclear strikes that the United States might envisage.

Notwithstanding these differences, France's nuclear doctrine is clearly within the western family. The image of a French doctrine fundamentally different from its partners' doctrines and completely out-of-phase with them hardly stands up to analysis[2]. Changes to the French doctrine on the question of the role of deterrence faced with proliferation (since 1994), bringing it closer to its allies, have even sometimes led to the perception of alignment on the American doctrine. Some elements of the January 19 2006 presidential speech (promise of an "adapted" response to States supporting acts of terrorism against our vital interests, affirmation of the "complementary" role of antimissile defenses with regard to deterrence, etc.) have confirmed the convergence of views between Paris, London and Washington on these questions.

Thus from the point of view of nuclear forces and the doctrine itself, France lies quite firmly within the "Western group" of nuclear powers, but remains relatively sheltered from criticism by States and international organizations favorable to nuclear disarmament.

[2] Remember that the concept of "unacceptable damage" that many French analysts consider is a French invention, is actually drawn from American policy during the 1960s.

2 – THE NOMINAL SCENARIO FOR 2030

The purpose of this study is to define a "nominal scenario" for the 2025-2030 period, in other words a consistent set of political and strategic assumptions appearing as being most probable. Political and strategic changes are usually made in what is called the "long term", therefore the definition of this scenario will take account of a retrospective of the last twenty-five years (1980-2005 by convention) in an attempt to identify the most influential structural elements of the context that are likely to remain in the future. Alternative futures will be defined in a second step.

1 – Retrospective: 1980-2005

A number of remarkable changes have taken place between the nuclear worlds of 1980 and 2005. The number of states believed to have nuclear weapons has increased from seven (including Israel and India[3]) to nine (including North Korea), and some new programs have appeared (Iran); but others have been abandoned (Argentina, Brazil and South Africa). Nuclear weapons have contributed to the emergence of new regional powers (India and to a lesser extent Pakistan). The evaluation of the potential threat for western countries has changed profoundly. This threat used to be dominated by one major and immediate threat; the emphasis is now on more diffuse regional threats, with NRBC means as instruments of blackmail. Chemical weapons have joined biological weapons as being "outlawed".

At the same time, stocks of nuclear weapons held by the major powers have been considerably reduced; but the precision of delivery means (nuclear and conventional) has very much improved, so that yields can be reduced in many planning assumptions. The multiple heads technology has become generalized. Deterrence means have thus become more refined in the principal official nuclear powers.

We have also seen a beginning of progressive equalization between nuclear arsenals; Russia and Western countries have abandoned many capabilities (tactical systems, particularly air-launched, ground-launched and sea-to-sea; France has abandoned ground-launched strategic missiles and the United Kingdom has abandoned airborne means). During the same period, the other nuclear States have diversified their means (development of the ballistic field) and expanded their arsenals, and most countries that do not have a submarine

[3] India performed a nuclear test in June 1974. Weaponization of the Indian arsenal dates from the 1980s.

component (China, India, Pakistan, Israel) have stated their need for a capacity in this field. And most nuclear states have started the development of cruise missiles to escape air defenses.

The number of ballistic missiles with a range of more than 3 000 kilometers reduced considerably between 1987 and 2005 (-51 % for intercontinental missiles, -97 % for intermediate range missiles) due to disarmament treaties[4]. But due to proliferation, the number of ballistic missiles with a regional range (1 000 to 3 000 kilometers) has remained fairly stable: 547 in 1987 compared with 417 in 2005[5].

These changes have coincided with a set of events tending to constrict changes to nuclear means within a stricter political and legal framework; these events include the creation of new nuclear-weapon-free zones (Africa, South-East Asia, Central Asia), the reaffirmation of negative security guarantees (1995), an advisory opinion by the International Court of Justice about the legality of the use or a threat of use of nuclear weapons (1996); a moratorium on testing and signature of the CTBT (1996); and the unilateral termination of the production of fissile materials for explosive purposes by some countries.

In conclusion, nuclear weapons now generally play a more restricted and better-controlled role. Political, strategic and technical changes over the last thirty years have affected the legitimacy of the threat of massive retaliation on populations per se. The development and dissemination of information technologies (guidance, satellite identification[6], etc.) also favor changes in planning towards better precision. Furthermore, diversification of methods of fighting wars now leaves less opportunity for concepts of nuclear deterrence by bans (threat of use on an operations theatre)[7]. **Thus, nuclear planning tends to give increasing priority to fixed political, economic or military targets on the adversary's territory**.

At the same time, **the world's nuclear order has not been overturned during the last twenty five years**. Members of the Non-Proliferation Treaty have chosen to extend it (1995), and the permanent members of the United Nations Security Council are still the countries that have the status of nuclear powers as defined in the NPT. Maintenance of security guarantees and Western alliances in Europe (NATO) and in Asia (Japan, South Korea) has contributed to preventing the emergence of new nuclear States within the industrialized world. From the western point of view, Russia remains a "controlling" country for nuclear planning; it is still the State with the largest nuclear arsenal in the

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[4] Similarly, the number of very short range missiles has dropped due to obsolescence of unmodified national *Scuds* arsenals.

[5] Joseph Cirincione, *The Declining Ballistic Missile Threat*, Policy Outlook, Carnegie Endowment for International Peace, February 2005.

[6] This refers particularly to "democratization" of high precision observation capabilities (less than one meter) due to American commercial offers (*GeoEye*, *Digital Globe*). But the number of countries acquiring such a capacity nationally is increasing (Israel, India, Japan, South Korea, Taiwan...).

[7] However, this option is still envisaged by some countries such as Pakistan (for a conflict with India), China (for a conflict with the United States). It could also, but in a different context, be envisaged by Russia (conflict with China) or in an extreme case by Israel (following re-emergence of a major regional conventional threat).

world, while there are still too many uncertainties about its political change for it to be considered as an ally. In China, where the political regime has not changed fundamentally in this period despite the fundamental transformation of its socio-economic fabric (communist system dominated jointly by the Party and the Army), it is still a country with interests that do not necessarily coincide with the West's interests, and its rise in geo-strategic power makes it necessary to take account of it in deterrence scenarios.

The organization of nuclear arsenals has not changed in most States. Western deterrence instruments are still built up around the maintenance of a sea-based force and permanent presence at sea, while other countries (China, Russia, India, Pakistan and North Korea) have decided to put their priority on ground-to-ground ballistic missiles. Nuclear doctrines have not changed drastically within the period considered, despite the emphasis placed on the regional powers described above. For States holding nuclear weapons, deterrence can only apply to States, despite the profound change in the strategic context following September 11 2001. Despite the fact that the legal obstacle formed by the ABM Treaty has been cleared, anti-missile defenses still only play a secondary role in defense doctrines. **The nuclear threshold has not been lowered in absolute terms** (threshold of interests protected by deterrence)[8].

But **if a single element of this picture had to be selected, it is simply the fact that nuclear weapons were not used**. There were many crises and nuclear temptations during the 1945-1980 period (Korea, Taiwan, Vietnam, etc.), and there were also dangers of uncontrolled escalation (Cuba). Apparently (since not all historical data are known to the public yet) the following period only included a few episodes (in Europe in 1983, Southern Asia in 2002...) that introduced the risk of effective use of a nuclear weapon. The increasing attention paid by political leaders to perceptions of opinions and images passed on by the media have also contributed to reinforcing inhibitions about crossing the nuclear threshold. To the extent that some consider that *"(...) we are approaching the point at which it will be impossible for a democratically elected government to use nuclear weapons"*[9].

A few conclusions for production of the "nominal scenario" can be drawn from this general summary, extrapolating major trends in the past:

- ⇨ **Changes in the nature of the threat, with their consequences for the nuclear planning, will take place slowly and with few surprises.** Only the case of a nuclear Iran would form a genuine break from the past, to the extent that this country was considered to be a sound ally of the West until the end of the 1970s.
- ⇨ **Technological changes in the nuclear field are fairly slow, and there have been few radical ruptures** (unlike in the political context).

[8] This does not mean that the "relative" nuclear threshold has not changed for some countries. Obviously this is the case for Russia, for which the situation in the field of conventional equilibriums has been reversed from what it was in 1980.

[9] Ambassador Henrik Salander, *Arms Control Today*, July-August 2005.

- ⇨ **Nuclear deterrence has shown its capability to adapt to major changes in the context and fairly naturally still has a place as a basis for defense policies for countries that have the nuclear capacity**.
- ⇨ Finally, **the nuclear taboo appears to be sound for the moment**.

The US nuclear deterrent today

The *Nuclear Posture Review* made in 2001 set up a "new triad": nuclear and conventional offensive forces, antimissile defenses and "reactive" infrastructure. The emphasis is now placed on “deterrence by denial” (conventional forces, antimissile defenses) as much as deterrence by the threat of retaliation[10]. This change was already underway before 2001 but it was accelerated by the Republican administration. Unlike what is suggested by some public debates, it cannot be said that the nuclear threshold has been lowered in the American strategy. In fact, the nuclear element is now almost marginalized; it has never had so little importance in the United States' defense policy. Nuclear forces now only account for about 3% of the Pentagon’s budget. The 2006 *National Security Strategy* only contains one paragraph dedicated to nuclear forces (compared with 26 in 1988). According to a former NSC senior staff member, "*The White House is allergic to the word 'nuclear'* "[11].

The American nuclear doctrine still lies within a deterrence logic. (Earth-penetrating systems, for which so much ink has been spilled, have been developed in this logic). Another function of American nuclear weapons is to reassure allies (*Assurance*) and to deter any potential adversary from developing means that could threaten the security of the United States.

President Bush reportedly signed a new targeting directive in April 2004. The SIOP was revised in 2003, and renamed *Operations Plan 8044*; the change in name reflects change in the planning logic, which is now much more flexible. Against major powers, planning includes counterforce, counter-C3 and counter-leadership options. The STRATCOM functional command is now solely responsible for nuclear planning.

At the end of 2006, the United States still had about 10,000 nuclear weapons; half of which were in reserve or waiting for dismantling. But the American arsenal is quickly being reduced unilaterally. The essential reasons for this reduction decided upon in 2001 were Russia’s change of status from that of an immediate adversary to that of potential adversary[12], and the acceleration of precise conventional long range strategic weapons programs (JASSM, *Tactical Tomahawk*)[13].

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[10] This is also called "damage limitation".

[11] Interview, Washington, November 2006.

[12] About 5,000 weapons were probably intended for the Russian scenario in the 1990s, including 3,500 against the conventional military system.

[13] The program to convert four Ohio class SSBN submarines into cruise missile launchers should be completed in 2007.

The active stockpile is composed essentially of W76 weapons (1,700 weapons) and W80-1 (1,450 weapons). According to open sources, the range of available energies varies from 475 kilotons (W88 weapon) to 0.3 kiloton (B61 weapon), which is very much higher than the most powerful conventional explosives[14].

The framework of American deterrence is composed of SLBM Trident-2/D5 missiles. Starting from 2008, 336 missiles provided with W88 weapons (about 400 weapons, the most modern in the American arsenal) or W76 weapons will be carried by 14 SSBN submarines[15]. The Trident-2/D5 equipped with the W88 weapon is considered as having an anti-force capability. The Navy would like to improve its accuracy to 10 meters by 2011.

Ground-to-ground forces have recently been modernized. *Minuteman*-III ICBM missiles have been fitted with W87 weapons taken from MX missiles; their number will be reduced to 450 in 2007.

Presidential directive NSPD-34 (2004) reportedly decided that the total stock will be halved, so that there will be about 5,000 weapons in 2012. Three factors explain the decision to retain this number of weapons: (1) the need to maintain a large number of weapons as "spare parts" in case of reliability problems; (2) the existence of counter-force options against Russia, that have apparently been maintained; (3) the stated will to prevent a major power from becoming the world's leading nuclear power.

The number of operational strategic weapons will also be reduced and by 2012 will consist of between 1,700 and 2,200 weapons, representing a reduction of about 80% from 1990.

The American nuclear complex is aging. The United States has not produced any military grade plutonium since 1988 and has not carried out a nuclear test since 1992. It has not made any weapons since 1989. The average age of weapons in service is 21 years. Production of tritium should be resumed in 2007.

The *Reliable Replacement Warhead* program designed by the DoE plans for two weapons at this stage; one for SLBMs (RRW-1), and the other for ICBMs (RRW-2). They will come into service starting from 2012 and their life will be not less than thirty years.

[14] The experimental MOAB (*Massive Ordnance Air Blast*) missile contains nine tonnes of H6, with energy equivalent to 0.08 kilotonnes of TNT. The lowest energy nuclear weapon ever produced by the United States (Mk-54, 0.01 kilotonne) was dismantled in the 1980s.

[15] The Trident-2/D5 carries a W88 weapon with a maximum energy of 475 kt and its CEP is 155 meters.

