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Daivis Petraitis*
*The Ministry of National Defense of the Republic of Lithuania***

Missile Defense - What It Is Designed For and How It Is Understood

This study will discuss briefly the history of missile defense, the concept of its design, created by a pioneer of the system—the USA—, as well as differences and similarities of three different and more or less functional missile defense systems existing today. The indirect influence and impact of a missile defense system to defense policies and international relations will be presented in brief as well. Additionally, the following points of popular discussion will be addressed: the potential of missile defense to substitute nuclear weapons and nuclear deterrence and its role as an instrument of propaganda and pretext to justify actions will be discussed in more detail. At the end of the study, based on all the prior-named features of the missile defense system organization design and known differences of existing US, NATO and Russian missile defense systems, the feasibility of the creation of a single missile defense system, proposed by Russia, will be explored.

Introduction

With the increase in the numbers of ballistic missiles that started right after the Second World War and reached its zenith during the Cold War, political and military authorities of the USA and USSR started to think about organizing a defense from those missiles. Although the first ballistic missile defense systems appeared already in the 1950s 1960s of the previous century, technologies that allowed making reliable ballistic missile defense systems were absent on both sides. To create and develop such technologies, and apply them in building new weapon systems was very costly. At the same time any achievements made could have been made useless by opponents only increasing a number of their own ballistic missiles. So, all costly US achievements in developing ballistic missile defense (BMD) systems were easily countered by

* *Major (ret.) Daivis Petraitis* is an employee of the Department of International Relations and Operations of the Ministry of National Defence of the Republic of Lithuania. Address for correspondence: Totorių g. 25/3, LT-01121 Vilnius, tel. +370 273 5673, e–mail: petraitisd@yahoo.com

** Evaluations and ideas presented in this article exclusively belong to the author and can never be considered an official position of the Ministry of National Defense of the Republic of Lithuania or its departments.

the Soviets simply by producing more ballistic missiles or improving existing ones. One such improvement worth mentioning was a change of ballistic missile design that allowed a number of warheads to be placed onto one ballistic missile. As a result, instead of one or two interceptors previously required to destroy a missile, now ten or more interceptors were needed. Later, besides real warheads, decoys were placed too, so that one ballistic missile could spread ten or more reentry vehicles: real warheads and decoys. To eliminate this threat, even more, BMD systems and interceptors were needed. Later improvements led to the development of maneuverable reentry vehicles, so the number of systems and interceptors needed kept growing and the interception of a ballistic missile became more complicated. As a result, the USSR did not care about BMD and focused all its efforts on producing more ballistic missiles.

Finally, at the end of 1960s, the West shared a mindset that the best defense against nuclear ballistic missile threat was a policy of mutual assured destruction – MAD. The US offered the USSR the opportunity to sign a treaty proposing that both sides stop any development of BMD systems. Even though at the beginning those proposals were rejected, later, after signing the first strategic arms limitation treaty, START, the USSR agreed and in 1972 countries quickly agreed and signed an anti-ballistic missile treaty - ABM. The treaty restricted further development of BMD systems and allowed countries to have only limited BMD capabilities devoted to the defense of limited territories. In the beginning both countries were allowed to defend two separate places – the capital and a base of ballistic missiles; but later countries lost any interest in developing BMD and the number of places to defend was reduced to one. The US decided to defend a ballistic missile site and together with Canada established for that purpose the North American Aerospace Defense Command (NORAD). As weapons for the BMD short range missile systems were selected. The USSR decided to defend its political leadership and established a BMD system designed to defend Moscow and its close surroundings. As a weapon for defense an A-35 type BMD system was created. One of variants of this system (A-350) was armed with nuclear warheads and could destroy an opponent's ballistic missiles at the distances up to 350 kilometres from Moscow[1]. Later the system was modernized to the A35M system and around 1995 substituted by the A-135 system.

The ABM treaty lasted for almost thirty years. It satisfied both sides. It is worth mentioning that the US kept assigning and spending limited resour-

[1] Russian/Soviet Anti-Ballistic Missile Systems, Technical Report APA-TR-2009-1203, Sean O'Connor, BA, MS (AMU), December 2009

ces for a continuation of programs to develop BMD capabilities. One of more famous of those programs was President Reagan's Strategic Defense Initiative (SDI), which, according the American's understanding, did not confront the treaty, even though the essence was an attempt to design a system to destroy ballistic missiles. Still, a real breakthrough came only after the collapse of the USSR, when the threat of massive ballistic missile attack disappeared and the threat of limited ballistic missile attack against the USA appeared. The new threat was caused by an increasing number of countries possessing ballistic missile technologies and limited numbers of missiles. It could also be that one of the motives to move forward in developing BMD capabilities and terminating the ABM treaty was a new Russian approach to a code of conduct of military conflict. Russia, while possessing only a portion of the former USSR military capabilities, decided that conventional power was not enough to guarantee its security and approved a new military doctrine in 2000. According to the doctrine a "door step" for nuclear weapons to be used was lowered. Already in 1999, during the military exercise "West 99 ", and later, during other strategic military games, Russians kept imitating limited nuclear attacks, usually done by short range ballistic missiles, and after this terminating all military actions. Such a code of action might be called "nuclear blackmail". Russian chose it to terminate warfare run by conventional forces. Limited nuclear strike had to demonstrate a strong determination not to be afraid of using nuclear weapons. It had to show an opponent that if military action by conventional forces is not terminated the full nuclear power option would be used. One or other cause being true, in 2001 US President Bush informed Russia about willingness to terminate the ABM treaty and after six months, foreseen in the treaty, did that. Since then the development of the American BMD system, which is being discussed almost every day now, began.

1. Missile Defense as a Strategic Military Defense System

A strategic BMD system as such had never existed before, so we could say that the US was the creator of all basic general principles for it. In January 2002, the US Secretary of Defense signed a DoD memorandum called "Missile defense program directions". The memorandum stated that the main tasks for a BMD were to defend US territory, its forces and allies from ballistic missiles,

by effectively engaging them in all stages of their flight[2]. This meant that the BMD should be able to engage and destroy ballistic missiles of all ranges (short, medium, long or intercontinental) as well. Existing BMD systems at that time allowed engaging ballistic missiles only in the terminal stage of their flight. As a result any separate BMD system could defend only a conditionally small area, usually approximately few tens square kilometers. To defend effectively all US territory, its allies and deployed forces a large number of such systems would be needed. A clue to that dilemma was provided in the memorandum as well. The memorandum "b" direction pointed out that the BMD system had to be able to engage ballistic missiles in all stages of their flight. This meant that the US had to develop new technologies, which later could be used to create new BMD systems able to destroy inflight ballistic missiles not only in the terminal but also in the midcourse and boost stages. (Figure 1).

