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National and International Perspectives of the Hungarian Ground-Based Air Defence Forces (2)

Status Quo, Development Plans, Operational Performance and Remaining Capability Gaps

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Based on the findings of part 1 of my article series, analysing the strategic environment and considering first ideas of multinational capability development options for the Hungarian ground-based air defence forces, the present force structure and already initiated next steps are assessed and remaining capability gaps are identified. It is encouraging to see that prudent procurement decisions can systematically lead the way from a Soviet dominated weapon system landscape to swiftly being on track to becoming one of the most capable ground-based air defence forces nations in Europe and NATO.

Keywords: *Hungarian Defence Forces, ground-based air defence, Zrínyi programme weapon systems, NASAMS, SAMOC*

"New capabilities emerge just by virtue of having smart people with access to state-of-the-art technology."
Robert E. Kahn

The combination that Robert E. Kahn describes will at least form the main prerequisite for a new capability. However, next to smartness and technology, several further steps have to be taken, at least when discussing capabilities in a military sense. Many years of experience in the field of capability development and procurement matters showed me that developing and managing a capability is much more than procuring the system. Definitely, more than one way leads to Rome, but the secret of success is obviously to find and use the right capability development tool in the right moment and constellation.

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Soviet legacy and peace dividend

After having focused predominantly on the strategic environment and on generic aspects of multinational cooperation in the first part of this publication series, the following article will shift the perspective and demonstrate that Hungary is on a very good path to becoming one of the leading air defence nations in the NATO. Therefore, I will turn my gaze specifically to the Hungarian ground-based air defence (GBAD) forces in order to assess the current performance, contemporary developments and remaining capability gaps. As in many allied countries, due to the illusion of gaining a peace dividend[2] after the end of the Cold War, defence spendings have been kept on a low level in Hungary as well. Consequently, capabilities have been reduced, less resources have been allocated to defence matters and no systematic capability development took place. All this shapes the current status quo of the Hungarian Defence Forces (HDF) and thus also their GBAD forces.

During the 1990s, the Soviet legacy systems SA-5 Gammon, SA-2 Guideline, SA-3 Goa[3] were gradually phased out. In 2000, the SA-4 Ganef[4] medium range systems as well as the short range man-portable air defence systems (MANPADS) SA-7 Grail and SA-16 Gimlet[5] have been abandoned as they had reached the end of their operational life. As the only GBAD procurement between 1990 and 2016, the French short range air defence (SHORAD) system Mistral 2 has been acquired during Hungary's NATO accession process in the late 1990s and put into service in a phased manner from 1999–2000. Since the beginning of the 21st century, after a transition phase in 2003–2004, one single surface-based air defence regiment, namely the MH Dánielfy Tibor 205th Air Defence Missile Regiment (until 31 December 2022: MH 12th Arrabona Air Defence Missile Regiment[6]) in Győr, has remained, until recently possessing the SA-6 Gainful[7] and the Mistral 2 as its main weapon systems. During the past years, a life extension programme for the SA-6 has been implemented to bridge the time until the succeeding system (Norwegian[8] Advanced Surface-to-Air Missile System, NASAMS) has achieved Full Operational Capability (FOC).[9] After the Hungarian accession to NATO in 1999, it was necessary to ensure full integration of the HDF SA-6 systems into NATO's Integrated Air and Missile Defence System (NATINAMDS), since its own Soviet fire control system did not allow this. The integration has finally been achieved between 2004 and 2009 with enhancements of the K-1P and K-2PC fire control and distribution centres, that were completed on a domestic industrial base.

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2 The peace dividend describes the economic benefit that was expected after the end of the Cold War, since money formerly spent on military capabilities was suddenly available for other purposes. Despite the fact that most countries have decreased their military expenditures, a noticeable peace dividend has not been accomplished.

3 The Russian/Soviet designations of these systems are S-200, S-75 and S-125.

4 The Russian/Soviet designation of the SA-4 Ganef is "2K11 Krug".

5 The Russian/Soviet designation of the SA-7 Grail is "9K32 Strela-2" and of the SA-16 Gimlet is "9K310 Igla-1".

6 55/2022 (XII. 28.) HM Instruction.

7 The Russian/Soviet designation of the SA-6 Gainful is "2K12 Kub".

8 The acronym NASAMS is sometimes also referred to as "National Advanced Surface-to-Air Missile System".

9 Tömböl et al. 2021b.

Zrínyi National Defence and Armed Forces Development Programme as a paradigm shift

The substantial modernisation was initiated by the Zrínyi National Defence and Armed Forces Development Programme[10] (Zrínyi Programme), which undoubtedly represents the most ambitious defence development programme of the post-change era. It was launched in January 2017 and aims to comprehensively modernise and renew the equipment across all capability areas of the HDF. One of the priorities of the programme was to introduce a state-of-the-art missile operations centre capable of delivering NATO-interoperable strategic command and control of air and missile defence systems. This initiated the first giant leap towards the future for the Hungarian GBAD forces.[11] The procurement of the Surface-to-Air Missile Operations Centre (SAMOC)[12] was contracted in December 2018 between Airbus Defence & Space and representatives of the Hungarian Ministry of Defence.[13] Hungary is the third user nation after Germany (DEU) and Saudi Arabia (SAU), having the SAMOC equipment deployed at the MH Dánielfy Tibor 205th Air Defence Missile Regiment base in Győr. One further prominent goal of the Zrínyi Programme is the restoration of a modern medium-range air defence missile defence capability. As just described, the major technical solution for the GBAD C^2 portion, namely the SAMOC, has already been acquired.[14] Thus an adequate air defence system had to be chosen in the next step. After a deliberate decision-making process including market research, technical analysis and management decisions within the Hungarian Ministry of Defence (MoD), the contract for the purchase of the NASAMS system from the Norwegian defence company Kongsberg and the US defence company Raytheon was signed in November 2020.[15] The first components of the system have already been delivered to the MH Dánielfy Tibor 205th Air Defence Missile Regiment and will finally replace the obsolete Soviet-era system SA-6.[16] The procurement contains the most modern version of NASAMS (NASAMS-3), which was first deployed by the Norwegian armed forces in 2019. While currently 13 nations officially operate NASAMS in total, Hungary has become the sixth NATO member state to use this air defence system.[17] In total, six fire units (FU) are scheduled to be introduced until the end of 2024. Complementing the procurement, 180 Advanced Medium-Range Air-to-Air Missile (AMRAAM)[18] as well as 60 AMRAAM with extended range (AMRAAM-ER)[19] were also purchased for the Hungarian Air