2 – The nature of the threat in 2025-2030

2.1 – Major Powers

Based on the assumptions mentioned above, the major powers that could threaten vital interests of Europe during the post-2015 period should remain **Russia and China**. Both are large nuclear countries, they are strongly animated by nationalism and would like to affirm their power, and their interests only very partially coincide with the interests of Western countries. Obviously, within the time period considered, there is a risk that one of these two countries could become fragmented, this assumption can never be excluded in the case of such "internal empires". But even if this happens, it is quite likely that a smaller State (Muscovy or North-Eastern China) would inherit the national nuclear force.

After a period of political and budget uncertainties through the 1990s, Russia has undertaken a gradual modernization of its nuclear forces under the direct control of Mr. Putin ("2015 Plan"). Internal changes and its external policy are causing increasing uncertainty, made more acute in Europe by the eastwards expansion of the European Union (2004). **The common frontier between the Union and Russia has become considerably larger, and Europe is now an immediate and direct neighbor of the largest nuclear power in the world** (in terms of both land surface and total weapons stockpile) **and undoubtedly will remain so for a very long time**. It seems prudent to consider that by 2030 Russia will still be a "non-allied" power that cannot be completely eliminated from nuclear planning logic. A Historic reminder supports this forecast; less than ten years after the Second World War, Germany and Japan were firmly allied in the "western camp", both politically and culturally; **however, more than ten years after the end of the Cold War, Russia appears to be moving further away from it**. Apart from political changes taking place in Russia, the definition of major military crisis scenarios with Russia by the year 2030 depends on whether or not Western institutions will continue to open up to former Russian satellite countries (Belarus, Ukraine, Moldavia, Georgia, etc.) and the possible entry of Turkey into the Union. The military affirmation of Russian power in surrounding countries will be even more probable because Russia will see European vulnerability in the energy field (massive imports of natural gas). In any case, there is no doubt that **the "flavor" of these scenarios will be European and Western much more than national**. The only scenario in which France might take a different position from its partners would be a crisis opposing Moscow and a non-member country of the European Union. And even so such a position would not be a simple "return" to the situation within the Atlantic Alliance at the time of the Cold War – because the very existence of the European Union has changed the situation; French interests are much closely tied to the interests of its partners and allies than was the case at the time of the East-West conflict.

Future longer term changes in China do not introduce the same concerns for Europe as Russia, particularly because its nuclear force that is probably still fairly modest, will only be built up slowly. **At the moment, Chinese nuclear modernization is more like a "long march" than a "great leap forward"**. But the determination of Chinese Leaders to assure re-emergence of Peking in the world geo-strategic context, and primarily in Asia, makes it

necessary to consider the scenario in which European nuclear powers need to apply a form of deterrence on China. **In particular, it would seem reasonable to start from the principle that European economic, political and military interests in Asia will be much greater in 2030 than they were in 2005**. Three assumptions can be made. The first might be a Sino-American conflict (in which Japan could be directly of indirectly involved) about Taiwan, or the "deterioration" of a maritime crisis started by the many remaining territorial disputes in the South China Sea and the Japan Sea. The second assumption would be a western military intervention in the Middle East or in Central Asia, facing a country allied with China. The third and more improbable scenario would assume a direct confrontation between Moscow and Peking, in which Western countries firmly support Russia.

Even more than for Russia, it appears obvious that **deterrence assumptions towards China would be increasingly "multinational"**: it is difficult to imagine Peking threatening the vital interests of France without at least also threatening the vital interests of the United Kingdom if not also of the United States (except for an extreme assumption of a French military action in the Middle East or in Central Asia involving Chinese interests, in which British forces do not participate).

Taken individually, scenarios of an open military crisis in which nuclear deterrence against Russia or China might play a part remain fairly improbable and would undoubtedly have a **strong multinational dimension**. On the other hand, faced with such major powers, France's capacity to inflict unacceptable damage in response will remain an instrument for affirmation of power (even if it is only implicit), and especially sovereignty with regard to the United States.

2.2 – Proliferation and regional powers

At the moment only ten countries have military nuclear programs, compared with 23 in the 1960s. However, a combination of factors since 2003 have genuinely put proliferation "at a crossroads". Libya and North Korea have taken two different possible paths for countries developing weapons of mass destruction, particularly nuclear, with Tripoli choosing to renounce them (announced in December 2003) and to restore normal relation with Western countries, and Pyongyang choosing to continue forwards and to withdraw from the NPT (announced in February 2003), and isolation. **The choice to be made by Iran will largely determine which way the scales will tip**. Either Teheran will decide that the benefits are not worth the cost and will verifiably renounce all military nuclear plans; in this case, it would be possible to say that nuclear proliferation is contained, at least for the moment. Or the Iranians will take their logic to the military threshold with de facto, if not legal, withdrawal from the NPT. If this is the case, the risk of a genuine collapse of the nuclear non-proliferation regime is a concern. Regional neighbors of Iran and some countries in South-Eastern Asia would undoubtedly be tempted to imitate the Iranian example.

In the first case, the number of nuclear weapons holders could continue to increase, but in the same way as was the case in the past

("arithmetic" progression)[16]**. In the second case** – alternative scenario examined below – **it would increase rapidly ("geometric" progression).**

Since the end of the Cold War and the Gulf War (1991), many States have considered nuclear weapons as being a means of equalizing Western power. The "security demand" remains strong, partly due to the large number of American military interventions during the last fifteen years. The current development of precise long-range conventional means, particularly in the United States, can only increase this trend. And the symbol represented by the nuclear status remains intact despite the relative marginalization of the role of their own arsenals by western countries. We have never heard so much spoken about the emergence of India, North Korea and Iran as regional powers since current events have put the nuclear programs of these countries under the glare of the spotlights... Particularly because **the failure to reform the UN Security Council could encourage some States, like India in 1998, to use the nuclear pathway to force access to the status of major power.**

Technical barriers will remain relatively low. The demand for nuclear energy should lead to an increase in the pool of world expertise in the field after a "drop" related to the Chernobyl accident (which affected renewal of human resources) and re-conversion of some ex-Soviet nuclear complexes. This demand will also increase for desalination of sea water in parts of the world in which there is a strong water shortage (particularly in the Arabian Peninsula). The construction of nuclear reactors designed for generation of electricity is still an extremely expensive enterprise, and the growth of reactors in service should remain fairly slow from now until 2025-2030[17]. But many nuclear technologies are more accessible to developing countries than was the case in the past.

However, a distinction can be made between different branches of the nuclear industry:

- ⇨ The risks of irradiated fuel being diverted to produce military grade plutonium appear to be fairly limited. The IAEA's detection capacities are improving, and Western States have stopped exporting their separation technologies. By 2030, the generalization of fourth generation reactors should limit the risks of materials being diverted[18]. Much of the risk will then be from plutonium-generating "research" reactors based on natural uranium and heavy water that some countries (China, India, Pakistan and Iran...) might choose to export[19].

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[16] Schematically: since 1945, there has been one new nuclear State every six years on average (doubled in thirty years).

[17] The OECD Nuclear Energy Agency and the AIEA predict that installed world capacity will increase from 369 GW installed in 2004 to about 500 GW installed in 2025 (between 449 and 553 GW depending on the scenario). It is true that other studies suggest a faster growth (600 GW in 2030 according to Eurostaf, a private organization).

[18] Some types of fourth generation reactors (such as fast sodium cooled reactors) could be developed by 2015. However, 2030 is the date selected in the work done by the Generation IV Forum.

[19] The availability of technologies for separation of the different plutonium isotopes (separation of Pu-239 / Pu-240) within about fifteen years would change the situation; such means could "clean" fuel extracted from light water power stations and could make it possible to use light water power stations to obtain military grade plutonium.

⇨ The risks of highly enriched uranium being produced for military purposes are increasing. The lack of any limitation to proliferation of enrichment plants remains an essential weakness of current regimes[20]. The idea promoted by Western countries and the AIEA to restrict proliferation of uranium enrichment capacities is badly accepted considering the increasing number of countries that are developing such capacities (Iran, Brazil, etc.) or that are tempted to develop them (Australia, Argentina, South Africa, etc.). **Uranium enrichment remains a powerful symbol of modernity and national sovereignty:** the Brazilian approach to this point is not very different from the Iranian approach that follows the approach adopted in Pakistan in the 1990s... Although the main protagonists in the A. Q. Khan affair have been neutralized so that they can no longer do any harm, this was not done until after a large amount of know how had been distributed in the enrichment and in other fields. Therefore, there will no doubt be a large increase in the number of enrichment installations during the next twenty years, particularly because modern techniques contribute to making this method more widespread (the use of computer controlled tools for machining the most sensitive parts; reduction in the cost of equipment necessary for enrichment by laser; etc.).

The nuclear temptation will remain in the minds of State leaders and governments of countries that do not have a nuclear capacity for many years, particularly because even tighter control is exercised over chemical and biological proliferation; there has been no military use of such weapons since the Halabjah event (Iraq, 1988), and a convention banning biological weapons has come into force.

But the nuclear non-proliferation norm has been considerably strengthened in the last fifteen years because the two nuclear powers that had not already formally signed the Treaty (China, France) added their signatures to it, the validity of the Treaty was extended for an undetermined duration (1995), and finally because the rest of the international community adhered to it. After the adhesion of Cuba (2003), **the NPT has become almost universal**, and the only countries that are not members are de facto Nuclear States (India, Israel and Pakistan). **The political cost of the proliferation approach has become much higher than it was at the end of the Cold War.** In an optimistic scenario, the "proliferation taboo" could one day be as strong as the "use taboo".

We now need to mention a **median assumption** intermediate between the two paths mentioned above, **namely "virtual nuclear proliferation"**. The nuclear proliferation dynamics in the future are likely to resemble that of Japan than that of India, to consider two opposite examples. The principle of "nuclear precaution", at the limit of violating the Treaty while formally respecting its stipulations, could become widespread[21]. Such an **increase in the number of virtual military nuclear programs** will be particularly probable as long as

[20] At the time that the NPT was written, it was considered that the enrichment technology would remain exclusive to major powers.

[21] Such a future was envisaged about thirty years ago by Albert Wohlstetter, the great opponent to the plutonium economy. See “Spreading the Bomb Without Quite Breaking the Rules”, *Foreign Policy*, No.25, winter 1976-1977.

the possession of weapons remains attractive and technical barriers to obtain some capacities remain relatively low. **Thus, the "threshold country" concept should once again become relevant. In this scenario, the distinction between nuclear States and non-nuclear States would become more theoretical than real; the remaining uncertainty about the precise capacities of a potential adversary would oblige western countries to treat such powers as states with a nuclear capacity during a crisis**, **"by default"**[22].

For France, in the nominal scenario, the potential regional nuclear threat should remain relatively limited. **In the extreme case, in this scenario it would only concern North Korea, and possibly Pakistan** in case pf a negative political evolution of this country. However, planning for this scenario should take account of the possibility that a State has acquired operational nuclear capacities in a concealed manner.

But scenarios in which the vital interests of France are threatened by a regional power are not limited to a nuclear threat. The French nuclear arsenal could also be called upon to play a role:

⇒ To dissuade a regional power from a military attack against an ally (Europe, Middle East, Africa),

⇒ To dissuade a regional power from using ballistic, chemical or biological means against our forces deployed in an operations theatre – if the Leaders concerned are persuaded that such a threat could affect our vital interests,

⇒ To dissuade a regional power from using such means against France, such a threat possibly occurring at the time of a military operation, or during a major political crisis in which an enemy makes serious threats against France.

The assumption by which our vital interests could be threatened by cutting off energy supplies was raised after the speech made by the French President of the Republic on January 19 2006. It appears to be an extreme assumption and it is difficult to imagine the circumstances in which it could be credible to threaten one or several production countries with a nuclear strike if they envisaged stopping supplies to Europe... However, the dependence of the European Union on oil and gas is increasing, and an increasing proportion of the supply will come from a small number of countries. **A hypothetic alliance between Russia and some Middle East countries could apply blackmail that Europe would find economically unbearable**[23]. But in such a scenario, the French nuclear capacity would be mainly an instrument to freely and firmly

[22] *Mutatis mutandis*, this is the same reasoning already used by Peking towards Tokyo: for good or bad reasons, the Chinese willingly consider Japan to be a nuclear State.

[23] The European Union's main external suppliers are Saudi Arabia, Iran, Iraq and Algeria for oil; and Russia and Algeria for gas. In 2025, Middle Eastern countries should provide about 50% of all oil consumed in Europe, and Russia about 60% of the gas consumed. Nicole Gnesotto & Giovanni Grevi, *The New Global Puzzle. What World for the EU in 2025?* (Paris: EU Institute for Security Studies, 2006), p. 64.

affirm our country's strategic choices (for example choice of the type of reprisal...), rather than a tool to prevent aggression.

