

Original article

Air security of NATO's eastern flank: threats and challenges

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INFORMATIONS

Article history:

Submitted: 20 March 2019

Accepted: 22 October 2019

Published: 15 June 2020

ABSTRACT

The focal point of the paper is to assess the air security on the NATO's eastern flank in the context of the dynamic changes that have occurred in its immediate vicinity. The authors, beginning with an overview of the current framework of the air security situation in the region, have analysed the developments that have taken place in that regard. The modernisation of missile systems, as well as air and space forces by the Russian Federation, both in qualitative and quantitative terms, have been the subject of thorough scrutiny. The challenges generated by the new situation have been weighed against the current and future NATO's defence capabilities against air threats.

KEYWORDS

air defence, air security, air threats, NATO's eastern flank,
Russian Federation's air force

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Introduction

The North Atlantic Treaty Organisation counts currently 28 members and has undoubtedly been the longest-lasting and the best military alliance in modern history. From the 1970s, NATO has been a guarantor of maintaining peace and security in Europe. Following the end of the cold war, due to the lack of threat from the Soviet Union, many experts on international cooperation wondered about the future of the alliance. It was argued that the end of three threats from the former adversary – the USSR – did not mean the end of threats to NATO [1-5]. However, one of the darkest visions of the future was related to the return of past conflicts [6]. One may risk the claim that the current politics of the Russian Federation makes that vision become reality.

The military conflict that was initiated on the territory of Ukraine after the annexation of Crimea by Russia in April 2014, undeniably finished the period of carefree faith in unwavering peace. Since the beginning of military actions in the Donetsk and Luhansk Oblasts, the countries in central and eastern Europe began to question the NATO's capability to secure their safety in spite of the fact that the Western Alliance represents the institutionalisation of the transatlantic security community based on common values and the collective identity of liberal democracies [7]. In the event when these values are in peril, the alliance should possess proper means and power to successfully eradicate those threats. In that context,

a critical analysis of the possessed potential has to be carried out, and then it should be compared with the potential threats.

In the case of military security, particular attention should be given to the newest dimensions of conducting warfare. The analysis of the current military conflicts shows the constant increase of significance of air space and more and more frequent use of the air component in the military action. Moreover, on the account of such analysis, one may claim that air threat has become an integral element of all military actions, regardless of their scale, intensity, time, or geographical environment. Already at the beginning of the military aviation, G. Douhet – the author of “The Command of the Air” [8] noticed that the victory in a military confrontation is achieved by the party that is able to aptly foresee changes in the nature of war. The authors of the paper, inspired by this timeless statement and the changes occurring within the air security environment, came to the conclusion that a proper assessment of the threat generated by military aircraft (and other air warfare means) is necessary for carrying out an effective defence. They have, therefore, formulated the goal of the article as “identification of changes in air security in the eastern region of NATO”. The authors, in order to attain the presupposed aim, have conducted the evaluation of air security threats of NATO's eastern flank, as well as the changes that have occurred and influenced the security environment and will continue doing so in the short term. In the last stage of the research, the authors have assessed the possibility of conducting air defence in the event of a military conflict in the discussed part of Europe. It enabled the determination of the necessary strategic changes that should be implemented in order to enhance NATO's air security.

1. Air threats to NATO's eastern flank

Air security threats are defined as international and domestic processes, situations, or events that create a high risk of losing the capability of commanding the air space or losing its sovereignty and the freedom to accomplish goals pertinent to its exploration [9]. That threat, in its gist, is related to the real probability of using military violence in the air space.

Air security threats to NATO's eastern flank is generated, above all, by the Russian Federation. Hence, the first step of the analysis was the identification of air forces and strategic missile bases locations in the Russian territory (Fig. 1 and 2). The location of military bases and their potential determinate the anticipated direction of threat or carrying out military operations.

The analysis of the locations of the air force and strategic missile bases shows preparing Russian military forces for operations towards west. Moreover, since the annexation of Crimea, Russia has been increasing the potential of the western and southern military regions. These military districts are in close proximity to the NATO's eastern border and thus constitute a direct threat for the eastern flank of the alliance.

