Executive Summary

Proliferation of weapons of mass destruction and missile technologies is a growing threat to NATO member states, their territories and citizens. Although the number of nuclear warheads around the world decreases, states' nuclear capabilities continue to expand with development of ever-more precise delivery systems. Approximately 30 states around the World, including Iran and North Korea, possess or strive to acquire advanced missile technologies.

Growing tensions between NATO and Russia challenge the air defence capabilities of the alliance's eastern flank. By implementing A2AD strategies, Russia puts in question NATO's capacity to come to aid and assistance of threatened members. Although the Alliance declares that the aim of a NATO Missile Defence capability is to provide coverage and protection for all NATO European member states against the threats posed by the proliferation of ballistic missiles, controversies about its current shape are emerging. On the one hand, after the Iran Nuclear Deal, the threat of unexpected missile attack from Middle East seems to diminish. On the other hand, however, modernisation of Russian missile forces, Moscow's violations of INF treaty as well as increasingly aggressive rhetoric in the NATO-Russia relations cause concerns.

From the Polish perspective, principal issue lies in assuring the ability to provide point missile defence against a potential threat of Russia's ballistic missile strike. The strategic area that has been neglected for many years is the Polish air defence system. Until now, the core of the Polish weaponry against the air attack has been based on Soviet missile systems. After many years of neglect, the MoD planners as well as the policy-makers realised that further delay of the technical modernisation in these areas is no longer possible. As a result, Polish Air Force is expected to obtain 8 batteries of medium range air defence system WISŁA, which are capable of hitting aircraft targets at a distance of 100 km and ballistic missile targets with a range of 1000 km. The modernisation programme also foresees obtaining short range NAREW SAM system for the Air Defence Forces and the Land Forces.

Such a big project poses a number of challenges. However, it provides new opportunities for the Polish Armed Forces,

also in terms of the cooperation within the Alliance. Nevertheless, Poland is not the first country that implements an extensive air defence programme with missile defence capabilities. Residents of several states, such as Israel, South Korea and Taiwan, live in the shadow of hostile missiles. Over the years, Poland's allies in NATO have also been developing their capabilities in terms of missile defence. What conclusions can Poland draw from their experience?

The report consists of five chapters, which were summarised in this executive summary. The report aims to describe the process of development of the air defence systems in five selected countries: the United States, France, Germany, Israel and Taiwan. Three of them are NATO member states, whereas two others are outside of the Alliance's structures. This selection of systems enables an analysis of a wide range of threats and solutions, derived from various experiences and concepts from around the world. The analysis is based on open sources, surveys and interviews conducted with experts as well as the information obtained directly from the producers of the air defence systems. The report is the culmination of several months of the project that consisted of three seminars with the participation of experts from the United States, Israel, Germany, and Taiwan, as well as the international conference concerning the missile defence (NATO Ballistic Missile Defence Conference).

Conclusions for Poland

USA

1. The USA has been developing missile defence systems for over 70 years and the BMDS for over 20 years. Despite that, currently the BMDS is capable of countering only a limited ballistic attack, and even this could not have been achieved without a high-priority status within the Department of Defense's projects. Therefore if the Polish air defence system is to be effective against ballistic threats, it ought to receive the highest priority in the Armed Forces Technical Modernisation Program.

2. 'The complex demands of developing and integrating a BMDS capable of defeating ballistic missiles of all ranges in all phases of flight require a level of management, engineering, analytic, and leadership capabilities that approaches the limit of reasonable expectation.' This is

shown in historical organizational changes (SDIO, BMDO, MDA) and a gradual approach to implementation of the subsequent capabilities of the system (the so-called spiral developments). Therefore, Poland should procure a currently available or highly advanced system, and then participate in its continuous

modernisation, rather than develop its own system ground-up.

The PATRIOT (Phased Array Tracking to Intercept On Target) system represents the lowest layer of the BMDS. The currently fielded configuration, Patriot Advanced Capability-3, is a point air and missile defense system, designed to fight, inter alia, short-range ballistic missiles in the final phase of their flight.