Finally, there is still the threat of State terrorism, an extreme scenario but that must continue to be considered[24]. This would be a way of considerably reducing the risks of nuclear reprisals; for despite progress made in techniques for the analysis of fallout and waste (nuclear forensics), it is by no means certain that these techniques could achieve the degree of certainty that would be demanded by the government of the attacked State making a nuclear counterstrike. **The level of the State terrorist threat would depend particularly on the state of two parameters, namely the perception by the Leaders of an enemy country of the probability of a nuclear attack as reprisal following aggression, and the degree of protection of western countries against a missile strike (defenses).** More generally, it could be considered that the threat of nuclear State terrorism will also depend on the magnitude of nuclear proliferation; as more countries hold nuclear weapons, indirect means will become more attractive. This is already true in the Middle East (see for example the support given by Iran to Hezbollah against Israel). But this could also be the case for some major powers[25].

Therefore the regional threat is potentially high in the nominal scenario, but the regional nuclear risk itself is fairly limited.

2.3 – Potential targets

Hardening and burial of political and military targets (command and communication centers, installations for production and storage of weapons of mass destruction) **form a serious trend**. There are two contributing factors, firstly technology that makes means reserved to highly industrialized countries in the recent past more accessible (fast and high performance drilling machines); secondly, western military superiority particularly in air warfare. Thus, after the first Gulf War, the CIA remarked an explosion of sales of drilling equipment in the Middle East[26]. The United States estimates that about 2,000 important strategic targets are hardened and/or buried (particularly in Russia, China and North Korea). Conventional means are not always capable of dealing with this development. The highest performance American penetrating bomb in service at the moment (the GBU-28 bomb fitted with a BLU-113 munition) cannot penetrate more than 10 meters in a hard rock (or slightly more than 30 meters of earth). But some regional targets are now buried under more than

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[24] The limiting case of a "State under influence" (Afghanistan in 2001, Lebanon in 2006... Somalia tomorrow?) is difficult to deal with. Undoubtedly one form of deterrence can be applied towards such States, for example the leaders of a country that did no do everything possible to prevent a major terrorist attack from their territory could be held personally responsible for such an attack. But it is difficult to see how Western political leaders could apply this reasoning to include nuclear deterrence.

[25] In this respect, remember what General Sakharovsky, a former leader in Soviet intelligence at the time of the Cold War said: "*In today's world, while nuclear weapons have made military force obsolete, terrorism should become our main weapon*" Quoted in Ion Mihai Pacepa, "Russian Footprints", *National Review Online*, August 24 2006.

[26] David A. Fulghum, "Busting the Bomb. U.S., Israel Ponder How to Slow Iranian Nuclear Weapons Development", *Aviation Week & Space Technology*, September 11 2006, p. 44.

twenty meters of hard rock[27]. Faced with this development, American efforts are being made along several lines: systematic use of the hardest steels (*Eglin* steel used on the BLU-113 munition and the future BLU-122 munition that has just come into the production phase), or simply brute force (the *Massive Ordnance Penetrator* program). **At the moment, the "shield" appears to be stronger than the "sword"**, so that the United States officially launched a new nuclear weapon system program in 2002 dedicated to in-depth penetration (the *Robust Nuclear Earth Penetrator*, RNEP project)[28]. This program was abandoned for political reasons, but it is no doubt only postponed: **the United States will not allow an entire class of targets to escape from American deterrence**, and some research carried out for conventional penetrating system shells will certainly be useful when the time comes for a nuclear version if necessary. However, American research is also concentrated on alternative strategies (blockage of site access by conventional means).

2.4 – Air and missile defenses

Defenses that Western nuclear means might face will also have changed by the year 2030, but **strong uncertainties remain about anti-ballistic protection.**

Ex-USSR countries have continued to contribute to the dissemination of modern anti-aircraft defenses since the end of the Cold War and this trend should continue in that there is a strong "demand" caused by Western air superiority. However, the situation for everything related to anti-ballistic defense is much more uncertain. Their status in the years 2025-2030 will depend on several different factors:

⇒ Effective deployments made by the United States at that time (if only due to "mimicking effects" normally developed as a result of American military policy, even beyond the offense/defense logic).

⇒ The nature of the strategic relation between firstly Russia, and secondly the United States and China (that will determine the level of investment that Russia would like to set aside for modernization of the anti-ballistic defense perimeter around the Moscow region).

⇒ Changes in the Chinese nuclear strategy (because Beijing will probably one day break with its doctrine of "absorption" of a first enemy strike).

⇒ The state of strategic relations between the three major nuclear States in Asia (China, India, Pakistan) by the end of the period considered.

The possibility of a "return of nuclear defenses" cannot be excluded for national anti-ballistic defense considering the extreme difficulties of direct interception, as soon as anything other than a

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[27] Amy Butler, "Pentagon Developing Range of Penetrator Weapons", *Aviation Week and Space Technology*, September 1 2006, p 52.

[28] The RNEP project is actually inherited from the end of the Cold War; it was originally a classified program designed to take account of the increasing number of hardened and buried targets in Russia (particularly underground complexes in Yamantau and Kosvinsky in the Urals).

symbolic capacity is required; **perception of a fast development of a ballistic threat could lead some countries to select this solution if they face persistent difficulties with existing programs**.

2.5 – The threat against nuclear forces

There are three possibilities that can arise about the vulnerability of nuclear forces to neutralization or preemption operations.

⇒ The threat against patrolling SSBN submarines should not increase significantly. The increased number of nuclear attack submarine programs in the world could increase the potential threat in some patrol areas. But the difficulties inherent to detection of a silent ship in a marine environment are well known, and no technological break through seems likely that could reduce the comparative advantage of SSBN submarines in terms of the protection/reprisal capacity ratio.

⇒ It seems certain that by the end of the period considered, **some potential adversaries will have the capacity (at least theoretically) to attack fixed infrastructures of western deterrence forces by military means**. Access to high resolution satellite intelligence and the availability of some technologies that can increase firing precision will enable new adversaries to make "targeted" strikes of a nature that could possibly affect the normal functioning of deterrence.

⇒ Similarly, some of these new adversaries will be capable of degrading information and communication systems by recourse to an HEMP firing, or even by recourse to some computer warfare means (for example in which China is making massive investments).

2.6 – The nature of enemy means

The ballistic threat should remain high and the ballistic/nuclear combination should only be seen as a "subset" of this threat. Ballistic missiles symbolically attract attention compared with cruise missiles (in addition to the twofold space/military aspect). For most countries that might represent a threat, they will remain the most reliable means of reaching the European heartlands.

Thirty countries now have ballistic missiles. As we have seen (see above), the number of ballistic missiles with a regional range (1,000 to 3,000 kilometers) has remained fairly stable: 547 in 1987, 417 in 2005[29]. They are in the possession of seven countries, namely Saudi Arabia, China, India, Iran, Israel, North Korea, Pakistan.

There is no reason to fear a widespread ballistic proliferation in the scenario considered. The proliferation role of the main source countries (Russia, China, North Korea) should reduce, with the help of Western pressure.

[29] Joseph Cirincione, *The Declining Ballistic Missile Threat*, Policy Outlook, Carnegie Endowment for International Peace, February 2005.

In this context, foreign based programs with a small national input (Egypt, Saudi Arabia, Yemen, etc.) could decline[30].

On the other hand, the increase in ranges characterizes several ongoing regional programs (India, Pakistan, North Korea, Iran). **Europe will certainly be within a range of a larger number of states in 2030 than it is at the moment**. The continuation of national programs should also be characterized by an increase in precision, a trend observed in the past in all States that have initiated a ballistic program since 1945. Finally, several countries will have the option of making use of the HA-EMP effect.

Therefore, the threat for the period considered can be summarized as follows: few countries holding nuclear weapons, but many missiles with higher performances.

This ballistic threat is not simply a nuclear threat, particularly because some States will be able to achieve a certain precision making them capable of threatening a particular area (including military). Therefore the future conventional ballistic threat cannot be summarized as a single "terror" use against towns as during the first Afghanistan War (the siege of Jalalabad), the Iran/Iraq war, and first Gulf war. Under some circumstances, a conventional ballistic threat (without any chemical, biological or nuclear warhead) could even threaten vital interests[31]. For example, could we imagine that a President of the French Republic would not consider the threat of a massive conventional strike (for example more than ten missiles) on Paris or on the Rhone corridor with its consequences in terms of public health (pollution due to the destruction of chemical sites, or even nuclear sites, etc.) as a potential attack on vital interests?

Cruise missiles are now attractive due to the diversity of the warheads that they can carry (conventional, nuclear, and also chemical and even biological[32]). However, they are still vulnerable, less reliable than the ballistic missiles, and technically more difficult to develop. And their limited range means that they are not an efficient means of threatening western countries outside the regional sphere[33]. **Thus, the rapid development of cruise missiles as preferred launchers for nuclear weapons remains improbable,** particularly for States with only a very limited stock of nuclear weapons.[34] Their quantitative development will depend essentially on the availability of countries such as China, Russia and the Ukraine remaining supplier countries. They could also provide a discrete method for building up to the carrying capacity of a nuclear

[30] The prognostic for Syria is no doubt more reserved.

[31] The rumor that was rife during the first Gulf War (1991) according to which Libya was in possession of ballistic missiles capable of striking towns in the south of France, gives an idea of the manner in which the French population would perceive a real ballistic threat from a North African country.

[32] The cruise missile is a particularly well-adapted carrier to dispersion of biological munitions.

[33] The use of merchant ships could be a means of making them the means of an isolated surprise attack.

[34] The low altitude and low velocity flight profiles of cruise missiles also introduce the risk of a weapon that falls on enemy territory being recovered.

weapon for highly industrialized States (obviously provided that they can make a sufficiently compact weapon)[35].

For Europe, the threat of cruise missiles will be aimed essentially at deployed forces and allied countries (particularly the Middle East). However, it is impossible to be sure that there will not be some countries capable of using cruise missiles to threaten Europe if they have long range systems (more than 1,000 kilometers), considering the deployment of efficient anti-missile defenses by NATO by the year 2030 and the increasing availability of some missiles (China, ex-USSR). Considering Western air superiority which will probably continue in the long term, such vectors would probably be based in enemy territory (south shore of the Mediterranean) or in its immediately vicinity (possibility of firing from the national air and coastal waters of the enemy country).

3 – The general context in 2025-2030

3.1 – The role of the nuclear weapon

In the absence of a clearly identified nuclear threat, **everything points to a gradual reduction in the position of nuclear deterrence in Western defense strategies by the year 2030.**

Technological developments contribute to the increasingly intensive development of new strategic defense means (anti-ballistic protection, remote conventional strike system). These changes occur slowly; remember that they began several decades ago. But they form a background trend and will become more important.

The United States (and to a lesser extent Israel) have already drawn conclusions about their defense policies by significantly reducing the importance of nuclear weapons. The American logic is based on two postulates. Firstly, there are real uncertainties about the satisfactory operation of deterrence faced with unpredictable and even unreasonable adversaries. Secondly, the President of the United States must not find himself in a position in which the only possible choice would be a nuclear reprisal. As is often the case, American philosophy will make its mark on strategic thinking in Western countries, particularly in Europe within NATO and Japan.

The memory of Hiroshima and atmospheric nuclear tests is becoming more and more remote, and the generations that are coming into power in Western countries today are the last to have been intellectually and politically educated during the Cold War. For them, the nuclear deterrence capacity still appears as being intangible data in the strategic landscape, but less and less as a "living" element in the absence of a major crisis potentially involving vital western interests. (Even a resumption of nuclear tests would hardly compensate for such a change, because in all probability they would be carried out underground and therefore with no immediate "visibility".)

[35] See the possible case of South Korea that is developing a national program of aerobic missiles.

Anti-missile devices will begin to be significant soon after 2010[36]. But although the role of defenses faced with limited threats will increase, **everything suggests that the role of defenses will continue to play a secondary role for protection faced with a massive threat**. Experience during the last forty years has shown that it is extremely difficult and expensive to develop defenses that are sufficiently reliable to be considered to be predominant in defense strategies[37]. **The only way to achieve a major qualitative leap forwards in terms of reliability and cost/efficiency of anti-ballistic defenses would be the development of new generation nuclear interceptors.** Such a development would not be impossible for countries such as Russia, China and India[38].

Despite considerable progress with conventional weapons, nuclear weapons will maintain special technical features; particularly the ability to threaten highly protected targets possibly covering very large areas[39].

It will also remain the only means of "mass destruction" that can be used facing States with chemical or biological capabilities, either as deterrence or to terminate the conflict if deterrence fails.