Therefore, a detailed analysis of military potential in those two regions has been carried out. The literature review has shown that Russia maintains there 60 strategic missile systems, 2850 artillery units with a calibre greater than 100 mm, 570 aircraft, 180 fighter helicopters. After 2014, air forces operating in the western part of the country have also been strengthened – the 6th Air and Air Defence Forces Army got approximately 20 battalions equipped with S-400 missile systems [11].

Due to its specific geopolitical position, the Kaliningrad Oblast deserves particular attention. The region can be understood both as the area of cooperation and conflict between Russia



Fig. 1. Location of air force bases in the Russian Federation
Source: [10, p. 58].



Fig. 2. Location of strategic missile bases in Russian Federation
Source: [10, p. 47].

and the West [12]. In so far as the A2/AD systems are located in regions like Syria, Crimea, and Arctica do not directly impact the military capability of the NATO members, the ones

stationed in the Kaliningrad Oblast influence directly the security and efficient operation of NATO's defence systems. The analysis of the military potential of the Russian Federation shows that in the Kaliningrad region there are two regiments of combat aircraft – the 689th Independent Fighter Aviation Regiment and the 4th Guards Maritime Assault Aviation Regiment. The regiments are equipped with Su027 combat fighters and Su-24 and Su-24MR fighter-bombers that have been progressively replaced with Su-30. The quantitative potential of the combat aircraft accrued in the region is estimated at approximately 60 – the number that provides a comparative advantage over the capacity of Poland and the Baltic states.

According to the Lithuanian President, Dalia Grybauskaitė, in February 2018, 9K720 Iskander-M ballistic rockets together with their entire infrastructure were deployed in the Kaliningrad Oblast [13]. The rockets are able to deliver conventional and nuclear warheads in the range of 500 km. Recently, speculations have appeared that these launchers can be potentially used to fire missiles of the cruise type called Kaliber. The latter increases the firing range up to 2,500 km. Moreover, in the region, there is also Toczka-U ballistic rockets system with the firing range of up to 120 km and Toczka-M with the range of up to 185 km. It means that the forces of the Russian Federation located in the discussed Oblast can successfully destroy targets in central Poland, in Baltic states, and fringes of Finland. Nowadays, Russia possesses approximately 130 Iskander-M systems [14].

It should be noted that military exercises carried out by the Russian Federation, such as ZAPAD-17, demonstrated the capacity of transporting significant forces from the hinterland to perform tasks at Russia's western and southern flank. In order to fully present Russian potential in that regard, major means of air attack (MAA) that might pose the highest threat to the air space security of NATO members will be presented. It is worthwhile to emphasise that the depicted quantitative potential includes only some chosen aircraft and hence it differs from the entire potential.

In order to define the tactical technological capability of the selected means of air attack, a comparison correlating the indices like altitude, range, and maximal speed has been carried out.

Table 1. General number of the chosen means of air attack of the Russian Federation

Type	Number	Type	Number
Su-35	36	Su-25	200
Su-57	10*	Su-27	61
MiG-29	147	Su-30	23
MiG-31	32	Su-33	17
MiG-35	0*	Su-34	57
Sum: 550-650			
Tu-95	120	Tu-22	63
Tu-160	32		
Sum: 190-200			

Source: Own work on the basis of [14].

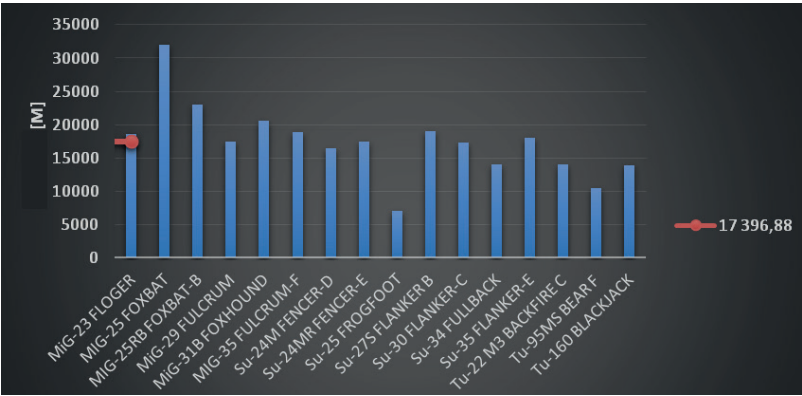


Fig. 3. The altitude of the chosen aircraft of the Russian Federation
Source: Own work on the basis of [15].