Figure 1. **Stages of Ballistic Missiles Flight**

Creation of such systems would help solve the problem of a large numbers of systems required as well. The rationale was as such: the earlier in a ballistic missile flight trajectory a system could engage and destroy inflight missiles, the bigger the territory it would be capable to defend. For example, if you can destroy an inflight ballistic missile during the midcourse stage (until numerous warheads and decoys were not spread yet) you need fewer interceptors and systems. So instead of tens of BMD systems able to destroy incoming ballistic missiles in the termination stage you might need just a few systems to be able to destroy ballistic missiles in the midcourse stage.

Another statement of the memorandum, which described the shape of the strategic missile defense system, points out that the system must be unified and integrated. In the real world this means that the system will be composed of different missile defense elements like sensors, weapons and weapon control systems and they all will be integrated into one joint system. The last will be able to accommodate any extra already existing BMD elements or newly created ones.

And finally, according to the memorandum the authorities were obliged to create a ballistic missile defense system using a capability approach. This

[2] "a" and "b" point, DoD memorandum "Missile defence program directions", 2 January 2002.

meant that the system would not be targeted against any particular country and the ballistic missiles it possesses. The system has to be able to intercept any type, any system, and any range ballistic missiles fired from anywhere.

1.1. The US National Strategic Missile Defense System

The DoD memorandum not only described the kind of a system the US national strategic BMD system had to be; it also established an organization to create the system, the Missile Defense Agency, or MDA.

It is worth mentioning that the DoD was a result of the US Congressional document dated from 1999 and named the "National Missile Defense Act". The Act stated that the US must develop new technologies and to use them to create a national ballistic missile defense system. The system had to be able to coup with accidental, unauthorized or deliberate limited ballistic missile attacks.[3] The highest US executive authority, the US president, approved and supported the DoD memorandum with Presidential National Security Directive-23 dated December 16, 2002. The directive announced that the country has to build missile defense capabilities able to fulfill all requirements of the National Missile Defense Act. Additionally the presidential Directive stated that the program is open-ended and it will be expanded and improved as required.

When talking about the US missile defense system it is important to point out that the system has to apply a hit-to-kill (or a direct hit) method to destroy incoming ballistic missiles. The speed a ballistic missile can reach is measured in kilometers per second. Interceptors, used in a missile defense, develop similar speeds. Achieving a hit-to-kill result is like hitting a bullet with another bullet. To succeed in that one needs to possess very modern and advanced technologies in ballistic missile detection, identification, tracking of its flight, transfer of information, analysis of data, interceptors control in flight and in a number of other fields. It was necessary not only to create and develop those technologies but also to put them into new weapon systems. But the effort was worth the price – a direct hit very effectively destroys ballistic missile. When an interceptor flying so fast hits an incoming ballistic missile travelling at similar speed, the kinetic energy transfers into heat. As a result both missiles evaporate during a hundred parts of a second. MDA tests show that during an intercept up to 80 percent of the missiles evaporate; thus, as a result of the intercept, nearly no debris what so ever falls down. Another good

[3] The 106th US Congress, "National Missile Defence Act of 1999", 1 January 1999.

thing about the hit-to-kill approach is that the destruction of a ballistic missile happens so fast that the warhead does not detonate. This reduces the danger of nuclear, biological or chemical pollution to a minimum. Also, an interceptor has no explosives. Instead it has a solid metal bulk warhead. As a result interceptors are much safer in comparison to other missiles, which have explosive warheads. It is worth mentioning that other countries still prefer to have interceptors with explosive warheads. The destruction of a ballistic missile in this case is achieved not by hitting directly, but by detonating an interceptor close to the target. The method is called a proximity detonation. This does not require hitting a ballistic missile precisely. While exploding close to it an interceptor spreads hundreds of pieces of shrapnel, which cut a ballistic missile into pieces. To build such systems requires simpler technologies, but at the same time, when used, they produce huge amounts of debris after an intercept. That debris might include the remaining parts of nuclear, chemical or biological warheads and will fall down to ground. Besides that, interceptors have explosives, which could detonate, so such missiles are not as safe as missiles that have just a metal bulk.

Following all decisions and requirement mentioned above, the MDA proposed the creation of an integrated BMD system which would consist of different independent and specialized sensors and weapons "plugged" into a unified control system covering all command, control and communication issues and usually called command, control and battlefield management system – C2BMS. Every separate sensor or weapon has its own system designed to guarantee its functioning and orientated to perform specific tasks like the detection of ballistic missile launch, tracking of missile flight, interceptors flight control and an intercept of a ballistic missile in certain flight trajectory phase and so on. This design received the name of "System of Systems". Figure 2 presents a schematic view of this system of Systems.

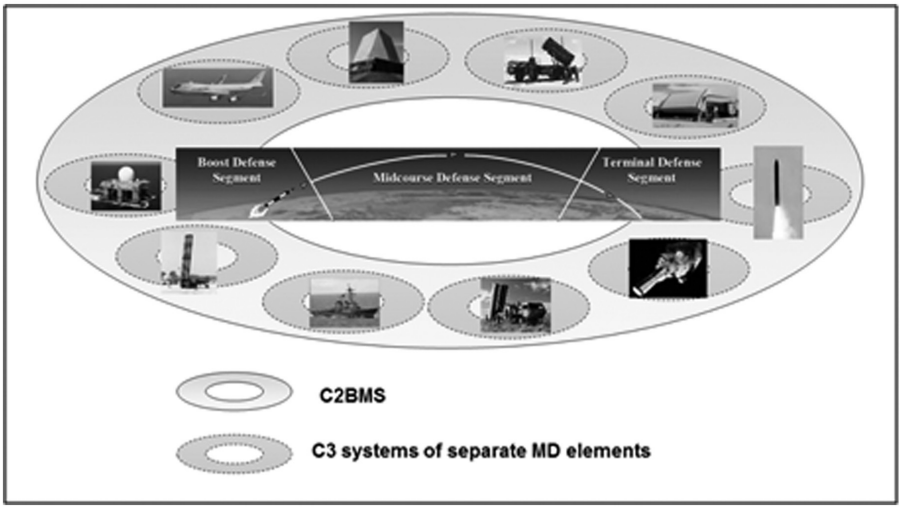

Figure 2. **Organization of The US Ballistic Missile Defense**

As previously mentioned, an additional feature of the system is that elements of the system are more or less designed and adopted to a particular ballistic missile flight trajectory segment or phase. Some of them, as an example sensors, might have quite a wide range of application, and some, like weapon systems, might be designed to cope with missiles in narrower intervals. Figure 3 demonstrates possible application ranges of different weapon systems in the ballistic misssile defense system.