However, the position of nuclear deterrence as a basis for national defense policies for States with nuclear weapons will remain valid as long as no alternative means appears of a nature that could create as much fear as the threat of a nuclear strike and that would be equally efficient technically. The case of very high power lasers has been mentioned for a long time as being one possible "alternative" to the nuclear weapon; but such means would not have the same instantaneous and massive destruction capacity. Obviously, it is possible to imagine that this could be the case for some technological applications of existing know how (e.g. anti-matter weapons, etc.), but this remains extremely improbable within the period considered**. It is unlikely that nuclear deterrence will have genuine competition in terms of psychological and physical effects before the end of the timeframe considered.**

As time goes on, **the nuclear taboo will continue to strengthen**[40]. For political authorities in nuclear countries, crossing the "nuclear threshold" will

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[36] The United States is envisaging the installation of at least one site in Europe by 2011. The defensive architecture selected by Japan must also be in place entirely by 2011. Furthermore, collective work done by NATO in the defense domain should lead to setting up a defense system with the possibility of partially covering Europe by 2015.

[37] The probability of a successful defense decreases very quickly for hit-to-kill interception systems; For example, for an interceptor with 70% chance of being efficient, the accumulated interception probability if four attempts are made for each missile is 99%. For 10 missiles, the accumulated interception probability is still 92%. On the other hand, the probability facing 100 missiles drops to less than 50%; there is a better than 50% chance that one of them pass. W.K.H. Panofsky & Dean A. Wilkening, “Defenses against Nuclear Attack on the United States”, in George Bunn & Christopher F. Chyba, *US Nuclear Weapons Policy*. *Confronting Today's Threats* (Washington, DC: Brookings University Press, 2006), pp. 224-225.

[38] Proposed by the *Defense Science Board* in the Pentagon in 2003, at the time it was rejected.

[39] This reasoning could also be applicable to the destruction of mobile enemy launchers, a mission for which the difficulty is well known.

[40] There is a reverse thesis called "complacency"; with time, as memory of nuclear explosions disappears (Hiroshima and Nagasaki, and also atmospheric tests), the taboo on use might be relaxed.

increasingly become an extremely serious political decision regardless of the type of weapons[41].

Furthermore, for Russia (facing China), **for China** (facing the United States), **and for Pakistan** (facing India), **the possibility of developing tactical nuclear options remains an option facing adversaries considered as being conventionally threatening.** Nevertheless, such a development could remain within the logic of deterrence, as was done by NATO during the 1960-1990 period.

No doubt the permanent members of the United Nations Security Council will still precisely be the countries that have the status of nuclear powers as defined in the NPT. It is difficult to imagine the circumstances in which the UN General Assembly could agree on a significant reform of the Council. The transfer of the two European seats (Paris and London) to the European Union is also an extremely unlikely hypothesis in the main scenario. In particular, this means that management of the "nuclear order" (particularly management of proliferation and disarmament questions within the UN) will remain the prerogative of the Five, and therefore France will continue to have a significant responsibility. The position of India – the only nuclear country at the moment to claim the status of a large new power within the period considered – will thus remain an exception, and it could be gambled that India will continue to make its deterrence force a symbol of its status, including through the development of a triad of strategic means. The possession of nuclear forces will continue to enable nuclear countries to defy the UN Security Council or to take military action beyond the legitimate defense threshold specified in the United Nations Charter[42].

Note that in the inverse case (in other words the case in which a non nuclear state acquires the status of a permanent member), France could strengthen the value of its international position by maintaining its nuclear capacity, because it would still have an advantage that the others do not have.

Having a nuclear capacity will remain a status element for Leaders of Western countries that will help to distinguish them from emerging powers. The reasoning consisting of saying that the appearance of new non-nuclear powers (Germany, Japan, Brazil, etc.) devalues the nuclear status is reversible; in this context, a nuclear capacity becomes an element of differentiation for States with this capacity.

It is doubtful if this would occur in the Western States, at least in the medium term, but it could be more applicable for "new" holders.

[41] It is possible that this could have an impact on nuclear planning; Western political authorities will undoubtedly be increasingly reticent to approve plans including the use of several hundred or even several thousand weapons. However, it is probable that a Western government envisaging a nuclear strike would want this strike to have an immediate and decisive effect; thus it is impossible to assume that the amount of nuclear weapons needed in times of crisis will necessary be low ...

[42] In this respect, remember that the UNO charter is a document that can be qualified as "pre-nuclear". The Charter was adopted (June 26 1945) less than three weeks before the first experimental nuclear explosion (July 16 1945) and not much more than a month before the first "visible" nuclear explosion (August 6 1945).

3.2 – The geo-strategic landscape

The structure of the "nuclear world" will have one of three different faces:

- ⇨ **A tripolar nuclear world.** Three large nuclear poles could develop, including the Western pole (United States, United Kingdom, France and joined by India and Israel), the Asian pole (Unified Korea, China, Pakistan); and between the two, the Russian pole will alternately lean towards one side or the other. A formal alliance between Peking and Islamabad is possible if India disputes Chinese influence in Asia[43].
- ⇨ **A reinforced nuclear club.** The common fear of proliferation and the need for recognition of some countries as "quasi-nuclear States" (India, Pakistan) may lead the Five to accept seeing some legal arrangements binding the main States holding nuclear weapons. This assumption remains very improbable outside an "NPT-II", that could not be produced until after collapse of the regime (see below).
- ⇨ **The West versus the Rest.** Considering everything, the assumption of a "Western nuclear group" (including the United States, United Kingdom, France, India, Israel, and their allies and closest partners in management of civil nuclear power such as Japan) built up under the auspices of the United States, appears less improbable than the above[44].

In all cases, Asia will affirm itself as the "nuclear continent" even more that it is at present. In the future, the largest number of States holding nuclear weapons will be in Asia, with China, India, Pakistan, North Korea, and also Russia, and the American nuclear "umbrella" in North East Asia. Civil nuclear complexes will develop most quickly in Asia. Finally, the risk of weapons being used remains strongest in Asia with three main scenarios, namely India/Pakistan, China/United States, North Korea/Japan-United States alliance.

Having nuclear weapons will probably remain the prerogative of States. Despite the proven interest of some terrorist groups in acquisition of such a capacity, the cost/effectiveness ratio of such a project is still unfavorable. Although September 11 2001 was a qualitative leap in terrorist violence and created a debate at the time about the nuclear option for any network that wants to "do more", the opposite reasoning may also be used; since homemade and relatively inexpensive means can do so much damage, the conclusion might be that nuclear projects become less attractive? The availability of suicide bombers and martyrs remains an extraordinary force multiplier for terrorist groups. And logically measures taken since September 11 2001 (*Global Partnership*, *Proliferation Security Initiative*, *Global Threat Reduction Initiative*, the UNO Security Council Resolution 1540, etc.) should make access to significant

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[43] China is theoretically engaged in the defense of Pakistan, but in a manner that remains ambiguous and that does not provide a formal security guarantee.

[44] In the future, some analysts see the beginnings of such an evolution towards a non proliferation "meta-regime" in the American GNEP (*Global Nuclear Energy Partnership*) program that would be superimposed on the existing order (NPT/IAEA/NSG).

quantities of fissile materials even more difficult. In summary, nuclear terrorism remains a credible hypothesis, but its realization is fairly improbable[45].

3.3 – Arms control

It is unlikely that major new disarmament and non-proliferation instruments will affect western deterrence postures.

The foreseeable strategic context is not conducive to the return of major bilateral Russian-American or Sino-American negotiations. In the lack of a "new Cold War" situation (which is inherently the case in this scenario) and due to the highly complex nature of modern armament control agreements, there would hardly be any reason for the major powers to make a new start to such exercises[46]. The situation is made even more difficult because the Americans would have to unduly recognize equality of status with some countries (Russia), and also because they are emerging potential adversaries (China). Future reductions of arsenals will be made essentially unilaterally.

By 2030, the development of legally restrictive instruments for controlling so-called "non-strategic" weapons (not covered by Russian-American agreements) will continue to be hindered by two other obstacles; firstly the number and dispersion of these systems and secondly the will of some States to use such means to compensate for the conventional superiority of their potential adversaries. (It would be quite imaginable that permanent deployment of nuclear weapons on foreign soil could be covered by a standard ban, for example to prevent Pakistan from deploying its weapons in Saudi Arabia, or to prevent China from deploying its weapons in a "friendly country".)

Similarly, **it seems unlikely that there would be any spectacular progress with multilateral disarmament**.

"Commitments" made by States that held nuclear weapons in 2000 at the time of the NPT Review Conference (the Thirteen Steps in the Conference concluding document) failed to create the motivation that they would have liked, to the great disappointment of States and non-government organizations arguing for nuclear disarmament. The Five only give lip service to this political document; they do not see it as creating an obligation to go faster and further in nuclear disarmament. The failure of the 2005 examination conference confirmed that States without nuclear weapons do not have any sufficient means of applying political pressure to force States with nuclear weapons to apply Article VI in the Treaty more strictly.

The CTBT could possibly come into force during the period considered, but the most probable scenario remains a de facto moratorium that will be interrupted occasionally by the will of a particular State to access a wider variety of formulas (India for thermonuclear weapons, Pakistan for plutonium weapons), new weapons (Russia ?[47]), robust

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[45] A detailed argument on the same theme was supplied by Robin M. Frost, "Nuclear Terrorism After 9/11", *Adelphi Paper* No. 378, International Institute for Strategic Studies, London, 2006.

[46] There is a possibility of an extension to the START-1 treaty.

[47] This does not prejudge the capability of this country to develop some reliable formulas for weapons with controlled effects without carrying out tests.

formulas (China), if a serious defect is discovered in the existing arsenal (United States), by the will to demonstrate power (North Korea[48]), or to "restore" a visible deterrence capacity (Israel if the Iranian crisis worsens)[49]. **Thus, it is extremely probable that several countries will carry out nuclear tests in future years**.

If the CTBT were to come into force during the coming 25 years, the countries concerned need to have a high degree of confidence in the future of their nuclear arsenals and be ready to do without making tests. **This condition will probably not be satisfied for the foreseeable future**, if only because there are very few countries with an advanced simulation program[50].

On the other hand, the existence of a treaty banning fissile materials for explosive purposes is very probable during the period considered, despite difficulties in the verification of such an instrument[51].

Under these conditions, attempts to revitalize nuclear complexes will find it difficult to compensate for the aging effect that will appear at all levels (human, scientific, technological). The only way to compensate for this would be the development of new weapons (particularly with controlled effects); some States like Russia might be ready.

Finally, the legal context of deterrence could be reinforced during the next three decades by the creation of new zones free of nuclear weapons (coming into force of existing treaties[52]), or even by a generic standard banning nuclear weapons from being kept in or transiting through non-nuclear countries (see above).

It is also possible that by then we will see a legal formalization of negative security guarantees (commitments not to use nuclear weapons on non-nuclear members States of the NPT). But it is doubtful if States with nuclear weapons would make a commitment in this sense that would considerably restrict their deterrence capacity. **Production of any new legally restrictive standards for nuclear deterrence will most probably be a formal and predominantly political exercise with no great practical scope**.

In summary, instead of entering the "end of nuclear weapons" era (as announced by a French daily in 2000 after adoption of the Thirteen Steps) we **may instead have entered the "end of nuclear disarmament" era**.

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[48] A test carried out by North Korea on October 9 2006 broke a taboo, in that no "visible" nuclear test had been carried out since May 1998.

[49] These assumptions should also take account of the possibility that one State would do a test on behalf of another (e.g. Pakistan for China).

[50] Unless the legal technique for provisional entry into force is used.

[51] Remember that the fact that there is no verification protocol does not prevent the existence of a biological weapons ban agreement.

[52] In February 2007, treaties setting up Nuclear-Weapon-Free Zones in Africa (1996) and in Central Asia (2006) had not come into force.

3.4 – Nuclear arsenals

It is probable that **the considerable disparity that exists today between firstly the Russian and American arsenals, and secondly the arsenals of other nuclear powers, will have been significantly reduced** by the year 2030.

Moscow and Washington are towards reducing their arsenals, while Beijing, New Delhi and Islamabad have not reached what they consider their "sufficiency" level and are still working towards quantitatively and qualitatively increasing their arsenals. The mistrust of these three capitals towards their corresponding reference adversaries can increase this trend. Finally, the policy of London, Paris and no doubt also Jerusalem is to maintain the level of their arsenals.

These developments will continue at least until 2015, and probably afterwards.

The superiority of American nuclear weapons should remain, but will be less overwhelmingly predominant than it was in 2006 (Russian qualitative modernization, Chinese catching up, Indian emergence), and will not be contested in the same way that it was during the Cold War.

The nuclear landscape of 2030 should show the American nuclear arsenal in the leading position followed by a group of countries with operational arsenals consisting of a few hundred (between 100 and 1,000) weapons, including China, France, India, Israel, Pakistan, Russia and the United Kingdom. **In any case, the United States would like to assure that neither Moscow nor Peking could claim symbolic parity in terms of the number of weapons**[53]. China would no doubt like to be at least the third nuclear power in the world; but the United States intends to prevent it from being the second.