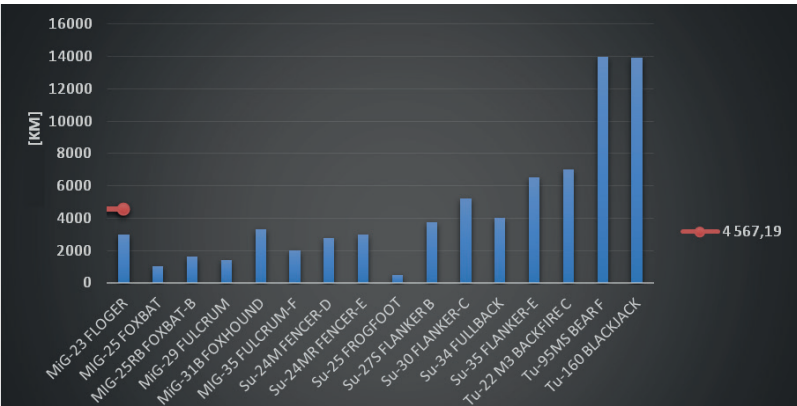


Fig. 4. The range of the chosen aircraft of the Russian Federation
Source: Own work on the basis of [15].

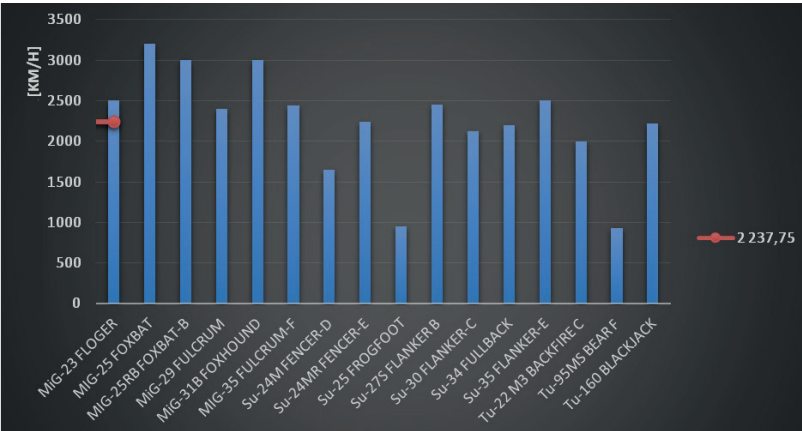


Fig. 5. The maximum speed of the chosen aircraft of the Russian Federation
Source: Own work on the basis of [15].

On the basis of the analysis of the aircraft's tactical and technological data, it can be stated that the average value of the maximum altitude amounts to 17,000 m, their range to 4,567 km, and the average maximum speed to 2,237 km/h (621 m/s). The above values are not pertinent to the Tu-95 and Tu-160 bombers, which have much higher parameters. For a more comprehensive picture of the air threat brought forth by aircraft it should be pointed out that they also have the capacity of delivering and firing air-launched anti-radar missiles, whose range exceeds 100 km (e.g., Kh-28 – 110 km, Kh-58 – 250 km).

However, it should be stressed that the increase in the number of military equipment in the Russian Federation is accompanied by the realisation of modernisation programmes, where the means of air attack play a significant role. In 2011, the State Armaments Programme (GPW 2020) was initiated, which was the basis for the modernisation plans for the Russian army. The Programme assumed spending over 20 trillion Russian roubles during a decade, an equivalent of 705 billion American dollars, for purchasing equipment and armament [16]. The objectives of the performed plan are presented below (Table 2).