3. Over the past 30 years, the cumulative budgets of MDA and its predecessors amounted to more than 180 billion USD. At the same time, the estimated cost of a single PAC-3 MSE missile is approximately 5 million USD. Therefore, much attention is paid to changing the cost-result relation of air defence systems, e.g., by producing more economical missiles. Polish arms industry should establish, in cooperation with a foreign partner, a native ground-to-air missile, whose subsequent versions would possess ballistic defence capabilities.

4. The integration of Polish missile defence systems with the U.S. BMDS will be highly beneficial. The security of Polish airspace could be increased by taking advantage of decades of experience and hundreds of billions of dollars invested by the United States in the development of BMDS. This should be done through the development of data exchange links between the BMDS, IBCS and Polish command centres, supporting AEGIS Ashore and Polish air defence interoperability, as well as deploying BMDS elements on Polish territory (e.g. AN / TPY-2 FBM).

France

1. The Italian-French SAMP/T system is a response to specific threats to which the territories of these two countries and their Armed Forces operating overseas are exposed to. Focusing on the analysis of the air and

defence threats imminent to a particular country is an exemplary approach to the modernisation process of air defence systems.

SAMP/T is a fully autonomous, self-propelled system with truck-mounted modules. Each system typically includes a Fire Control Unit, with a multi-function radar (MRI) and an Engagement Module (ME), and launching elements, with up to 6 vertical launch platforms (MLT) using Aster 30 missiles. Source: Eurosam.com

2. The authorities responsible for procurement of 'Wisla' and 'Narew' GBAD systems, should perform an assessment of threats, taking into consideration the ballistic missile systems which are or could be deployed in the neighbourhood of Poland. However, the future air defence system of Poland should be also capable to protect the country from threats other than ballistic missiles. Particular care should be exercised to ensure defence capabilities against threats such as aircraft, cruise missiles and precision-guided munitions. Both the quantity and combat potential of these threats is much higher than in case of ballistic missiles.

3. The modernisation process of the Armed Forces should be a long-term, balanced process. The Aster-30 missile compliments this kind of approach through its dual application in land-based (SAMP/T) and sea-based system (PAAMS). Even though the 'Miecznik' type naval vessels will not become air defence platforms, it does not mean that the involvement of the Navy in the national air defence could not be verified in the future.

Germany

1. Due to similarities between German and Polish air defence modernisation programmes, Poland should carefully follow the 'TLVS' procurement process. Furthermore, the procurement of short-range air defence 'Narew' system should be expedited. Learning from TLVS experiences, Poland should consider adopting a model based on two-battery units, one of which is equipped with a medium-range air defence system, and the other one with a short-range system.

2. Provided that Germany finalises the contract for procurement of MEADS, Poland should consider following in neighbour's footsteps. Acquisition of MEADS by the Polish Armed Forces would ensure full interoperability of the national-security-critical system with Poland's most important ally in the region. Furthermore, it is worth noting that Germany has declared its readiness to support Poland's defence efforts with its Armed Forces in case of deterioration of the political and military situation on the Alliance's eastern flank.

MEADS incorporates the advanced hit-to-kill PAC-3 MSE missile, surveillance and fire control sensors, battle management/communication centers, and high-firepower launchers. It combines battlefield protection with flexibility that allows it to protect maneuver forces and to provide homeland defense. Source: MEADS International.

3. Another important advantage, related to the acquisition of the MEADS system, concerns potential gains for the Polish defence industry. If Poland decides to join MEADS International project, Polish military industry could participate in the production of the weapon system with significant export potential. Moreover, increased demand for modern air defence systems in the coming years seems certain. List of countries considering such procurement in the near future includes NATO member states, such as Turkey, Romania, Italy and Netherlands .