Arsenals will still be largely composed of ballistic means, but the place of aerobic missiles will no doubt have increased in importance. Western countries will probably have renounced the use of ground-to-ground strategic missiles[54]. **It is possible that China and the United States will reserve the possibility of a nuclear launch from outside the atmosphere** (orbital vehicles, and possibly hypersonic means[55]).

The precision of weapons systems will increase even further, no doubt reaching the point (precision of about one meter) in which the research for new progress in this domain will be governed by the law of diminishing returns. Improvements to existing systems will undoubtedly concentrate on the reliability, speed and discretion.

With smaller arsenals and with a smaller missile/number of weapons ratio, the principal major nuclear powers could be tempted to abandon counterforce

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[53] This is the sense of the concept that the United States call "deterrence" since the *Nuclear Posture Review* in 2001.

[54] The main traditional advantages (fast reaction or precision) of ICBM missiles will probably be equaled by SLBM missiles thus making ICBM missiles no longer applicable.

[55] Development of hypersonic means remains improbable within the period considered, except possibly by the United States.

planning against the reference adversary (Russia for the United States, the United States for Russia) that consumes large quantities of weapons.

Some countries (Russia, China, and no doubt others) will continue to have short-range weapons designed to apply deterrence on the battlefield faced with an adversary considered as being conventionally more powerful. But **nuclear tests will no doubt have to be carried out for any battlefield weapons with controlled effects**.

Six to seven countries (instead of five at the moment) will deploy strategic nuclear weapon systems at sea (surface ships or SSN/SSBN submarines) at the end of the period considered; these countries will be the United States, Russia, China, France, United Kingdom, India, Pakistan, and may be Israel. But the search for an assured second strike capacity will continue to consist of dispersion, camouflage and the mobility of ground-to-ground strategic ballistic forces, at least for some of them.

American nuclear deterrence in 2030

Regardless of internal political changes in coming years, the American stock of nuclear weapons will no doubt be considerably smaller by 2025-2030. In conceptual terms, the "nuclear" component of American deterrence will no doubt have been relegated to the background, behind conventional forces and antimissile defenses.

The Republicans will go further in reductions for reasons of principle (replaced by antimissile defenses and long-range conventional means), and will act essentially unilaterally. The Democrats will follow the same path but for political reasons; they will combine unilateral reductions ("showing the way" to new nuclear powers) and attempts to make negotiated reductions (to achieve a momentum of armament control with Russia) while reducing strategic antimissiles defense budgets[56]. However, they will be more prudent than their opponents to avoid the risk of appearing "weak".

Technically, three factors will contribute to a continued reduction of nuclear forces:

- The increased reliability and precision of systems, which will "simplify" planning and the number of weapons in reserve.

- The development of precise long distance conventional means and antimissile defenses, that could eliminate nuclear options against Russian forces (that at the moment still have a strong influence on the size of the American arsenal).

[56] Adoption of a new treaty for the control of offensive or defensive armaments would require a majority of 66 senators, but the Democrats do not have this majority at the moment. Nor do they have a large enough majority to pass a controversial bill (60 senators to avoid the "filibuster" procedure).

The introduction of RRW weapons into the American arsenal that will be more reliable – but undoubtedly larger and heavier than existing weapons and will correspondingly limit the carrying capacity of multiple head ballistic missiles.

If nuclear weapons have not been used by 2030, we can predict that American nuclear deterrence will perform the following "residual" functions:

- Affirm American superiority over other major nuclear powers.

- Protect United States allies and prevent them from developing nuclear weapons.

- Guarantee that no key target is inaccessible to American deterrence policy.

- In times of crisis faced with a regional adversary, deter "second use" of weapons of mass destruction after a possible conventional American reprisal[57] (or terminate the conflict by a limited nuclear reprisal).

- Prevent a long conventional war with a major power[58].

- Maintain an "apocalyptic" destruction capacity as the ultimate guarantee of survival of the country.

The stock of weapons will have been reduced so that the total number will be between 1,000 and 5,000 weapons (depending on whether or not massive strike options are kept against conventional Russian military means). If there is no proven major threat, only a few hundred weapons will have the immediately available status.

The American arsenal will include three types of means:

- A limited number of relatively low energy weapons, designed for very high precision systems with reduced collateral effects, including penetrating munitions; nuclear tests will have been carried out on these munitions to assure their technical and political credibility.

- A large number of Reliable Replacement Warhead (RRW) weapons; the size of this part of the American arsenal will be based on the capacity to inflict unacceptable damage on a major power.[59]

- A significant number of weapons produced at the end of the Cold War kept as insurance against resurgence of a major threat.

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[57] See Institute for Foreign Policy Analysis on this theme, *Implementing The New Triad*, Final Report, 2006, p. xi.

[58] "*Preventing a war of attrition with China from being conceivable*", according to a former Pentagon Leader (interview, Washington, November 2006).

[59] It is expected that by 2030, the "*major part*" of the American operational arsenal will be composed of RRW. *Complex 2030. An Infrastructure Planning Scenario for a Nuclear Weapons Complex Able to Meet the Threats of the 21st Century*, National Nuclear Security Administration, DOE/NA-0013, October 23 2006, p. 8.

It is probable that American deterrence will only maintain two components (sea-based and airborne)[60]. There will no longer be any platforms or weapon systems (SSBN submarine, aircraft, missile) dedicated specifically to carrying nuclear weapons. A single C4ISR network will support conventional nuclear and defense forces. American nuclear weapons now present in Europe will probably have been withdrawn.

The United States will maintain a significant number of SSBN submarines on patrol, distributed in two fleets - the Pacific fleet and the Atlantic fleet. Most will carry a "mix" of SLBM nuclear missiles and SLBM conventional missiles with a precision of better than 10 meters[61]. This arsenal will be supplemented by other precise conventional means fired from a long distance. Some American conventional means will have acquired a "counterforce" capacity.

Unless a policy change is decided upon, replacement of the current generation of strategic systems will begin. It will continue during the 2030s[62]. At least one of these future strategic weapons could follow a hypersonic trajectory, possibly partially beyond the atmosphere (*Common Aerospace Vehicle* project); or a "hybrid" system with a ballistic/aerobic trajectory[63]. The United States will prepare commissioning of the "second generation" of RRW weapons starting from 2042. The question of maintaining skills and expertise will arise again.

In the case of a significant development of nuclear/ballistic proliferation or the appearance of a significant immediate threat, the United States will have developed a program for interception of missiles during the boost phase, from space. This type of interception could be based on kinetic means, but would no doubt also make use of laser technology[64].

The American nuclear complex will have been consolidated around eight sites, and there will no doubt only be a single laboratory capable of designing and developing nuclear weapons (instead of two at the moment). A new installation would be capable

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[60] Minuteman-III ICBMs can remain in service until almost 2020. The USAF has expressed the need for a new ICBM starting from 2018. But the ground-to-ground component will probably not be modernized unless some of them carry conventional weapons.

[61] The conventional version of Trident-2 should come into service in 2008 with a CEP of 155 meter; a second version should come into service in 2011 with a CEP of 10 meters. Bruce Blair, Eric Hundman & Haninah Levine, *Conventionalization of Strategic Forces: Single-Shot Probability of Kill (SSPK) Analysis of Conventional Munitions for Strategic Targeting*, World Security Institute, October 12 2006.

[62] The life of Ohio class SSBN submarines was extended to 42-44 years. The first (*Henry M. Jackson*) should be withdrawn from service in 2027-2029, and the last (*Louisiana*) in 2039-2041. (The Trident-2/D5 missile could remain in service until 2040-2042.) B2 bombers should be withdrawn by about 2037 (but preliminary studies suggest that they could be prolonged until 2058); some B52 bombers could be kept in service until 2045 and later. (ALCM and ACM missiles should be withdrawn in 2030.)

[63] See the RAPIER (*Rapid Intercontinental Emergency Response*) system proposal, a heavy armed drone with a ballistic initial trajectory (Report of the Defense Science Board Task Force on Future Strategic Strike Forces, Department of Defense, February 2004, p. 7.8.).

[64] Provided that its feasibility has previously been demonstrated by the Airborne Laser (ABL) program, that should become mature in the 2010-2015 period. (The ABL program should start the flight test phase starting in 2008.). For defense and illustration of the value of strategic defenses in space, see *Independent Working Group on Missile Defense, the Space Relationship and the Twenty-First Century*, 2007 Report, Institute for Foreign Policy Analysis, 2006.

of manufacturing at least 125 nuclear weapon cores per year[65]. Hydrodynamic tests will have been transferred to Nevada after closure of the DARHT radiography machine, that will take place during the 2020s.

Three extreme scenarios can arise beyond this nominal scenario: (1) the assumption of a formal alliance with Russia (particularly against China), that could reduce the American nuclear arsenal to about one thousand weapons; (2) the inverse assumption of a return to the Cold War, with the consequence of reversing the trend to reduce the arsenal, and if necessary deployment of offensive and defensive means beyond the atmosphere; (3) assumption of deliberate renouncing to nuclear pre-eminence and almost complete denuclearization (keeping a few hundred weapons in a non-operational status, reduction of the SSBN submarines fleet and conversion of these submarines into conventional weapon carriers).

3.5 – The European framework

The European political context could change significantly over the next twenty-five years. It is extremely unlikely that there will be a politically integrated Europe with 25 or 30 members by the year 2030. On the other hand, it is possible and even probable that by this time, a set of geographically and politically similar countries ("hard core") will have decided to work in common, wherever possible, to manage their diplomatic and defense tools. In this context, nuclear deterrence would form an integral part of the European debate. Although it is difficult to imagine a nuclear decision being made in common, **it is quite possible that the closest allies would be consulted about the themes of French nuclear planning**. Finally, it is possible that by this time, France and the United Kingdom would be ready to declare that their vital interests are identical, which would open up the possibility of "pooling" their sea-based forces, either of the two countries being capable at any time of exercising deterrence for the benefit of their common interests[66].

Since NATO has resisted many upheavals to the strategic context, it seems logical to think that it will remain in existence in the nominal scenario. It is unlikely that the integrated nuclear system will be kept in its existing form (with the permanent presence of several hundred nuclear weapons within six European countries). But it is impossible to be certain that it will not be maintained, and at least part of French nuclear means could be assigned to an allied disposition managed in common.

[65] The *Complex 2030* project is planning a production capacity of 40 to 50 weapon cores starting from 2012.

[66] Furthermore, there must be no stipulation in bilateral American-British agreements opposing increased cooperation with the United Kingdom. (In 2004, the 1958 *Mutual Defense Agreement* was prolonged once again for 10 years. Its validity now expires on December 31 2014.)

THE WORLD IN 2025

By 2025, the economies of OECD countries will represent less than half of the worldwide GNP (in purchasing power parity, PPP), while Asia's share will have risen to 40%[67]. The GNP (in constant exchange rates, CER) for China and India will have exceeded the GNP of the main western economies: China will have passed Japan by about 2016, India will do so in 2032[68].

But the increasing power of China and India should be affected by their weaknesses; demographic unbalance (surplus male population, effects of AIDS), insufficiencies in the education and public health systems in rural areas, etc. Finally, each of the two countries has its own weaknesses. For China, aging of the population (20% retired in 2025[69]); particularly high corruption level; fragility of the bank and financial system; high degree of environmental degradation (deterioration of arable land); risk of political instability, social and religious contestation[70]; the influence of the Popular Liberation Army in strategic decisions for the country. For India: comparatively weak foreign investments; paralyzing bureaucracy; endemic poverty in many regions; water shortage in some regions. In 2025, the GNP per inhabitant of China will be of the order of 5% of the corresponding value for the United States, and the GNP per inhabitant of India will be of the 12%. (The corresponding numbers for 2035 are 8% and 22%)[71].

China will not be the equal of the United States. It should be the largest trading country in the world (imports and exports) by 2025[72]. And its GNP (PPP) will exceed the value for the United States in about 2017 (21.8% of the worldwide GNP in 2025 compared with 18% for the United States)[73]. But its GNP (CER) should not match the corresponding value for the United States before 2041[74]. And at this time its defense expenditure should only be of the order of 200 billion dollars, which is about 50% of current American expenditure[75].

Thus, American predominance will probably not (yet) be challenged. America's demographic growth rate should continue. The population growth of the United

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[67] Nicole Gnesotto & Giovanni Grevi (dir.), *The New Global Puzzle. What World for the EU in 2025 ?*, European Union Security Studies Institute, 2006 [see below: EU 2006], p. 155.

[68] Goldman Sachs, "Dreaming With BRICs", *Global Economics,* Paper No. 99, October 2003, p. 3.

[69] EU 2006, p. 158.