Table 2. The objectives of the qualitative modernization programme for the chosen military equipment of the Russian Federation

Russian Federation Armed Forces' modern weapon systems and military equipment [data in %]		
Type of military equipment/year	2019	2020
Aircraft	67	71
Helicopters	85	87
Missile systems	100	100
Percent of army modernization	64	70-100

Source: [17].

The realisation of the modernisation plan assumes upgrading military equipment, including the means of air attack of the Russian Federation from 19% in 2012 to at least 70% in 2020.

The presented quantitative and qualitative data demonstrate the progressive rise of the means of air attack potential of the Russian Federation and, in consequence, the increased air threat to the NATO's eastern flank. It should be also emphasised that we witness a constant development of air threats both in the sense of conducting military action, as well as of using forces and means.

2. Changes in the air security environment

2.1. Experiences from the Conflict in Ukraine

The conflict in Ukraine, which was the implementation of the Chief of the General Staff of the Armed Forces of Russia – Valery Vasilyevich Gerasimov's concept of the hybrid nature of future conflicts [18], shed some light on the new possibilities of conducting warfare. The practice of carrying out such a conflict shows, i.a., the following features:

- the disappearance of the differences between war and peace,
- inception and carrying out a military conflict without declaring war,
- conducting regular and asymmetric tactical actions simultaneously,
- the use of soldiers with and without uniforms in the conflict,
- conducting military actions, as well as political and economic pressure simultaneously.

The analysis of recollections of the soldiers who participated in the “DEEP UKRAINE” conflict [18] shows that because both sides of the conflict (separatist and Ukrainian soldiers) were equipped with good quality means of air defence, the air space was used only to carry out reconnaissance missions with the use of unmanned aerial vehicles – “air forces did not really participate in that operation. The main task was a fight with a UAV. They caused us many problems and a lot of harm” (own transl.) [18]. During one operation described by a NATO officer, several unmanned vehicles owned by separatists were shot down in Kramatorsk. The officer’s memories point at a quick fire response to the place where the anti-aircraft units were stationed – “After each UAV was shot down, we got in response a strong fire, accurately targeting the place we were shooting from” (own transl.) [18] and at the communication problems during the operation – “The most important problem of our army was communication; without it there is no chance for effective action” (own transl.) [18].

It is worthwhile to mention that the separatist groups had in their possession anti-aircraft units, what significantly limited the possibility of running operations by the Ukrainian air forces. Those units were in part taken over from the Ukrainian military units stationed in the eastern part of the country; some, however, were delivered by Russians. At the beginning of the conflict, more than a dozen aircraft were shot down (Fig. 6).

Another point that should be addressed here is that militarisation of outer space and space military technologies are becoming more and more important since they can provide a solid advantage. Contemporary warfare relies significantly on information gained from tactical ISR (Intelligence, Surveillance, Reconnaissance) systems, whose satellites are a more and more vital element. Hence, proper countermeasures have been also developed by, i.a., Russian military. There are five electronic warfare platoons and one of them is dedicated to jamming

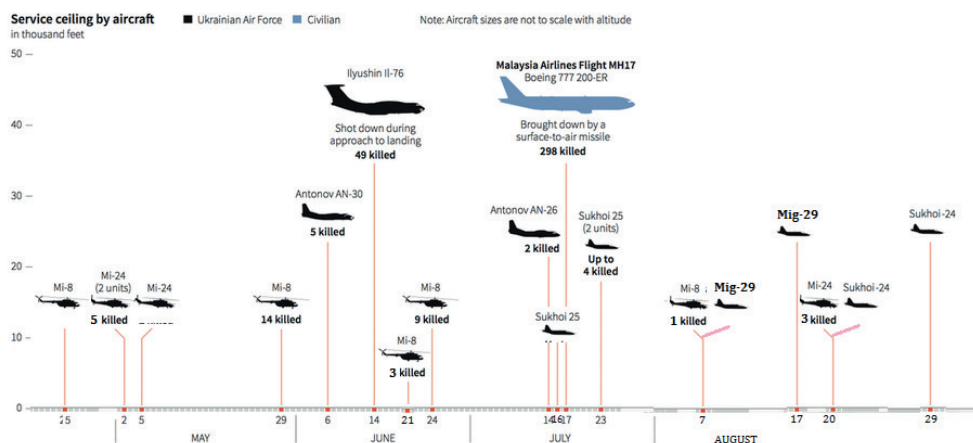


Fig. 6. The aircraft shot down over Ukraine in the first period of the war (2014)