Figure 3. **Potential Application of Missile Defense Weapons**

An appropriate financing was approved for the creation of the national BMD system and had kept increasing in past years. In 2008 it was 8,8 billion USD, in 2009 - 9,4 billion USD, in 2010 - 9,5 billion USD, in 2011 - 10,3 billion USD and in 2012 - 10,4 billion USD. Despite recent decisions to reduce the total US defense budget, the missile defense programs remain almost

untouched. In 2013 plans are to assign up to 9,7 billion USD to continue the program.

Because money was available, results came through already in 2004 when the initial operational capability (IOC) of national BMD system was announced. From the beginning, to create a base for defense of US territory, the US modernized four early warning radars designed to detect a launch of ballistic missiles and deployed ground based interceptor (GBI) systems in Alaska and California. Additionally, already existing antiaircraft defense PATRIOT and AEGIS systems were upgraded and adopted to perform missile defense tasks.

The next step was to protect US allies and deployed forces. The US signed adequate agreements on missile defense with some allies, which allowed the allies to join the creation of a missile defense. Such agreements were signed with a number of European (the UK, Denmark, Netherlands, later Poland, Czech Republic, Romania, Italy, Spain and so on), Asian (Japan, South Korea, Australia, New Zealand) and other (Israel, Turkey) countries. All participating countries contributed to the US national missile defense program by participating in different research and development projects, offering national territory to the US missile defense elements deployment or even providing national weapon or sensor systems. Scientists and engineers from those countries got an opportunity to join in the development of new technologies as well.

Sometime around 2007-2008 the US missile defense system started to expand beyond the US in a larger scale. As the national missile defense program progressed, early warning radars in Europe and Greenland were upgraded and new sea and land based sensor and weapon systems, mostly mobile, deployed in Asia (Japan and South Korea) to protect US and ally troops in the region. At that time the US deployed a mobile sea based X-band radar in the region and a land based ANTPY-2 radar in Japan, as well as announced plans to deploy land based radar in Czech Republic and GBI interceptors in Poland.

Progress in upgrading the sea based AEGIS system and improvements of standard missile (SM) systems to SM3 level made the system capable of intercepting ballistic missiles and suitable for missile defense. The land based BMD was strengthened by adding more PATRIOT capabilities for the missile defense only. Besides that, the development of a new program the Theatre High Altitude Area Defense, or THAAD found great success. As a result of this a new weapon system, THAAD system, was developed. Other programs like space surveillance and tracking, air based laser (ALB) placed in BOEING aircrafts, kinetic energy interceptor (KEI), two stage GBI and other continued.

Some of those progressed more, some less. An example of a success story is the AEGIS SM3 program. All changes and improvements allowed further development not only in a sea, but also for a land based SM3 design. The land based SM3 version is seen as a sort of substitute for GBI interceptors.

In 2008, after president Obama took office, the decision was made to speed up the creation of missile defense. In 2009, the missile defense program review was initiated. While reviewing the program, in autumn 2009, the US announced changes in the European part of national missile defense developments and a decision to continue by adopting the so called European Phase Adopted Approach, EPAA. Later, in 2010, when NATO announced a decision to create a NATO missile defense system, the US specified that EPAA would be an American contribution to this system. EPAA scheduled developments of US missile defense in Europe would be done in phases. Adequate missile defense elements: weapons and sensors would be deployed or stationed during every phase. The national missile defense review was finished and final report (Ballistic missile defense review report) presented in 2010.

The new program declared the same tasks, but implementation of them was clarified. Essentially the new program suggested a way to get a real, functioning missile defense system faster. With the main task–to defend the US and its ally territories and forces from limited ballistic missile attacks–remaining unchanged, the new program proposed the use of only those missile defense elements (sensors and weapons) which were already tested and approved. The earlier program allowed some elements to be included into the system while still in a developmental stage. The best example here could be two stage GBI interceptors, which were under development, but at the same time it was already planned that they would be stationed in Poland.

One more new program feature was an affordability requirement. According to it all new elements had to be affordable. The system had to be more flexible as well. The earlier proposed the US missile defense system possessed more stationary elements, whereas the new program suggested switching to more mobile systems.

The review report became an example of the US openness in missile defense as well. At first, it openly said what the US is going to do in developing its national BMD inside and outside the country. The document stated that the US will maintain and expand existing stationary elements inside the US (the GBI interceptors), to increase the number of sea based AEGIS SM3 systems upgrading those to SM3 IA, IB, IIA and IIB versions and to create a land version of the SM3. Additionally, the US announced its willingness to increase

funding for the development and acquisition of sensors and weapons designed to encounter ballistic missiles in other phases of their flight trajectories, to buy additional existing missile defense elements and to continue with the development of two stages GBI. Regarding the deployment of system elements outside, in Europe and Asia, it was noted that the additional existing systems PATRIOT PAC3, THAAD, sea based SM3 IA, radars AN/TPY-2 and so on would be bought and deployed. After successful completion of THAAD testing and establishment of the first THAAD battery in the US Army[4], those systems quite soon would also be provided for the missile defense missions only.

Second, the document declared a sincere US wish to attract as many countries as possible to participate in missile defense developments on a bilateral or multilateral basis. As previously mentioned, the document provided detailed plans on missile defense development in Europe as well. It stated that regional missile defense capabilities in Europe would be developed gradually, during four EPAA phases. The first phase, ending in 2011, had foreseen the deployment of already existing sea based AEGIS systems and forward based AN/TPY-2 radar. Priority in this phase would be given to southern Europe and the system itself was oriented against short and medium range ballistic missiles. The second phase called for additional existing sea based missile defense components, a call for land based SM3 systems stationing in southern Europe until 2015 and additional sea based systems and radars to expand the missile defense coverage in Europe. The third phase, which is expected to end in 2018, suggested additional stationing of land based SM3 systems in northern Europe and switching to an upgraded version of SM3, (SM3 IIA). This upgrade would allow defense against medium and long range ballistic missiles. The fourth phase with the end in 2020 would face another upgrade of SM3 to SM3 IIB version and allow the system to defend Europe from a complete range of ballistic missiles including intercontinental.

1.2. NATO Territorial Missile Defense System

Europe has a particular place in the US missile defense program. As soon as the program was started, the US took the initiative to paste that idea into NATO agendas as well. Already in 2001 NATO started to discuss the possibility of creating NATO theatre level ballistic missile defense[5]. Right after the

[4] "US fields first THAAD battery", Jane's Defence weekly, 14 March 2012.
[5] S.A. Hildreth, Carl Ek, „Missile Defense and NATO's Lisbon Summit", Congressional Research Service, 11 January 2011.