[70] The Chinese urban population will become a majority (57% in 2025, namely more than 800 million persons). EU 2006, p.157.

[71] Goldman Sachs, "Dreaming With BRICs", *Global Economics*, Paper No. 99, October 2003.

[72] EU 2006, p. 41.

[73] *The Economist*, "The World in 2026", The World in 2006, December 2005, p. 92.

[74] Goldman Sachs, *Global Economics* Paper No. 99, October 2003, p. 3 ; "2040 Vision", *The Economist*, September 16 2006, p. 12.

[75] In 2003 value. DoD Annual Report to Congress, Military Power in the People's Republic of China, 2004.

States will have been 17.4%[76]. Its population will be 364 million in 2030 (compared with 296 million in 2005)[77]. In particular, the United States pre-eminence in the field of intellectual education will no doubt remain for a long time. (At the moment 37 out of the best 50 universities in the world are American[78]).

The populations of Europe, Russia and Japan will decline. Europe will not contain more than 6% of the world's population and the average age will have increased. Almost half (48%) of the adult population (more than 15 years old) will be more than 65 years old[79]. Even allowing for immigration, the population of the European Union should reach a peak in 2025 (470 million inhabitants compared with 458 at the moment) before falling. This reduction will start to affect the active population starting in 2030.[80] The decline in Russia's population (-10,8%) will be particularly spectacular, dropping from 143.2 to 129.2 million, and almost a quarter (24.3%) will be over 60 years old[81]. Its demographic balance will be affected by deficiencies in its public health system and by the AIDS pandemic (one million carriers). Finally, Japan will also see its population decline from 128 to 124.8 millions.[82] The impact of social demand (retirement, health, etc.) on public finances could make it more difficult for countries to invest in their defense capabilities.

Conversely, in some parts of the world (the Middle East, West Africa), the age pyramid will be even more unbalanced in the opposite direction, with a particularly high proportion of young persons. In the Middle East, the proportion of young people of working age should increase by 50% by 2025[83]. The population of the region will become essentially urban (with an exceptional rate of 70%)[84].

The stability of the Arabian peninsula will be cast into doubt by the combination of water shortage and rising unemployment, while South Asian countries will no longer have access to "job basins" in the Persian Gulf, nor to financial transfers made by migrants[85].

Many developing countries will still be affected by the effects of the AIDS pandemic that should affect their demographic equilibriums[86]. But two new "giants" should emerge, namely Pakistan (229 million inhabitants) and Nigeria (190 million)[87]. An

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[76] EU 2006, p. 15.

[77] EU 2006, p. 20, p. 141.

[78] EU 2006, p. 95.

[79] European Defense Agency, An Initial Long-Term Vision for European Defense Capability and Capacity Needs, October 3 2006 [EDA 2006], p. 6.

[80] EU 2006, p. 19.

[81] EU 2006, p. 15, p. 21.

[82] EU 2006, p. 20.

[83] EU 2006, p. 119.

[84] EDA 2006, pp. 6-7.

[85] In the Middle East, available water quantities will drop from 1200 m^3 per person today to 550 m^3 in 2050 (EU 2006, p. 120).

[86] Particularly countries said to be "second wave": Nigeria, Ethiopia, Russia, India, China, Brazil, Ukraine, Central Asian Countries.

[87] EU 2006, pp. 20-21.

increasing majority of the world's population will leave in urban areas (60% compared with 50% at the moment)[88].

The effects of climate change are still uncertain at the moment. In a catastrophic scenario, the rise in water levels could affect towns in unprotected coastal plains in developing countries.

Developments of the major religions should have a significant effect on social balances in some large countries. Worldwide, Christianity should remain the religion with the largest number of followers: 2.6 billion in 2025[89]. By 2020, China and Nigeria will each have one of the largest Christian populations in the world[90]. But Islam should still be the major religion with the highest growth rate (2.1% between 2002 and 2025)[91]. In Europe, Muslim populations are expected to be between 24 and 38 million by 2025[92].

The world energy demand should have increased by 50% in 2025 (+40% for oil, +90% for gas). Fossil energies (oil, gas, coal) will provide about 80% of world demand[93]. The proportion of nuclear energy in world consumption should go down (4.7% in 2030 compared with 6.4% 2003), unless there is a major renewal in western countries[94].

By 2025, Europe will be dependent on outside supplies for 90% of its oil consumption and 80% of its gas consumption[95]. Similarly, the United States and Asian countries will be more and more dependent on external countries for their energy supplies. For the United States, this dependence should be about 60% for oil and 40% for gas by 2025. Africa will have become a major supplier of American oil (25% of its imports)[96]. Saudi Arabia will sell more to Asian countries than to western countries by this time.

Means of processing and storage of information should have changed, and many specialists believe that "Moore's law" will no longer be valid after 2015[97]. The use of nanotechnologies in industry will become routine starting in about 2015-2020. At the

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[88] 81.7% for developing countries. EU 2006, p. 17.

[89] *Status and Trends in Global Mission as Revealed by the Annual Christian Megacensus, AD 1800-AD 2025*, World Evangelical Research Center, 2001.

[90] National Intelligence Council, Mapping the Global Future. Report of the National Intelligence Council's 2020 Project, NIC 2004-13, December 2004, p. 79.

[91] *Status and Trends in Global Mission as Revealed by the Annual Christian Megacensus, AD 1800-AD 2025, World Evangelical Research Center,* 2001. The groups with the next highest growth rates are the Sikhs and Hindus.

[92] National Intelligence Council, *Mapping the Global Future*. Report of the National Intelligence Council's 2020 Project, NIC 2004-13, December 2004, p. 83.

[93] EU 2006, p. 53.

[94] EU 2006, p. 55.

[95] EU 2006, p. 57. En 2030, Middle-East countries will supply 50% of Europe's oil consumption. (Ibid., p. 117.)

[96] EU 2006, p. 150.

[97] Louis Laurent, "Nanotechnologies and converging technologies: what future in twenty years?" *Le Banquet*, No. 22, September 2005, p. 148.

same time, progress in biotechnologies (genetic engineering) should have opened up targeted "biological warfare" options against humans or the biosphere.

There will be a marked contrast in the use of military force. Firstly, munitions with precise all-weather guidance will have become the standard in conventional arsenals of western and other industrialized powers; they will have reached a precision level that it will be difficult to exceed (of the order of one meter). Furthermore, rudimentary means (AK-47, knives and daggers, etc.) will form the "ordinary" weapons for war, particularly in internal conflicts that will have become the most frequent.

International relations are dominated by China/United States relations. There will not have been any significant reform of the UNO Security Council, since members of the General Assembly will not have succeeded in reaching an agreement about the identity of new permanent members.

4 – Consequences for France

In this scenario, by 2030 France will be "one among several nuclear powers". After having made major decisions in 1996 (end of tests, simulation program, end of production of fissile materials for explosive purposes, abandonment of ground-to-ground missiles), it put itself in a "lead" position in many respects compared with others. It appears **to be relatively protected against pressures or new constraints in the nuclear disarmament field**.

i. Foreseeable political, strategic and cultural changes in western societies suggest that there will be a twofold demand from political authorities in the coming years and decades. Firstly, a **demand for range**, both for the ballistic component (to guarantee to the authorities that no target in the world is inaccessible to deterrence), and for the airborne component (safety of pilots[98], possible problem of overflight authorizations). Then, a demand for **precision** due to the increasing de-legitimacy of anti-demographic planning and the need to be able to threaten occasional hardened and buried targets if necessary[99]. Furthermore, the proven willingness of some adversaries to deliberately put some military installations in the same location as civil targets could also induce a demand for controlled effects[100]. Recourse to the HEMP effect will no doubt be among the preferred options of political authorities for warning firing. A **demand for "cleanliness"** (weapons with low radiological effects) could also

[98] This could only have an influence for the current generation of airborne vectors, we could imagine that the next generation could be unmanned (armed drone with long action range, etc.).

[99] To the extent that anti-demographic options are not really “controlling” (except for the case of very highly populated countries such as China or India), however it may be requested that they should be maintained to face a threat of the same amplitude; it could also be considered as “insurance” if there is any uncertainty about identification of enemy power centers.

[100] An American analyst referred to the preference that some adversaries have for concealing military means close to or even inside buildings such as “*mosques, hospitals and orphanages*” towards the end of 2006.

arise due to progress made in this field by other nuclear powers. **Although the French strategic culture is still characterized by widespread mistrust of any drift towards a "nuclear war-fighting" strategy**, the historical precedent of the enhanced radiation weapon suggests that **France would hesitate to deprive itself of means developed by other nuclear powers if these means seem to have a high political or strategic value**. France will be reactive rather than proactive in this field.

In terms of doctrine, it is unlikely that any substantial modifications will be made to the French concept. As we know, the fundamental elements of the French concept have remained unchanged for thirty years. Under favorable assumptions about the threat evaluation, the most that we might imagine is that political authorities could be tempted to adopt a "no-first use" doctrine, thereby reserving nuclear deterrence solely for use against a nuclear threat. Such a change would be very significant in terms of the doctrine, but it would have no particular consequence on the weapon systems plan.

ii. The foreseeable national **political and budget context** for the next three decades **does not guarantee that deterrence will last indefinitely**.

Admittedly, the consensus of opinion on the benefits of nuclear deterrence, as measured particularly by annual enquiries ordered by the Ministry of Defense, appears to be fairly positive[101]. At the moment there is no objective reason for thinking that French opinion could change so that a majority would be against maintaining deterrence. Admittedly the consensus on deterrence is largely tacit, but opportunities for debate as in the June 2001 and January 2006 presidential speeches did not incite any contestation movement, except for marginal comments, which is fairly exceptional compared with what is happening in the United States and the United Kingdom. (Note also that this consensus has been increasing since 2001). Apart from factors related to changes to the security context, which undoubtedly induces a certain reflex of caution in public opinion, it is possible that the status of France as a nuclear power is still perceived as being the instrument of the country's strategic independence[102].

Moreover, this reasoning is also valid in times of crisis: **there is no reason to suggest that French opinion could be an obstacle to exercising deterrence in the case of a serious and proven threat to our vital interests, as seen by the political authorities**[103]. The need to use force for the defense of legitimate interests has been deeply accepted as part of the national political culture. The threat of unacceptable damage against an adversary would be more acceptable to public opinion when it is applied, as in many foreseeable scenarios, against an adversary that does not have a protected

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[101] In answer to the question "*Could a country like France defend itself without the deterrence force (nuclear force)?*", 61% answered "no", compared with 34% "yes". Ministry of Defense, "Les Français et la Défense" barometer, 2006.

[102] This relation is hardly mentioned publicly, but there is no doubt that it still exists in the national political culture. Would France have *actively* opposed American-British cooperation in Iraq, to the point of threatening to use its veto in the vote for a second resolution by the UNO Security Council, if it depended on the United States for its security?...

[103] Remember also that the deterrence threat could possibly be applied discretely (communication to the adversary through various channels).

massive second strike capacity. Any specific manifestation of a major danger can incite brutal reactions in modern democratic societies, as was clearly emphasized after September 11 2001.

Having said this, it is still true that new political generations are less inclined than previous generations to see the nuclear deterrence tool as an instrument essential for national security. Especially, demographic change and social demand will result in political elites not being ready to finance the defense effort in the lack of any serious military threat, and this will be true in all European states[104]. Finally, *volens nolens*, the **nuclear budget might be reduced to pay for other expenses made necessary by France's participation to an antimissile defense system** in Europe.

Therefore it would be prudent for the French nuclear system to prepare for new budget reductions. It would be desirable to prepare for such an eventuality so as to avoid "surprises" like the moratorium on tests and cancellation of ground-launched ballistic component in their times.

For example, the question of whether or not to maintain the airborne component will undoubtedly return regularly in debates. Cancellation of the British airborne component at the end of the Cold War remains a politically strong argument for those who would like France to do the same; and even if NATO renounces a permanent presence of nuclear weapons in Europe, such a decision could also be used as an argument in the French political debate, particularly if it is used by our European partners**. Elimination of the airborne component could be accompanied by a request for additional precision for M51.2 missile.**

Other scenarios are possible. It might be imagined that the political authorities decide ASMP-A missiles to be "mothballed" if this option could achieve significant savings. Another conceivable scenario from the point of view of a future political authority that wants to make its mark on France's deterrence capacity would be elimination of the onboard component on aircraft carriers[105]; such a decision would have an essentially symbolic value (limited savings), towards France's contribution to the nuclear disarmament. Finally, all or part of the airborne component could be handed over to NATO.

Under these conditions, it is surely not too early to consider what could be a "second deterrence means" if it is considered necessary to diversify vectors of the nuclear force once again within the next ten to thirty years. This would means having other medium term options to make use of weapon systems that are already planned (SCALP-N on the Barracuda class SSN or FREMM/AVT destroyers), or feasible in the long term (successor to SCALP-N, new "strike" type platforms, cargo aircraft carrying strategic missiles, armed drones with long action range, etc.).