Source: [19].

mobile phones, Global Positioning System (GPS) signals, as well as radio communications and munitions that employ radio-controlled fuses [20]. During the last conflict in Ukraine, Russians were able to jam the signal, which resulted in the loss of GPS for radios and mobile phones and the grounding of some remotely piloted aircraft [21].

It should be also mentioned that the Russian Federation has the capability to destroy satellites in the orbit and is still developing its anti-satellite weapon systems. The Nudol direct ascent anti-satellite missile has been successfully tested and it is believed to be another milestone for Russian armed forces to be able to destroy navigation, communications, and intelligence satellites [22].

In spite of the fact that air operations were carried out in a limited scope during that conflict, on the basis of the conducted analysis we may conclude that:

- depending on the type of a conflict, the potential of the means of air attack may vary,
- in case of carrying out a conflict similar to the one in Ukraine, the ground-based air defence systems are of great importance,
- the ground-based air defence systems should possess the capacity of quick change of the fire position,
- gaining even a local advantage in the air during a hybrid conflict may be impossible, therefore the use of air forces will be very limited,
- it is necessary to possess communication and information systems immune to signal interference.

2.2. Modernisation of Air Forces of the Russian Federation

In mid-December 2017, the President of the Russian Federation approved the newest 10-year modernisation plan for the armed forces (*Gosudarstvennaia Programma Vooruzheniia* – GPV 2027). The outlines of the new modernisation plans in the part pertinent to aircraft include, above all, modernising the Su-30SM to the Su30MKI version of 12 to 18 planes yearly, which will secure the final number of at least 186 operational aircraft in 2027. Moreover, Russia plans to additionally acquire approximately 200 Su-35Ss. It should be noted as well that Russians develop Su-34 aircraft that is meant to replace the Su-24M. The Kremlin anticipates that more than 200 aircraft of that type will be armed with precise-guided munition (PGM) before the end of 2027.

On the basis of the Russian Federation's plans analysis, the strike potential of the Russian air forces after 2027 may look as in Table 3.

Comparing the above presented data on the anticipated number of means of air attack of the Russian Federation with their current quantities (Table 2), a significant increase of the quantitative potential can be noticed, as well as replacing old type aircraft with new machines of the 4th or 5th generation.

Apart from the development of the state-of-the-art aircraft, it is predicted that the deployment of the Iskander-M surface-to-surface missile systems and a new Tornado-S missile system with the range of 120 km (the successor of the BM-30 Smerch system) will be continued. Special attention should be given to the fact that the Russian Federation is very willing to develop the technology of hypersonic missiles. On 20 February 2019, President Putin confirmed that a scramjet-powered manoeuvring anti-ship hypersonic cruise missile Zirkon

Table 3. Anticipated number of strike aircraft of the Russian Federation

Type	Number	Type	Number
Su-35	200	Su-25	120
Su-57	50	Su-27	60
MiG-29	60	Su-30	190
MiG-31	150	Su-33	17
MiG-35	70	Su-34	210
Sum: 1100-1200			
Tu-95	60	Tu-22	69
Tu-160	66		
Sum: 190-200			

Source: Own work on the basis of [23].