NATO summit in Prague, back in 2002, a separate study, exploring possibilities to create a NATO missile defense system, was initiated.[6] In 2005, NATO started the so called Active Layered Theatre Ballistic Missile Defense – ALTBMD program. Basically the proposed organizational schema of ALTBMD was almost identical to the US one – NATO creates a C3 system and NATO countries contribute assets like weapons and sensors. Such theatre level missile defense system, when finished, will be able to protect deployed NATO troops from short and medium range missiles. In 2005 NATO initiated a study to explore the feasibility to create a missile defense system for the entire NATO territory. Results of that study were presented in the NATO summit in Riga, in 2006[7].

Discussions about NATO missile defense kept running for some years and, in Lisbon at the NATO summit in 2010, a political decision was eventually made. The declaration of this summit[8] stated NATO's determination to create a missile defense system that will be able to defend the entire NATO territory and populations from ballistic missiles. It was decided that the new system would be created on the basis of ALTBMD by expanding it. The ALTBMD would be extended to cover the entire NATO territory. This system would be a common NATO asset. At the summit NATO decided to offer Russia cooperation in the missile defense field. This decision assigned the NATO missile defense besides a pure military a political role as well. The military role of future NATO missile defense remains classical – to be a system for militaries to be used against ballistic missiles. At the same time the political role of missile defense could be expressed in two ways. At first, as the summit declaration stated, the NATO missile defense system would show a unity of allies in accepting risks and sharing costs at the same time representing one more field (similar to nuclear deterrence) for cooperation and demonstrating an transatlantic link. Second, the NATO missile defense may become a platform for cooperation between NATO and other regional countries and strengthen a regional security in general. Despite that only Russia was mentioned in the summit declaration, all other interested countries were welcomed to take part in such cooperation.

Basically the NATO missile defense system will be organized in a similar way to the US system. It will be a system of systems, where NATO owns the command, control and communications net (similar to the US C2BMS), which is able to accommodate all national missile defense elements (sensors and weapons) offered by NATO countries. As soon as this decision was taken,

[6] Missile Defence Fact Sheet, NATO, June 2011.
[7] S. A. Hildreth, Carl Ek, „Missile Defense and NATO's Lisbon Summit", Congressional Research Service, 11 January 2011.
[8] 36, 37, 38 points, „Lisbon Summit Declaration", 20 November 2010.

the US made a proposal to count all EPAA elements as the American contribution to the NATO missile defense. Other NATO countries are also welcome to offer national weapon and sensors to become national contributions to the system. Countries that possess no such systems could offer national territories for the deployments of elements of NATO missile defense. All this, united in one system, would provide a system able to perform all the tasks assigned to it. Of course, taken into account that the US contribution is sizably larger compare to other ones, the time lines for developing of the NATO missile defense should match the ones of the EPAA.

Talking about progress NATO made in developing its missile defense, it is worth mentioning that already in 2010 the first ALTBMD initial operational capabilities named as "Interim Capability Step 1" were created. This allowed NATO militaries to start planning missile defense scenarios. At the end of the same year "Interim Capability Step 2"[9] was developed. The work continued and in the beginning of 2011, at one of the NATO CAOCs located in Uedem, Germany, the commander of NATO Air Component (AC) Gen. Mark A. Welsh III, while visiting the CAOC, saw a demonstration of this system[10]. In November 2011 the first systems test took place at shooting range. During the NATO missile defense exercise "Rapid Arrow" a PATRIOT battery from Germany working together with US AEGIS ship and a frigate from German Navy, used the NATO C3 network prototype to exchange information and intercepted a target imitating an incoming ballistic missile. It is planned that the rate of development remaining the same, after Chicago summit in 2012, NATO would be able to announce about a creation of the NATO missile defense Interim Operational Capability. If no surprises are met while continuing development of the system, it is expected that final operational capability (FOC) of NATO missile defense in low and medium highs might be achieved as soon as 2018[11].

Despite many similarities to the US missile defense system, the NATO missile defense possesses some differences. At first it will have to accommodate national systems which might work based on different algorithms or destroy targets not by direct hit. This will be a challenge, while creating a NATO missile defense C3 network and software, to provide reliable information exchange and management of the entire system.

Second, the NATO missile defense would give much more attention to managing the consequences of an engagement (COE) and consequences of

[9] Missile Defence Fact Sheet, NATO, June 2011.
[10] „Commander AC Ramstein visits CAOC Uedem", "US Air Forces in Europe", 31 January 2011.
[11] Missile Defence Fact Sheet, NATO, June 2011.

the intercept (COI) of ballistic missile for civilians. This is due to the fact that Europe is more populated in comparison to the US. However, different approaches to the problem exist in different countries as well. Some countries state that the issues of COE/COI are very important. They argue that besides NATO military, civil defense people from NATO countries have to work side by side and organize civil defense any time the military is "fighting" a ballistic missile. Other countries argue that COE and COI, thought to be very important, are still different in level of importance. An explosion of a ballistic missile would have consequences a hundred times worse compere to on COE or COI, so the most important task is to concentrate the system on effective military personnel actions[12]. One way or another it is already obvious today that one of the NATO committees responsible for civil defense, the Civil Emergency planning Committee (CEPC), will be involved in the creation of NATO missile defense.

Third, COE/COI problems prove that all decisions regarding any movement in creating NATO missile defense will be harder to ochieve to compared to the US. Already today NATO has a number of bodies involved in different discussions and decisions on missile defense. Those are the NATO Defense Policy Planning Committee (DPPC), NATO Conference of National Armaments Directors (CNAD), NATO Military Committee (MC), NATO-Russia Council (NRC). As previously mentioned, the CEPC is getting involved as well. At the same time today it is unclear what impact a new NATO agency reform will have on NATO missile defense developments.

1.3. Russian Strategic Missile Defense System

As previously mentioned, Russia never gave priority to missile defense. The main motto Russia adopted was "more and better ballistic missiles make the best deterrence". So Russia kept producing ballistic missile defense systems only to defend the place allowed by ABM treaty - Moscow. The systems were using a proximity detonation to destroy inflight ballistic missiles. For the worst case, a nuclear version of missile defense, the A-350, missiles were available. They could carry nuclear warheads from ten kilotons to a few megatons[13], so no precision was needed to destroy flying ballistic missiles. Officially the service of those missiles had to expire around 2005, but a recent Russian statement

[12] B. Sweetman, "No Easy Answers To Missile Defense, " "Aviation Week", 7 December, 2009.
[13] „Насколько боеспособна российская ПРО?", „Правда" 27 января 2011

shows that Russia plans to upgrade and extend the service of this system[14]. Besides the strategic missile defense system, tactical level systems like the S300 were developed as well. They were used mainly for antiaircraft defense of separate points or small areas, but also possessed limited antimissile defense capabilities. According to the American scientist federation experts, the S300 system might have a nuclear version, where a nuclear warhead provides a potential to defend larger territories. They estimate that even today up to one third of different S300 systems might carry, if required, nuclear warheads[15].