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[104] Nevertheless, the reasoning is partly reversible: since France is aging less than its neighbors, the neighbors will be the first to be affected by the probable reduction of defense budgets due to the pressure applied by social budgets; in this case, the value of France's possession of a deterrence capacity contributing to the protection of Europe could increase.

[105] In this respect, note that since 1994 France has been the only country to maintain such a capacity permanently.

iii. Apart from the massive development of antimissile and anti-aircraft defenses in potentially adverse countries, **the change to the threat suggested above could also make a quantitative reduction to the French nuclear arsenal conceivable** for several reasons. Firstly, it is accepted that the vital interests of our allies, and particularly the United Kingdom and the United States, will also be involved in many scenarios affecting our vital interests; **the assumption of a common exercise of deterrence**, in one form or another, **could become the standard**. (The possibility of "pooling" French and British nuclear means could even become conceivable within the period considered, assuming positive changes in the European political context). Subsequently, **deterrence will probably be increasingly exercised through the threat of destruction of power centers, even for major powers** – which could mean a reduction to the means necessary for permanent planning. Finally, the assumption adopted in this essay that the "nuclear taboo" will be maintained (the weapon will not be used during the period considered) suggests that **the value of the threat of use will increase in value, so that the level of potential damage** necessary to make deterrence credible could be reduced in the future [106].

Therefore, we should prepare ourselves for a demand from political authorities to make a regular re-evaluation of the sufficiency level, no doubt every five years at the time of each new presidential mandate.

Finally, note that changes to the threat could necessitate increased protection (physical and electronic) for national nuclear sites.

The challenge for the French nuclear complex will consist of reconciling maintaining the existing arsenal in good condition and preparation for the future with a structurally constrained budget context. Undoubtedly scientific and technological creativity will be necessary to achieve this, synergies with civil applications will have to be maximized, and we will need to be able to efficiently defend our own interests within the national institutional system.

[106] Note that even within the framework mentioned herein, there are arguments against reducing the level of sufficiency. Firstly, any reduction in the weapons stock would be difficult to reverse. Then, as mentioned above, assuming a serious crisis involving our vital interests, the political authorities could ask that the first use of the nuclear weapon should be as decisive as possible - which for example might lead to planning for a particularly robust “final warning” including in terms of the number of weapons. Finally, economic modernization in most countries (with very few exceptions, such as perhaps North Korea) would contribute to the increased number of “power centers”.

3 – ALTERNATIVE SCENARIOS

The nominal scenario described above is considered to be the most probable. However, there is also a high possibility of one or several "singularities" occurring and very significantly affecting the context of French deterrence. In this part of the study, we will consider firstly some radical events that could profoundly modify progress of the nominal scenario, and secondly alternate scenarios for 2030.

1 – Four "events" that could affect the nominal scenario

1.1 – The collapse of the NPT

Almost forty years after its signature, the nuclear weapons Non Proliferation Treaty has become almost universal, and is still the principle standardizing barrier to the proliferation of nuclear weapons. However, the possibility of its collapse is an outstanding issue at the moment.

As suggested above, the Iranian question could determine the future of the NPT over the next few years. It is difficult to believe that the Treaty could survive a second withdrawal after North Korea[107]. An Iranian withdrawal would open up the way to others; no doubt firstly in the Middle East and then in North-East Asia. Countries wishing to withdraw would invoke the withdrawal clause specified in article X of the Treaty. As soon as four, five or six countries have withdrawn, the treaty would have lost its value as a norm. A movement could then develop, inverse to the movement in the 1990s during which the number of signatories increased. Eventually, about twenty countries would withdraw, essentially in the Middle East and Asia, but undoubtedly also in Latin America (Brazil, etc.) and in Europe (Turkey, Ukraine, etc.). The visibility of the AIEA for monitoring sensitive nuclear activities would then become practically zero and the **assumption of a "proliferated world"** (see below) **would become predominant in Western countries' evaluations of the threat**.

The Five might then attempt to create an "NPT-II", in which some countries (India, Pakistan, and Israel if Tel-Aviv had publicly admitted its capacity by then) would then be admitted as nuclear powers. This scenario is not realistic at the moment but it could become so in the context described herein.

[107] As is well known, the precise legal status of North Korea with regard to the Treaty is uncertain.

1.2 – The use of a nuclear weapon by a State

As mentioned above, the nuclear taboo is still strong. And it seems logical that it will become even stronger as time goes on; it will become more difficult and more significant to cross the nuclear threshold when 70, 80 or 90 years have passed since the end of the Second World War.

This does not mean that the usage scenario is improbable. On the contrary, a number of arguments suggest that this scenario could even be considered as **"almost probable" by the time period considered**:

⇒ The deterrence equilibrium remains a fragile phenomenon governed by particular conditions, both technical and political, for which the presupposed "rationality of the actors" is undoubtedly the most fragile element. Furthermore under extreme circumstances, the access of some political elites to means of mass destruction would probably not be compensated by the risk of a nuclear reprisal (particularly if governed by religious considerations).

⇒ Nothing can confirm that a Western State would react rationally to a "NBC September 11". Similarly, faced with massive destruction of allied populations, a government could be inclined to decide to use the nuclear weapon to "restore deterrence" (particularly if the aggression was committed with a nuclear weapon).

⇒ Finally, there is an inverse approach to the "taboo" concept, referred to as "compliance". Over time, with the fading of nuclear explosions from our memories and the fact that the generations of leaders who experienced them personally are now dead, the taboo on use could weaken.

An American expert who studied this question concluded that the probability of repeated use of the weapon before 2045 (all scenarios considered) **is at least 40%**[108].

In any case, a hypothetical future use of a nuclear weapon by a State would have a profound upheaval on the strategic landscape - especially since its effects would immediately be replayed repeatedly on all television screens in the world.

The most probable scenarios are well known. A first category concerns crossing the nuclear threshold during a major conventional war between two regional powers (for example India/Pakistan); a second category would involve two major powers (for example China/United States, China/Russia); a third category would involve a major power and a regional power (for example China/India), and finally the fourth category would involve a western State and a regional power[109].

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[108] George H. Quester, "If the Nuclear Taboo Gets Broken", *Naval War College Review*, vol. 58, n° 2, Spring 2005.

[109] The slowness of Chinese nuclear modernization and the extent of Indian ambitions suggest that not too much importance should be assigned to these different categories, to the extent that the distinction between "major" powers and "regional" powers is likely to reduce.

The crossing of the nuclear threshold could be the result of a wide variety of circumstances: uncontrolled escalation; the will to restore a regional deterrence equilibrium; finally, willingness to sacrifice or to be a martyr (scenario in which the reprisal threat will not work)[110].

The consequences of a third use of a nuclear weapon would be extensive, but their precise nature and amplitude remain unpredictable. These consequences would depend on the circumstances of the scenario, the identity of the country that took the initiative, the nature of the target and the scale f the damage caused, adverse reprisal or not, perception by the belligerents of the political and military impact of such a gesture, reaction of the major powers, etc.

⇒ In some scenarios, for example if use of the weapon caused massive and visible destruction of civil populations, it could lead to **generalized de-legitimatization of the nuclear weapon** opening up the way to complete nuclear disarmament[111]. A first step in this field would probably be to adopt "no-first use" doctrines (possibly even symbolically in the form of a multilateral treaty) in order to limit the role of nuclear weapons.

⇒ In others, particularly if use of the weapon is perceived as having provided political or military advantages at an acceptable cost, it could open up the way to **adoption of war-fighting strategies –** and consequently to a search for means of protection against States that do not have the nuclear weapon.

⇒ Finally, it is not impossible that the taboo could be violated by accident or an epiphenomenon, particularly if the State that perpetrated the aggression is severely punished[112]. An "effective" nuclear reprisal (to restore deterrence) to a first use could even lead to **reevaluation of nuclear deterrence**, and contribute to giving nuclear weapons a more important part in defense strategies (with the risk of encouraging proliferation).

Obviously, the consequences of a third use would not be limited to the nuclear domain. Thus, one analyst suggests that after a nuclear attack on the United States *"the American people would demand that the government takes*

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[110] A slightly perverse argument can be added, that might be relevant in some assumptions: the next State that uses the nuclear weapon will become “the equal of the United States”. (In any case, the argument will undoubtedly be used by those who want to defend the position of the aggressive nuclear State.)

[111] Remember that images of the effects of Halabja event (use of chemical weapons by Iraqi forces against a Kurd village in the country, March 1988) contributed to an international conference being convened in Paris on the elimination of chemical weapons (1989). However, the massive use of such weapons by Iraq against Iranian forces during the previous years had a limited political impact (use “on the battlefield” rather than on a civil population; few images available and broadcast by international media).

[112] Violation of a taboo does not necessarily weaken it. Mutatis mutandis, consider the annexation of Kuwait in 1991 (the only case in which an independent member State of the United Nations was annexed by another one) did not create a “precedent”.

whatever steps are necessary to transform the world such that such an attack can never be repeated"[113].

1.3 – A nuclear terrorism act

As was suggested above, nuclear terrorism remains fairly improbable. However, realization of the extreme assumption of a terrorist attack in an urban environment (the most probable scenario) would have two major effects.

Firstly, starting from the principle that such an act of terrorism would be committed in an urban environment in order to cause the maximum number of victims (which would not necessarily be the case for other usage assumptions, for example by a State), it would profoundly modify the perception of effects of the weapon in that black and white archive images of the devastation of Hiroshima would be replaced by a collection of extremely violent images traumatizing for the international community. As a result, the arguments likely to be put forward by States holding such weapons (security of weapons in their possession, exclusively deterrent purpose of their arsenals, variable and controllable nature of the effects of the weapon, etc.) would undoubtedly be inaudible for a long time.

The possible medium and long term consequences of such a scenario for the future of nuclear weapons are largely the same as if they were used by a State: risk of durable delegitimacy, or conversely reevaluation of deterrence strategies due to the demonstrated effects of the weapon that would thus have occurred. And as in the previous scenario, undoubtedly the consequences would depend on the precise details of the scenario. For example, if it was proven that the materials used originated from the arsenal of a nuclear State, then we could expect very high pressure towards a massive reduction of arsenals and stocks, and particularly consolidation in even better protected storage sites than is the case today[114].

1.4 – A radical change to the Euro-Atlantic context

Finally, the fourth and last type of event considered is of a slightly different nature, since it is political and concerns French deterrence more directly.

A major change to the European political context could occur following four different events.

⇨ One would be the **United Kingdom renouncing nuclear deterrence**. Materialization of this scenario is extremely improbable during the next few years, particularly because on December 4 2006 London announced its intention to modernize its nuclear force and the presumed successor of Mr. Blair, Gordon Brown, has approved this decision. But until the United Kingdom has not made the major financial investment to replace the *Vanguard*/*Trident* pair (which will not happen before 2013-2014), it is

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[113] Stephen Peter Rosen, "After Proliferation. What to Do If More States Go Nuclear", *Foreign Affairs*, vol. 85, No. 5, September-October 2005, p. 14.

[114] The assumption of a State terrorism act is excluded in this case, because in fact it corresponds to the use of a weapon by a State and is therefore included in the previous scenario.

perfectly conceivable. The extreme assumption (no longer reasonable) that the life of *Vanguard* class SSBN submarines would be prolonged for about another ten years would mean that the United Kingdom could wait until about 2015 before making such a decision, and before the construction of four new ships is started (undoubtedly in about 2015-2020)[115]. In this scenario, opposing pressures would be applied on French deterrence. Firstly, it would become more valuable, particularly in the eyes of our European partners. On the other hand, France would have to face a stronger "demand for disarmament" from its closest partners (Germany)[116].

⇨ The other would be the creation of a **European Federation of a few States including France with a single political executive** by 2025-2030. In this case (which would undoubtedly include at least France, Germany and the three Benelux countries), the question of putting the French deterrence force in common would arise[117]. (On the other hand, the question of sharing the usage decision would not arise, because the basic assumption is a unified executive). Europeanization of the deterrence force would in any case have specific consequences that would create an upheaval in conditions for exercising deterrence (for example the direct involvement of German engineers and officers in keeping nuclear weapons in good condition and in service, etc.)[118]. But various scenarios could be imagined. The European executive could at least temporarily allow the “French” nuclear complex to function unchanged at least during a transition period; military forces of other nations could be involved in the deterrence environment (nuclear security, protection of SSBNs by nuclear powered attack submarines, transmission, research and development, etc.); and finally Air Forces of France’s partners could be adapted to carrying aerobic missiles. On the other hand, any decision to replace or modernize would then be necessarily European, with its industrial consequences (contracts opened up to foreign companies, elimination of safeguard clauses, etc.). **Finally, there is the scenario in which the nuclear disarmament effort would be a condition set by our partners for construction of a fully integrated political Europe.** Admittedly, it is difficult to see France's partners making abandonment of deterrence a *sine qua non* condition[119]. But the definition of a common nuclear policy could oblige

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[115] In this case it is assumed that the United Kingdom would do the same as in the 1990s, in other words with a particularly short production and commissioning phase, unlike the method used by France.