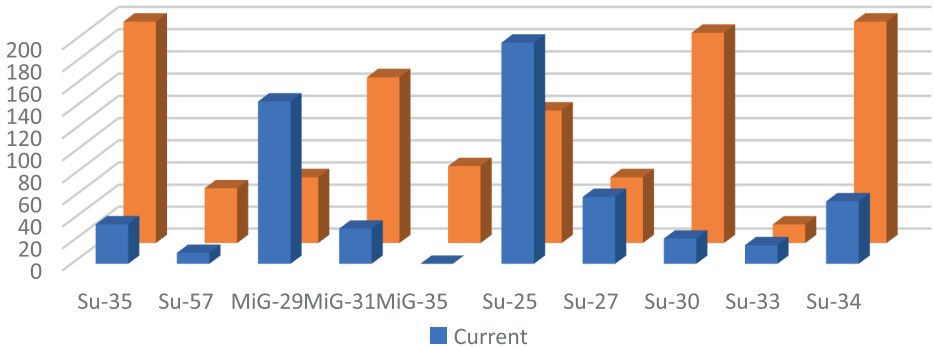


Fig. 7. The anticipated and current quantitative potential of the chosen means of air attack of the Russian Federation

Source: Own work.

(Tsirkon) had been in development. The missile, according to the Russian leader, will reach the speed of Mach 9 and will have a range capability of over 1,000 km [24]. The weapon is expected to join Moscow’s arsenal by 2022 [25].

Along with the deployment of new generation aircraft and the expansion of missile capacity, Russia is developing the concepts of using unmanned aerial vehicles. It should be added that the first strike UAVs are planned to be introduced into the Russian army before the end of 2027.

The potential of the means of the Russian Federation air attack is on the rise and the implementation of the above-discussed state armament programme (GPV 2027) significantly increases the number of new generation aircraft. That fact should not be left unaddressed by NATO’s modernisation plans. Moreover, the analysis of the modernisation trends shows the broad development of air strike capacities from the aircraft modernisation to new missile

types to UAVs and artillery systems. It supports the thesis that the multi-dimensional development of a defence system is necessary.

3. Air defence of NATO's eastern flank

Air security of the eastern part of NATO is directly dependent on the efficiency of the integrated air defence and missile defence system. Air defence of every NATO member state, and in consequence of the whole alliance, is supposed to constitute a fully integrated system engaging all types of armed forces and the means they possess. Among the main factors contributing to air security, there are means of air reconnaissance (sensors), means of fire and electronic attacks of airborne objects (shooters), and integrating them systems of command, communication, and automatisisation (links).

Nowadays, NATO's eastern flank countries are equipped with anti-aircraft systems coming from the Soviet Union. The majority of them are obsolete and do not meet the requirements of the current battlefield. Table 4 presents basic tactical and technological data concerning the chosen air defence systems of NATO's eastern flank countries.

On the basis of the comparison of the tactical and technological capacities of anti-aircraft sets and the possibilities of the air attack means, a conclusion can be drawn that apart from the small SA-2, SA-3, and SA-5 systems, those sets are unable to successfully engage an aircraft that flies at the altitude higher than the pointed out in the previous section average of 17,000 m. Moreover, the majority of the systems cannot affect an object beyond the range of 100 km, and on that account successful engagement of the means of air attack that include anti-radiation missiles becomes impossible. It should be pointed out, however, that the main deficiency of the discussed systems is a limited possibility to integrate them with the modern systems being in the possession of the western NATO countries.

The apparent technological shortcomings of air defence forces of NATO's eastern flank countries have been included by the majority of them in their modernisation plans. Examples of countries where the largest investments take place are Poland and Romania, which bought the PATRIOT systems, and Lithuania that is spending over 50 million dollars on the modernisation of their SHORAD system.

Referring to the modernisation plans, it is worth noting that participation in the NATO structure of the eastern European countries sets the new goals and tasks for their armed forces

Table 4. The characteristics of the chosen air defence systems of NATO's eastern flank countries

	SA-2 Guideline	SA-3 Neva	SA-5 Gammon	SA-6 GAINFUL	SA-8 Gecko	SA-9 Daskin	NASAMS
Range [m]	50000	25000	255000	24000	10500	4200	6000
Altitude [m]	30000	18300	29000	14000	5000	3500	4000
Missile speed [m/s]	1300	1000	1100	700	1020	580	870
Detection [m]	250	85000	500000	60000	20000	30000	optical

Source: Own work on the basis of [26].