We already know that a primary task of S300 is antiaircraft defense. Conventional S300 interceptors have a warhead of a few tens of kilograms of high explosives and shrapnel. While exploding in close proximity to an aircraft the shrapnel is spread and cuts the aircraft or ballistic missile into pieces. From the pool of first S300 systems, only the S300V version, which was designed for troop protection, had a limited antimissile defense capability. The S300P version was designed solely for antiaircraft defense. Later all S300 versions got a limited antimissile defense capability. Russia continues modernizing them today. Even the S400 system, today declared as a foundation for Russian missile defense, in its essence is only a slightly more modernized version of the S300 PMU. Furthermore, despite all loud announcements, a majority of the S400 remain armed with old S300 interceptors. Those are planned to be exchanged by new, long range 40N6 type interceptor as soon as testing of them is finished[16]. Until the exchange is done, the S400 system remains at S300 level, with the same, very limited antimissile defense capability. But the most importantly, it is very difficult to expect a breakthrough in technologies, because the S400 system and even forecasted the S500 system will keep the same approach to destroying a ballistic missile (a proximity detonation), so all the progress would be achieved only by improving technical characteristics of old interceptor and other elements of the system.

It is worth mentioning that the production of S400 today is far from the numbers Russia usually declares. There are recent announcements that Russia plans to build two new factories, which would start to produce the S400 and S500 systems for Russian Air-Space defense purposes in adequate numbers as soon as 2015[17]. So in the best case, this would be in 2015, but today they stand

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[14] „ Войска ВКО могут расконсервировать ракетные шахты в Подмосковье“, РИА Новости, 17 сентября 2012

[15] H.M.Kristensen „Non-strategic nuclear weapons“, Federation of Americam Scientits, Special report No.3, May, 2012

[16] А. Никольский, „Ракеты изготовлены, ждем выхода в море“, „Ведомости“, 12 мая 2012

[17] А. Гаравский „На страже неба Отчизны“, Красная звезда, 19 апреля.2012

where they are, and Russian ballistic missile defense foundation still consists of the S300 and a few S400 systems only. Based on what we know now, all they could provide is a limited missile defense.

Another Russian missile defense difference as compared to the US is the following. Russia prefers the universalization of a system instead a specialization. In simple terms, Russia, instead of designing a system for a particular task (for instance a midcourse flight trajectory), prefers to develop a few types of interceptors to a system with the task to extend its application range. As an example, the S400 system might have three different interceptors, which are designed to intercept targets at different ranges but in the same, terminal defense segment. By continuing improvement of those interceptors Russia hopes to create an interceptor that would be able to cover other ballistic missile flight trajectory segments as well. (Figure 4).

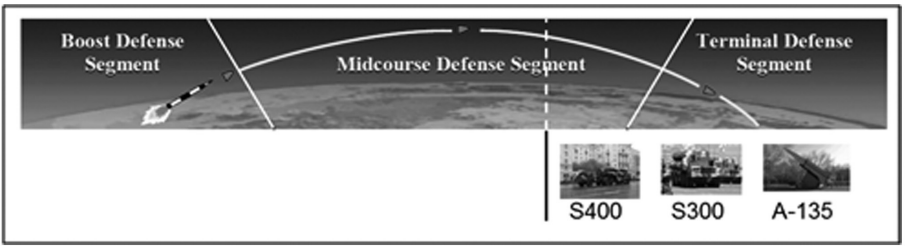

Figure 4. **Potential Application of Missile Defense Weapons**

For early warning of the launch of a ballistic missile, Russia, like the US, uses both land and space based early warning sensors. The Russian space based early warning system, called "Oko", is quite old. The first satellite was launched back in 1991. Later the system was being strengthened on regular bases. But even the Russian military was not happy with the system, so in 2011, the former commander of the Russian Air-space defense, gen. O.Ostapenko, mentioned Russia's wish to create a new system. In was not clear at the time what kind of system it would be, and there is no information today about how well the Russians have progressed on this.[18]. To summarize, the space early warning sector of the Russian missile defense is not as good as was expected.

The situation with the land based early warning sensors is better. They have undergone a modernization program in recent years. Old radars are being replaced by new "Voronezh" type radars, which are built in a number of new places.

[18] В России создаются новые спутники для системы предупреждения о ракетных пусках" Минобороны, ИНТЕРФАКС-АВН, 19 апреля. 2012

All work goes smoothly and quickly, because Russia sorely needs a unified radar system established along its borders to ensure a capability to detect any launch of a ballistic missile. The majority of "Voronezh" type radars are operating in a metric wave diapason, but some of them are operating in a decameters' band (Voronezh DM type). Those radars, according Russia, might become the Russian contribution to a single, unified European missile defense system..

So far it remains unclear what kind of C3 system is planned for Russian missile defense system. Today, there is no information (or data) showing that Russia will create something similar to the US C2BMS or NATO C3 systems, where all missile defense elements are plugged into a system and could exchange data and even be controlled from any place of it. Apparently recent Russian missile defense C3 is organized in a network based on a hierarchy of elements. Lower level systems are plugged into adequate upper layer structures, those, in turn, are plugged into the central command and control unit. Even more, today not all of the elements of the systems are plugged into the system. As an example, the widely announced S400 located in Kaliningrad are not in the C3 system of Russian Air-Space command and will become a part of it only in remote future.[19] Besides all that, today they are commanded by the Baltic fleet. This means that they are designated to perform tasks of the fleet. This finding only proves an assumption that due to the recent reform of Russian Armed forces, the establishment of the new strategic commands and uncertainty in dividing areas of responsibilities, new Air-Space C3 system is still in "thick fog" and the possibility to get it done fast is complicated[20]. Other reasons like lagging behind in computer and other technologies development, algorithms of transfer of information inside the system and so on make chances to create the system similar to the US C2BMS even less feasible.[21]. As a result, based on what we know, we could imagine the Russian missile defense C3 system being organized differently compared to the US and NATO. It might look like what is shown in Figure 5.