[116] One variant of this scenario would see London abandoning its ocean component at this time and replacing it by a new airborne component, thus abandoning all independent second strike capacity, but without completely renouncing maintenance of national deterrence.

[117] Remember that Germany and Italy had issued reserves and interpretative declarations in their NPT ratification document, according to which the Treaty must not form an obstacle to building an integrated Europe.

[118] France would undoubtedly insist that such a change should take place without affecting the technical credibility of the deterrence tool, with specific consequences in terms of training, choice of the communication language, etc.

[119] If the United Kingdom abandons deterrence, it would naturally have an impact on this debate, but it is difficult to predict how. For some, it would form an example that France should follow; but others would not fail to point out that the French force would then be the last “nuclear rampart” in Europe and would hesitate to ask for its disappearance ...

France to adopt a more flexible attitude – for example leading it to make concessions in its doctrine (adoption of a "non-first use" posture? French commitment not to deploy the weapons in other European countries?) in the field of capacities (symbolic reduction of the means or number of weapons?) or industrially (abandonment of reprocessing?).

- ⇨ The third conceivable scenario would be a **major transatlantic breakup.** A rupture between American and European societies following a major strategic event would be such that it would prevent continued traditional cooperation in defense and security. In such a context, London and Paris would probably feel obliged to work much more closely together than they do at the moment, and the European deterrence dimension would become much more important. **This assumption would open up the possibility of pooling the next generation of SSBN submarines, provided that schedules could be made to coincide** (which for France could mean early withdrawal of one or two ships in the *Triomphant* class[120]), or even adoption of a "French" solution for future replacement of British weapons.
- ⇨ The last would be the **attachment of Russia into European political structures,** Moscow becoming an ally in the formal sense of the term, member of NATO and partner of the European Union. In such a scenario, the sufficiency level would no doubt be reviewed downwards, since the "controlling" potential adversary would have disappeared.

2 – Three extreme global scenarios for the year 2030

2.1 – A "highly proliferated" world

The hypothesis of a highly proliferated world is defined for this essay as doubling the number of States with operational nuclear capacities, namely a total of about 16 to 18 countries (three new nuclear States in North-East Asia, three in the Middle East, one or two in other parts of world, South-East Asia or Latin America). Such a scenario could be due to collapse of the NPT or supposedly "effective" use of the weapon. It assumes that security guarantees given by Western countries (and particularly by the United States to about fifty States in the form of unilateral commitments or treaties) would no longer be considered as being sufficiently effective.

The causes of such a new wave of nuclear proliferation would partly define the modus operandi of such a proliferated world. Slow erosion of the NPT and a gradual increase in the number of States with nuclear capacities could enable the international environment to adapt progressively[121]. On the other hand, a

[120] After a life of 30 to 35 years, the *Triomphant* should be withdrawn from active service between 2027 and 2032 and the *Téméraire* should be withdrawn between 2029 and 2034. The first two British SSBN submarines in the *Vanguard* class will be withdrawn in 2022 and 2024.

[121] This concept of “homeostasis” of the international system should obviously be considered with caution because it is potentially dangerous. It could have threshold effects; the capacity of the system to adapt could be reduced beyond a certain point. The biological metaphor could be extended by considering that “mithridatization” would occur instead of homeostasis: the adaptation capacity of the organism to absorption of a poison becomes zero above a certain dose

"race to the atom" situation would be more instable, including because it would be some time before all new nuclear nations develop a secure second-strike capability.

In any case, most proliferation analysts are in the "pessimistic" school; it is more likely for a proliferated world to be an unstable world in which the risk of conflict and use of the nuclear weapon has increased, than it is for such a world to be stable. (The arguments are well known: probable lack of protected second strike capacities in many cases; limited capabilities of government control; difficulties of mutually understanding of strategic cultures and "red lines" for each country; etc.).

Crises and conflicts could be particularly complex in such a world, and it could be difficult to classify everyone as friends or foes. For example, pressure on ties with the West could encourage some countries such as Turkey or Saudi Arabia to access the nuclear status in one way or another, without formally denying their alliance with the United States.

Such a scenario could eventually bring western countries to initiate a total nuclear disarmament movement (see below). But other consequences could be imagined. For example the West could attempt to "maintain order" in such a world by declaring that they would take military action to support any country that is the victim of a nuclear aggression. Such actions could make use of conventional means, installation of mobile antimissile defense means, or even use of the HA-EMP effect.

Finally, the prospect of seeing a highly proliferated world by the year 2030 would undoubtedly have consequences on work being done for the fourth generation of nuclear reactors, the criterion of "resistance to proliferation" becoming more important.

For France, a proliferated world would have five specific consequences:

- ⇨ Faced with the increased number of crisis and usage assumptions, the question about the capability to independently detect a nuclear explosion would arise more acutely.
- ⇨ The nuclear status of the country would undoubtedly be less important in its international relations than it is at the moment. There would have been a devaluation of nuclear "currency".
- ⇨ Opinion and elites would then probably be more likely to demonstrate their support to maintain deterrence; but some proliferation assumptions would radically change the situation in terms of French perception (extreme assumption of a nuclear Algeria).
- ⇨ In a world comprising multiple nuclear powers, the French distinction between a "major power" and "regional power" would no longer be relevant.
- ⇨ The calculation of the degree of sufficiency of the national deterrence force could be modified by the possibility of crises or conflicts simultaneously involving two or three significant nuclear states.

2.2 – A new immediate major threat

The appearance of a major new immediate threat for Europe is a fairly improbable scenario. For geographic reasons, it is difficult to see where such a threat would come from, apart from the case of a newly expansionist Russia, possibly accompanied by a union of adjacent States built up around it[122].

The assumption of a "new cold war" between NATO and Russia is a well known scheme. On the other hand, a hypothetical alliance between Moscow and Peking would be a more unexpected situation.

Other major threat scenarios are conceivable, but they would not have the same consequences for Europe. The assumption of a Sino-American confrontation for domination of Asia is fairly probable. But it would hardly result in a massive and immediate threat against Europe. Particularly because in one unexpected variant, Russia could be allied with NATO against Chinese power.

Other major threat scenarios are even more improbable. We might think of a "regional" nuclear power that has become a "major" power. This scenario could concern India, Japan or Iran by the year 2030.

Iran as a major power (scenario which would undoubtedly require the price of oil and gas to remain high so that Teheran has the means of developing its military arsenal) would obviously create a particularly serious problem for Europe, particularly if Turkey were to enter the Union one day. And if Ankara is not admitted, Turkey might consider that it has no other choice than to align itself with Iran or build up its own nuclear deterrence force.

In summary, there is no probable major threat scenario that would be as demanding as the appearance of a Russian threat on the European continent.

2.3 – The end of the nuclear era

Finally, we need to consider the scenario in which pressure for disarmament is so strong that Western political authorities envisage renunciation of nuclear weapons.

These extreme circumstances could only occur under very precise scenarios such as:

- ⇨ nuclear war or the use of the nuclear weapon creating a major psychological shock in opinions;
- ⇨ fast and uncontrolled nuclear proliferation, leading Western Leaders to decide that a world without nuclear weapons would after all be less dangerous than a world with a large number of nuclear powers;
- ⇨ development of a new type of weapon that, if used, would have physical and psychological consequences at least as great as those of nuclear weapons.

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[122] The other possibility of a union of Arab countries on the South shore of the Mediterranean (militarily and politically strong to the extent of forming an immediate major threat) is sufficiently improbable for it to be ignored.

The French authorities could only abandon the deterrence force if there is no immediate threat against European security, as perceived by the government. It would more probably occur when systems in service come to the end of their life, before significant investments had been decided upon for their renewal; this costs/advantages calculation would undoubtedly form part of the reasoning made by the political authorities. (As suggested in the previous scenario, in one extreme assumption the deterrence force might also be unilaterally abandoned as a consequence of the construction of an integrated political Europe).

4 – GENERAL CONCLUSIONS

In the nuclear field as in other fields, it is difficult to predict very far into the future in terms of strategic prospects; it can be assumed that our vision is not good enough to draw useful conclusions beyond what has been said above for periods more than twenty-five years into the future.

Forty years from now, we will reach a very important date beyond which it is impossible to make any prediction at the moment: **nuclear weapons will be one hundred years old in 2045**[123]. All of the final survivors of Hiroshima and Nagasaki will be dead (and so will be the designers of the weapons on which nuclear tests were carried out). If the weapon is not used again, the logic of nuclear deterrence could be considered as belonging to the history books, particularly because technological and social changes would no doubt by then have been very significant. **For both cultural and technical reasons, it seems fairly improbable that deterrence strategies based mainly on nuclear weapons will be maintained in 2045**. Therefore weapon systems that will have replaced the generation currently in service will probably be the last.

The nominal scenario described above can be defined due to the "viscosity" of a number of elements and parameters in the international context. By construction, this nominal scenario is the most probable. But at twenty-five years, **its probability of occurrence should be considered as not more than 50%.** The world has seen no less than two major strategic surprises in twelve years (1991, 2001). Fast "phase changes" are not only possible, but even probable when considering a period twice as long (twenty-five years instead of twelve years)... Although nuclear deterrence has shown that it could easily be adapted to the post-1991 and post-2001 contexts, it would be unreasonable to assume that this will always be the case.

An examination of the scenarios suggests the following options in terms of operational conclusions for the future of nuclear deterrence in France:

⇨ **It is wise to expect attrition** to budget, technical and human means assigned to nuclear deterrence**,** except perhaps for dual-use fields (civil & military, nuclear & conventional).

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[123] Coincidently, this date symbolically corresponds to the maximum useful life of military grade plutonium, as recently estimated in the United States (Walter Pincus, “Plutonium Lifespan in U.S. Weapons Much Longer Than Thought”, *The Washington Post*, November 30 2006).

- ⇨ **A regular reevaluation of deterrence needs will certainly be requested** for all scenarios, no doubt every five years.
- ⇨ **Therefore reactivity, flexibility and adaptability** will be indispensable characteristics for the French nuclear complex.
- ⇨ All technological and human components of **intelligence will be even more necessary** than it is at the moment for construction of planning (detection of a virtual or hidden threat in time, precise identification of power centers, understanding of doctrinal logic of Nuclear States, identification of missile firings, identification of the origin of materials following a nuclear or radiological attack, etc.).
- ⇨ **In the future, China will be a determining factor for international strategic equilibriums**, including indirectly for France, much more importantly than it is at the moment.
- ⇨ The **traditional distinction between "major powers" and "regional powers" could become less clear than in the past**, with consequences in terms of planning.
- ⇨ The concept of national independency in the nuclear field will not have the same meaning as in the past, for political and industrial reasons. **The political demand for cooperation between Western countries** in fields related to nuclear deterrence, **particularly with the United Kingdom**, have a good chance of being stronger than in the past.
- ⇨ **The year 2012** could be a significant step in studies on the future of nuclear deterrence, particularly in France. The following will all occur at the same time in 2012:
  - ❖ The first antimissile defense systems will come into service in Europe at this time (the NATO program and the American GBI site), while installation of the initial American homeland defense capacity will be completed (between 20 and 50 missiles),
  - ❖ The end of the program to reduce the American nuclear arsenal planned in 2001, and commissioning of the first RRW weapons and the conventional new Trident-2 missile (precision 10 m),
  - ❖ Completion date of the Russian-American treaty on limitation of operational strategic weapons (the Moscow treaty),
  - ❖ The end of destruction of chemical weapons (date planned by the CIAC),
  - ❖ Completion of the main tools for the simulation program (LMJ, AIRIX),
  - ❖ The next French presidential and parliamentary elections.

In all cases, the most important event that could radically affect the nuclear deterrence context in one direction or another depending on the circumstances, would be a "third use" of the weapon.

The future of French deterrence: some illustrative scenarios

2007-2017 period

Scenario 1: Modernization programs kept in their existing state and continued

Scenario 2: Symbolic reduction of the weapons stock (10 to 15%)

Scenario 3: Reduction in capacity

3.1: Elimination of the airborne component

3.2: Reduction of the airborne component and integration into NATO

3.3: Massive reduction of the weapons stock (25 to 50%)

2017-2030 period

Scenario 1: Maintain existing state and decision to renew the two components

Scenario 2: Decision not to renew the airborne component

Scenario 3: Creation of a common nuclear force with the United Kingdom (six SSBN submarines instead of eight)

Scenario 4: Decision not to renew the ocean component, integration of French nuclear forces into NATO