[27]. Among the most important of them in the international setting, there is the possibility of cooperation of chosen components in a coalition structure, i.e., integration throughout interoperativeness of armament and technological equipment, but also on account of streamlining organisational structures, ensuring compatibility and preparing commanders and authorities to act according to the NATO rules and procedures. This is why, apart from the technological aspect, there is a necessity to unify the C2 system (command and control), including the provision of training programmes on air space control and coordination of actions for various components.

In spite of a rather sceptic assessment of the current state of air defence forces and means of the eastern NATO flank, it can be stated that there are real chances for obtaining gradually higher levels of interoperativeness and compatibility in the particular member states. It is crucial for NATO, whose one of the key objectives is to integrate air defence forces and means within the framework of an integrated air defence and anti-missile NATINAMDS system.

Conclusions

The analysis of the NATO external security environment allows to state that one cannot exclude the occurrence of air threats in the future. The conducted research enables drawing the conclusion that the engagement of the means of air attack will depend on the nature of the military conflict. On the one hand, the aggressor may use their entire military potential, on the other – the means of air attack may be used in a limited way in the case of hybrid warfare. The engagement of the whole potential of the means of air attack will entail not only using the conventional means of air attack, but also the deployment of state-of-the-art armed combat systems, including the use of outer space and new missile technologies (e.g., hypersonic gliders or cruise missiles).

The research on the means of air attack of the Russian Federation demonstrates their dynamic development, both in numbers and quality. Moreover, it should be emphasised that tactical and technological capacity of conducting air operations by the potential aggressor is much larger than the one of the NATO eastern flank countries. Using an anti-access strategy (A2/AD) may significantly limit the possibility of receiving support from the western countries of the alliance. The contemporary concepts of creating and operating air defence systems are based on the idea of integration and network-centric disposal of information on the situation in the air space. The essence of the integration of the modern national air defence systems within the framework of an integrated alliance is a transfer, by each state, of both responsibility and mandate to defend the territory, troops, and civil population, as well as the necessary forces and means for attaining that goal [28]. It is worth mentioning that NATO members may keep some of the rights to carry out air defence over its own territory and not to transfer it to the command of the alliance. Moreover, we can now observe various approaches towards modernisation of air defence systems among the NATO member states, which may significantly obstruct or entirely make it impossible to carry out integrated actions in dynamically changing situation in the air. That is the reason why it is necessary to possess the strategy for the development of a NATO integrated air defence system.

Acknowledgement

No acknowledgement and potential founding was reported by the authors.

Conflict of interests

All authors declared no conflict of interests.

Author contributions

All authors contributed to the interpretation of results and writing of the paper. All authors read and approved the final manuscript.

Ethical statement

The research complies with all national and international ethical requirements.

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Bezpieczeństwo powietrzne wschodniej flanki NATO: zagrożenia i wyzwania

STRESZCZENIE

Artykuł skupia się na ocenie bezpieczeństwa powietrznego wschodniej flanki NATO w kontekście dynamicznych zmian w jego bezpośrednim sąsiedztwie. Autorzy rozpoczynając od przeglądu obecnej sytuacji w zakresie bezpieczeństwa powietrznego w regionie, dokonali analizy rozwoju tego środowiska. Szczególną uwagę zwracając przy tym na proces modernizacji systemów rakietowych, sił powietrznych i kosmicznych Federacji Rosyjskiej, zarówno pod względem jakościowym jak i ilościowym. Wyzwania wynikające z nowej sytuacji zostały porównane z obecnymi i przyszłymi zdolnościami obronnymi NATO przed zagrożeniami lotniczymi.

SŁOWA KLUCZOWE

obrona powietrzna, bezpieczeństwo powietrzne, zagrożenia powietrzne, wschodnia flanki NATO, siły powietrzne Federacji Rosyjskiej

How to cite this paper

Michalski D, Bernat P. *Air security of NATO's eastern flank: threats and challenges*. Scientific Journal of the Military University of Land Forces. 2020;52;2(196):352-65.

DOI: <http://dx.doi.org/10.5604/01.3001.0014.2538>



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