[19] И. Сафронов," Последний осколок советсткой системы", „Коммерсантъ", 31 мая 2012.
[20] В. Рыжинков, А. Дрешин, "Единство и комплексность ВКО – объективное требование современной войны", "Воздушно-космическая оборона", 2012
[21] Б. Чельнов, С. Волков, "Сетевые войны XXI века", "Воздушно-космическая оборона", 2012

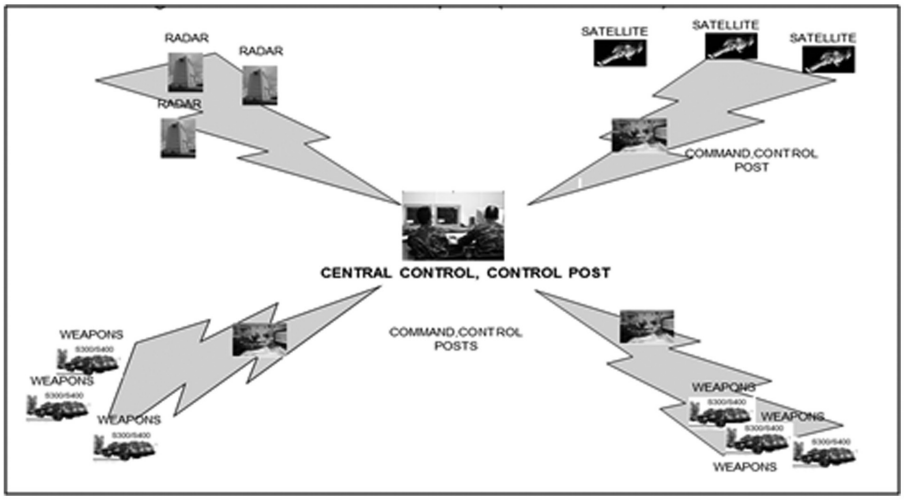

Figure 5. **Organization of Russian Air-Space (ballistic missile) Defense**

In summary, the Russian ballistic missile defense system practically does not exist today. It is still being created. Even more, today still no commonly agreed understanding exists of what kind of system it should be. Some would like to see it as a system similar to the US and NATO. Others argue that it must not be a weapon-sensor system, but a missile defense concept or program consisting not only of specific weapons and sensors, but including nuclear forces, conventional units and other capabilities as well. One way or another, today the creation of system is based on the Air-Space command that was officially established in 1st of December 2011. The command is already given an early warning system, the ground radars and space satellites, and the newly established air-space defense brigades, armed by recent missile defense systems.

2. Missile Defense as an Argument to Justify Defense Policy

The last few years have proven that missile defense has started to play a wider role than simply a military one. More and more, it becomes a political-military argument while discussing topics not related to ballistic missile threats or defense organization, but debating other issues, which at first glance are not related to missile defense at all. The missile defense topic more often is

taken from a military-technical context and moved to general defense policy formation, implementation, international relations or other spheres. In those discussions missile defense is seen more as a substitute for another defensive or offensive system or simply as an instrument of propaganda. The best examples here could be discussions about the possibility for missile defense to supplant nuclear weapons, or efforts to make it "a scapegoat" to justify decisions and actions. In this case a country just declares any of its own actions to be an asymmetric response to the opponents' missile defense.

2.1 Missile Defense Instead of Nuclear Weapons.

Nuclear weapons as the strongest means for a deterrence successfully passed the test for more than half a century. Today the majority of platforms to transport a nuclear charge to destination consist of using ballistic missiles. At the same time, the fear of total mutual destruction is still plying an adequate role in influencing the opponent society's behavior. But life does not exist at a standstill. Due to new technologies and innovations a number of new ways to influence opponent societies have appeared. Global and targeted spread of information to any place in the world, long range and precise attack on any infrastructure or system located anywhere and so on are examples of new deterrence. Some of those might have the potential to substitute deterrence based on total destruction. One of those, at least theoretically, is missile defense. In an ideal case, when it is able to destroy absolutely all incoming nuclear ballistic missiles, missile defense can discredit opponents' nuclear weapons as a deterrence tool and to force him to search for other tools, such as developing their own effective missile defense. Theoretically, and I would like to emphasize once more, only theoretically, if opposing sides have missile defenses providing one hundred per cent assurance, nuclear weapons in foes' arsenals would lose the deterrence role.

Thoughts about nuclear disarmament, relocation of nuclear arms and a search for ideas to speed up those processes became especially cultivated in 2009-2010, when the US and Russia had START negotiations on-going. Trying to find points for the agreement and in a light of new US nuclear policy, announced by US president Obama, missile defense became one such point, able to influence the behavior or negotiation positions of both sides. Missile defense as an alternative to nuclear weapons suited some interests of antinuclear, pacifistic or other groups as well. Antinuclear, green, pacifistic and other organizations, political forces and movements which are against US troops and weapons in Europe, used that topic as one of the options for discussions. All

sides applied very simple arguments to present missile defense as an alternative to nuclear weapons. And all sides chose those particular arguments which best benefited their own positions. Here just a few examples.

The main carriers of nuclear war charges were and still remain ballistic missiles. So missile defense, as a system directed against ballistic missiles, would directly affect nuclear deterrence. The main supporter of this argument is Russia, who insists that any development of missile defense must be associated with the nuclear question. Russia strongly believes that if the number of nuclear weapons are limited and reduced, a country possessing better missile defense would gain certain advantage. As we already know, Russia is behind in missile defense development, so while negotiating START, it saw an inclusion of missile defense into the treaty as one of basic requirements. And later, after START, Russia kept insisting for legal guarantees that the US and NATO missile defenses would not be directed against it, even knowing and understanding that the request was senseless. At first Russia knew very well that any missile defense would be not able to stop all Russian intercontinental missiles. Quite recently it was openly stated by the former chief of staff of Russian strategic missiles command, gen. V. Jesin. One of Russian publications presented his interview, where he reasoned his statements that the US or NATO missile defense cannot affect Russian strategic potential[22]. Secondly, any political guarantees Russia is requesting are politically unacceptable simply because this would mean a step back to the Cold War times and assigning Russia a role of an opponent again. Today the US and NATO no longer use threat-based planning and instead use capability-based planning while developing their military forces. Today Russia is a partner, not an opponent. In sum, all Russian initiatives should be evaluated not in the context of its efforts to safeguard its strategic deterrence but in the light of general defense policy.

The US basically agrees that missile defense could eliminate a part of nuclear arsenals, but takes a different view. It sees missile defense as a platform for the enhancement of mutual trust between countries. The position is seemingly based on the understanding that to create a missile defense system that can guarantee one hundred percent destruction of all ballistic missiles is practically impossible. There are a number of reasons for failure. One of those is the cost. Today billions of USD dollars have already been spent on missile defense. It has become one of the most expensive systems ever. But even today or in the close future there is almost no chance of making it capable of intercepting hundreds of

[22] В. Есин, Е. Савостьянов "ЕвроПРО без мифов и политики", Независимое военное обозрение, 13.04.2012

ballistic missile launches at once—an action only Russia can perform today. But the existing missile defense is already able and will be able even more in the future to guarantee the interception of a limited number of ballistic missiles armed with nuclear or other mass destruction weapons and used for a nuclear blackmail or terrorist act. Because the US, and I assume Russia as well, has no blackmailing plans, missile defense has the potential to become a good platform to increase a mutual trust and create a new code of conduct in fighting any blackmailers. That is why almost all the US proposals for cooperation start and emphasize the importance of a common threat assessment and exchange of information.