Israel

1. Contemporary missile threats are not only related to ballistic missiles in the inventory of state-agents, but also to the weaponry that could be used by non-state organisations. This issue also concerns artillery and mortar missiles as well as cruise and anti-ship missiles. A scenario of possible threats and countermeasures should include unmanned aerial vehicles (UAV) that could be used by an adversary to conduct reconnaissance and combat missions. To illustrate this point, it is worth mentioning the July 2016 incident, when the Israeli Armed Forces unsuccessfully attempted several times to shoot down the UAVs

using various countermeasures including the Patriot missiles.

Stunner is a two-stage interceptor missile developed to intercept short-range ballistic missiles, large calibre rockets and cruise missiles and unmanned aircraft systems. Source: Army-technology.com

2. The Israeli experience provides evidence that the construction of an efficient and multi-layer air defence system against a wide range of aerial threats is difficult, however it is technically possible. Modern air defence systems are capable to fight against conventional targets, such as aircraft, helicopters, unmanned aerial vehicles, short-range ballistic missiles, mortar and rocket artillery missiles, as well as anti-ship and cruise missiles. It is necessary to emphasise that the construction of air defence is a long process and it requires stable financing as well as long term planning that defines needs and capabilities in a realistic manner.

3. Israel possesses operational experience as well as an advanced technology, which put this country in the first line of possible partners for Poland in the process of development of the missile defence. An example of Israel also shows that even a developed country needs an external partner such as the United States. Furthermore, the case of Israel is a proof that another country's support can lead to the technological and operational independence in terms of missile defence.

4. If Poland decides to follow Israeli solutions it is necessary to consider certain differences between these states, such as total area of the country and specific threats related to the situation of Poland. Consequently, the total number of systems that could protect the entire territory of Poland as well as their technical specification would be different than in the case of Israel.

5. Poland has to take into consideration the interoperability of the future missile defence system and its components with the air defence systems used by NATO and the United States.

Taiwan

1. Due to Taiwan's geographical and geopolitical surrounding, the threat of ballistic missile attack is a top priority for country's decision makers. Apart from the national air and missile defence system, Taiwan has also developed a wide range of unique solutions in terms of defence against large-scale missile attacks. These include prioritisation of defence of certain objects, particularly command, control and communication centres; defence constructions; high manoeuvrability of the Armed Forces; and highway strips that are widely used in this country. All of the above techniques and technologies could be valuable guidelines for Poland's air defence architects.

2. In year 1979 the United States acknowledged the communist government in Beijing and unilaterally voided the Mutual Defence Treaty which bound it with Taiwan. Ever since then, the government in Taipei has pursued development of an efficient, national military industry, which could supply crucial weapon systems for the Armed Forces of Taiwan. Nowadays, thanks to consistent development efforts, the Taiwanese defence industry possesses capabilities in production of complex systems such as combat aircraft as well as medium-range air defence systems.

3. The case of Taiwan is a prime example of effective industrial cooperation with the United States and acquisition of crucial technologies. Taiwan has developed advanced air defence systems based on the technologies acquired in the United States. Furthermore, many of these solutions exceed specification of comparable systems in the United States and Europe. Taiwan's experiences in the field of technology transfer are worth analysing, particularly in the context of the Polish air defence programmes ('Wisła' and 'Narew').

The Tien Kung III (Sky Bow III) surface-to-air missile system was developed by the Chungshan Institute of Science and Technology to counter tactical ballistic missiles. Source: GlobalSecurity.org

4. Security of Taiwan is based on both defensive and offensive capabilities. The Armed Forces of Taiwan are

developing modern deterrent systems, e.g. HF-2-E cruise missile (range of 1000 km), HF-3 supersonic missile and YF ballistic missile with an effective range of 1200-2000 km. These weapon systems could be used to launch a retaliatory attack on economic centres located on the coast of China, which certainly increase costs of a potential attack from Beijing's perspective. This combination of defensive and offensive capabilities can be also an interesting solution for Poland.

Authors: *Rafał Ciastoń, Robert Czulda, Jerzy Gruszczyński, Maciej Kowalski, Tomasz Smura*

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