There is another argument suggesting that missile defense can supplant nuclear weapons. Here the emphasis is put not on nuclear weapons as weapons, but as a tool of deterrence which unifies allies. In this context missile defense plays the role of "symbolic glue" which keeps all allies together and represents a transatlantic link. Such ideas could be heard starting from student discussions up to high level expert talks. For example, on the 8th of November 2008 the US Peace Institute organized a discussion titled "A Future of Nuclear weapons and NATO missile defense". Participants of the discussion, including a representative from the US State department Ms. E Taucher, German ambassador IW Ichingerand and others, discussed the possibility for missile defense to play a symbolic role of responsibility and burden sharing between NATO members and to act as particular "glue"[23].

2.2. Missile Defense as a Pretext to Rearm

Another example of how a military system could be assigned a political role is found in recent Russian behavior. As previously mentioned, despite all wishes and declarations, Russian success in the creation of its own missile defense still does not allow it to compete with the US. Russian politicians and military brass make different statements about the success and progress in building their own missile defense. Those statements quite often contradict or even deny each other, sometimes different officials say opposing things about the same subject and so on. Some examples: On 13 February 2012, Russian news agency INTERFAX published a statement of the commander of Russian Air Forces, gen. A. Zelin. The general stated that in 2012 the S400 system would

[23] US Institute of Peace, round table on „Future og nuclear weapons and missile defence in NATO", 8 November 2010. http://www.usip.org/newsroom/multimedia/audio/the-future-nuclear-weapons-and-missile-defense-in-nato-security.

get a new long range interceptor, which is able to fly as far as 400 kilometers[24]. As a result the missile defense capability would be increased considerably. The type of the interceptor was not mentioned, but experts believe the talk is going around the 40N6 missile type. This interceptor is effective at distances up to 400 kilometers, but, the truth is that, it could engage only aircraft at that distance. In the case of ballistic missiles, the effective range is only 60 kilometers (a modernized version might have twice the distance). This means that even having the new interceptor, the S400 would be only able to provide only a point or small territory defense. The interceptor itself is also not a new one. First reports about it appeared in 1999. In 2003, during the MAKS exhibition, it was stated, that the 40N6 interceptor would be brought to armament in 2005. Later terms were moved to 2007 and 2008[25]. The INTERFAX messages already talks about 2012. Another example is the situation with the acquisition of S400 systems. Back in 2007, it was announced that plans exist to have around 200 systems by 2015[26]. Today (five years later) Russia claims to have two regiments of those systems, which means, in the best case, less than a hundred systems[27]. There are more examples showing that Russia faces difficulties creating and acquiring missile defense systems. Not being able, at least in the coming decade, to compete in the missile defense building, Russia has chosen the same old strategy from the sixties. Russia decided to modernize and improve its ballistic missiles, to increase the number of warheads, to create additional countermeasures against interception and to increase early warning capabilities. These steps allow us to assume that the so-called asymmetric Russian answer to the US missile defense might sound like this - "Because we are not able to create more or less reliable missile defense in the close future, we decided to refuse a defense and to concentrate on an offense. We will launch all our missiles at once, any time we see any bigger launch of any type of missiles, including missile defense interceptors". The main task of such a message is singular: to create a situation of uncertainty, then the US or NATO would never know how Russia is going to interpret, for example, the launch of ten interceptors to intercept a few Iranian ballistic missiles. The Russian early warning system will detect the launch and Russia would decide itself how to interpret it - as a missile defense against Iran or attack on Russia. This "mild" Russian blackmail is the answer Russia has chosen. And this was confirmed by the Russian Prime minister V. Putin, who said that to create its own missile defense

[24] Заявление генерал-полковника Александр Зелина" Москва. 13 февраля. 2012 INTERFAX.RU
[25] "S300 system", Global Security catalog" , http://www.globalsecurity.org/military/world/russia/s-400.htm
[26] "S300 system", Global Security catalog", http://www.globalsecurity.org/military/world/russia/s-400.htm
[27] „Минобороны разместит комплексы С-400 на границе в ЗВО"13 февраля 2012, http://www.rg.ru/.

is expensive and senseless; it is much better to make an asymmetric answer[28]. Some in Europe understood that message as well. The director of strategy department from the ministry of defense of France, during his speech in the Moscow international missile defense conference, said straightforwardly that Russia used missile defense to justify a massive modernization of its own nuclear weapons[29].

At the same time, it appears that Russia has decided that missile defense could justify anything, not only nuclear modernization. Anything means everything: modernization of other weapons and systems, military reform, relocation of military units, creation of new operational plans and so on. This was obviously presented in a declaration of the Russian president responding to creation of NATO and American missile defense[30]. On November 23, 2011, the president as supreme commander sounded a declaration which named five response actions. The first three actions specified an asymmetric answer. First, to include a new radar in Kaliningrad into the unified early warning system - meant to increase the ability to detect any interceptor launch from Europe. Truth be told, only Kaliningrad was mentioned. It looks like this was done deliberately just to increase the psychological effect on some countries. Such radars are already built or being built in other places like Saint Petersburg, Orenburg, Irkutsk, and the polar circle[31] as well. The second action ordered the increase of protection of strategic objects or, simply put, the defense of stationary strategic missile units. This meant securing the possibility to launch its own missiles. And the third point ordered the modernizing of ballistic missiles, an increase in the number of warheads and so on. The fourth and fifth actions had nothing to do with missile defense. Here missile defense was only "a cover" to justify other actions and represented mainly not a response to missile defense but changes in Russian defense policy and maybe potential future plans. But one may judge for oneself. The fourth order told Armed forces "to prepare means to destroy missile defense C3 and Information infrastructure if required[32]". Missile defense C3 and information infrastructure here is understood as the US BMC3M and NATO C3, radars and command posts. The phrase "to prepare the means" translated from Russian

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[28] „Модернизация ядерных сил и разработка высокоточного оружия станет асимметричным ответом РФ на американскую ПРО – Путин , Алабино (Московская область). 22 февраля.2012, ИНТЕРФАКС-АВН.

[29] А. Александров, Е.Орлова, "ПРО: диалог продолжается", „Красная звезда" , 4 мая 2012

[30] Заявление Д. Медведева в связи с ситуацией, которая сложилась вокруг системы ПРО стран НАТО в Европе, 24 ноября 2011.

[31] Заявление, командующий Войск Воздушно-космической обороны (ВКО) генерал-лейтенант Олег Остапенко, ИНТЕРФАКС-АВН, 13 мая 2012.

[32] Заявление Д. Медведева в связи с ситуацией, которая сложилась вокруг системы ПРО стран НАТО в Европе, 24 ноября 2011.

military language into daily speech means to plan what particular things to destroy, how to destroy, what troops and weapons to use, to train those troops for that kind of action and so on. The phrase "the means" might contain not merely "Iskander" missiles. It might be a conventional aircraft raid or Special Forces operation, secret services agents' action or you name it. But the most important point here is that those missile defense objects are located on NATO territory. So, frankly, the Russian President ordered his own military to start military planning for an attack on NATO. In essence this is already planning for aggression. One can argue that those plans might already be in place. Yes, such plans might exist, but officially and publicly such an order was never given before, and this is already more than missile defense business; this is already a defense and foreign policy matter. Lastly, the fifth and final order is also strange. The decision to place "Iskander" missiles in Kaliningrad is not a new one and not caused by missile defense. The decision to substitute all old "Tochka" type short range ballistic missiles with new "Iskanders" was made much earlier than military reform was started. Russia has ten short range missile brigades and one of those always was stationed in Kaliningrad. Sooner or later it would have been rearmed with "Iskanders" independently of missile defense existence. We all know that the "Iskander" range is larger than "Tochka". Deploying them in Kaliningrad without any explanation would have risen a number of questions to Russia and might be taken as an aggressive step without any reason. Now everything is "explained".

So the missile defense became "a scapegoat", "the reason" to justify any rearmament. It is used by Russia to justify any—and not merely the "Iskander"—case. Another example is long range precision guided weapons. The chief of Russian Air Force gen. A. Zelin announced that Russian MIG-31M aircrafts would soon get new air to air missiles for missile defense purposes. He added that the MIGs would get air to land and air to sea cruise missile to engage different targets on land and sea as well. Among other targets whose cruise missile could engage, he mentioned missile defense objects. This keeps going. Missile defense is being used to justify almost anything nowadays. The Russian newspaper "Izvestija"explained, that modernisation of the Tu-22M3 strategic bombers is a response to missile defense[33]. The vice president of the Russian academy of geopolitical problems, Mr. K. Sivkov, believes that arming Russian "Antei" class nuclear submarine with new "Kalibr" cruise missiles, which are able to attack any targets in the Europe, is a response to missile defense[34]. Even the president Medvedev himself once mentioned that by ignoring existing arms control mechanisms Russia is only responding asymmetrically to missile defense.

[33] Д. Тельманов „Из ТУ-22М3 сделают убийцу европейской ПРО", Известия, 7 февраля 2012.
[34] Д. Тельманов „Близнецов АПЛ «КУРСК» Превратят в убийцу ЕВРОПРО", Известия, 23 мая 2012.

Conclusion: Why is It Impossible to Create a Joint (Russia – NATO) Missile Defense System?

Today the missile defense topic remains among the most current and relevant ones in the US-Russia and NATO-Russia dialogues. Russia keeps recommending to NATO the creation of a single, joint missile defense system and promises to contribute its own systems to it. Still, taking into account everything mentioned above, we can state a number of objective reasons why creating such a system would be impossible. Those reasons include different political positions on certain issues, different levels in technology, differences in concepts of missile defense organization and management of consequence of intercepts, and, lastly, the financial capability of both countries to run the venture.

Naming different political positions on certain issues, at first it is worth mentioning the differences both sides have in positioning each other. As soon as the Cold War ended, the US and NATO, in all documents and at all levels, kept stating that Russia is not a foe and offering a role as a strategic partner. By offering cooperation in the missile defense, NATO and the US do not rule out the possibility to see this cooperation progressing, expanding and finally leading to potentially new missile defense system integration. In contrast, in a majority of its own national strategic documents, including its military doctrine, Russia keeps clearly stating that the Alliance (and in majority of cases the US) is among the main threat sources. As long as this situation remains, it would be very naïve to believe in Russia's supposedly sincere intentions to create a single missile defense system with those named as potential enemies.

As previously mentioned, the development of adequate technologies is a very important factor in building a missile defense system. We have to keep in mind that countries choose different methods to destroy ballistic missiles: by direct hit and by proximity detonation. As a result of this choice, the US has made sizable progress not only in the development of interceptors but in launch and target detection, trajectory tracking, dissemination, transfer and analysis of information and other fields as well. All those achievements were incorporated into existing or new systems. Other countries, Russia in particular, have been paying less attention to possible changes in concept, so their weapons and sensors designs were far behind. While creating a unified missile defense system the question of sharing modern technologies with partners comes up and has to be somehow solved. In the Russian case, the creation of a single missile defense system, which supposes incorporation of so many different systems into one, would mean unilateral transfer of the newest technologies without receiving anything.

The Russian proposals to have a joint system (a joint command and control system) are being criticized even by its own military experts. It appears an impossible project today and in the near future.

We should not forget the differences in concepts of missile defense organization and the consequence of intercepts. The US and NATO have their own understanding of how the system is going to appear, how it should be built, how it would be used. All this has a direct impact on concepts of operation of the system. Russia's understanding about its own system is not finished, so the concepts of operation are also in the development stage. Add to the mix topics like COE/COI, which neither exist or never were discussed in Russia, and we will see that creating a new system would mean either the US and NATO sticking into Russian internal military debates and forcing it to accept already existing concepts or to change already existing own ones and adopting them with Russia. It is obvious that both missions are practically impossible.

In conclusion, despite the fact that missile defense systems appeared at about the same time as ballistic missiles, today there are different understandings about the place and importance of those systems in the context of a country's total armaments. As a result money devoted and spent on missile defense is different in comparison to money spent on other defense systems. For example, antitank or antiship defense cases' targets are conditionally slow (compared to a ballistic missile), so in general all elements of the defense remain more local and less joint. Because systems are built on simplier technologies they are cheaper as well. Antiaircraft defenses face faster targets – aircrafts, so they are more sophisticated, usually united into regional systems and of course more expensive. A missile defense systems advanced even farther compare to antiaircraft defense ones. They are based on the newest technologies and are very expensive. For example, to create its own system the US spent more than 45 billion USD (approx. 1.1 trillion rubles) in the period from 2008 to 2011 and still keeps financing in the range of tens of billions USD annually. Despite all the Russian announcements and real increases in defense financing, the country simply will not be able to devote enough money to be a sterling participant in any joint missile defense venture.

Trakai, September 2012