[10] Previously: Zrínyi 2026 Defence and Force Development Programme.
[11] Kolozsi 2022: 30.
[12] See: https://intelligence.airbus.com/industries/defence/c2/air-c2/fortion-samoc/
[13] About Hungary 2018.
[14] The SAMOC communication and relay equipment is part of a separate, central HDF procurement.
[15] See: https://www.kongsberg.com/kda/what-we-do/defence-and-security/integrated-air-and-missile-defence/nasams-air-defence-system/
[16] Kolozsi 2022: 27–35.
[17] Váradi 2021.
[18] DSCA 2019.
[19] DSCA 2020.

Force in 2020 as effectors for the NASAMS system.[20] Next to the Sentinel[21] radar that is integrated into NASAMS, a purchase of a longer-range sensor, the ELM-2084[22] multi-mission radar (MMR), produced by the Israeli (ISR) company Israel Aerospace Industries (IAI) ELTA, was announced in November 2020. This sensor with active electronically scanned array (AESA) radar technology will execute surveillance tasks for the HDF and replace the decommissioned Soviet legacy radar systems.[23] According to current concepts, the ELM-2084 will be operated by the Hungarian Air C2 entities in the Air Operations Centre Veszprém. In parallel, a modernisation of the Mistral system will take place. The intended lifetime extension until approximately 2035 serves the purpose to maintain the VSHORAD/SHORAD capability in the HDF in accordance with NATO requirements. The measures include the upgrade of the link interface to NATO standards (Link 11/JREAP) as well as implementing an Identification Friend or Foe (IFF) mode 5 capacity.[24]

During the recent decision-making process regarding air defence capability development, a clear prioritisation emerged within the Hungarian MoD. First, a powerful medium range air defence should be established. Assessing the recent procurement efforts, owning the SAMOC and now acquiring NASAMS, that aim is on its way to be achieved soon. In the second step, the SHORAD capability should be maintained. With the above-described Mistral upgrades, this goal is settled as well, at least in terms of an interim solution until 2035. The third priority was set to re-establishing an organic air defence capacity within the Hungarian Land Forces, true Army Organic Air Defence (AOAD) forces that should be affiliated to the land forces' troop level. Introducing a missile defence capability is not on the Hungarian defence development agenda yet. However, an Anti-Tactical Ballistic Missile (ATBM) system is considered to be a potential next step in the following decade,[25] after the above steps have been completed, including the build-up of countering unmanned aircraft systems (C-UAS) and counter rocket artillery and mortar (C-RAM) capabilities.[26] Overall, the capability management process and the following development and procurement decisions seem to be very stringent in the light of the national and international strategic foundation documents. The National Security Strategy 2020 (NSS 2020) and the National Military Strategy 2021 (NMS 2021) both refer strongly on the alliances and the NATO–EU framework. My hypothesis and assumption on the "balancing act" between national and international ambitions is: If the assigned NATO requirements for Hungary in terms of air defence capabilities will be met, then the national ambitions – i.e. regarding protection of critical infrastructure – will be accomplished as well.

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20 Baranyai 2020.

21 The AN/MPQ-64 Sentinel, produced by Raytheon, is an X-band electronically steered pulse-Doppler 3D radar used with SHORAD weapon systems.

22 See: https://www.iai.co.il/p/elm-2084-mmr

23 Hungary Today 2020.

24 Expert discussion 2022a.

25 Respective considerations re-emerged in Hungary in reaction of the Polish missile incident on 15 November 2022, cf. Army Recognition 2022.

26 Expert discussion 2022b.

Current operational performance

In terms of operational performance, the high altitude, long and medium range GBAD capability in the HDF had been eliminated by decommissioning the Soviet-era systems SA-5 Gammon, SA-2 Guideline and SA-3 Goa. Through further force reduction processes based on the 1990s' and 2000s' peace dividend thinking, the SHORAD capability and mobile escort protection of land forces against air threats also disappeared. The SA-6 Gainful has been delivering a basic contribution to NATINAMDS, but it operates with only one target channel and is due to uncertain technical conditions of equipment and missiles definitely outdated.[27] The Mistral system is technically more advanced and complements with SHORAD and point air defence protection capabilities. However, despite the mentioned modernisation steps, including a missile upgrade to the M3 missile, and even though it is surely better to have a functioning SHORAD component compared to not delivering this capability at all, the Mistral system represents the technological level of the early 1990s. Due to several of these technical issues and further upgrade requirements, it is not capable enough to counter a modern conflict's air threat spectrum and fulfil NATO's as well as Hungary's self-imposed requirements.[28] Therefore, at present, the air defence tasks in the Hungarian sovereign airspace lie almost entirely in the responsibility of combat aircraft forces.

The SAMOC C2 system is capable of coordinating and supporting the full process of surface-based air defence (SBAD)[29] employment, which includes planning and pre-planning of combat activities, organisation, combat readiness, combat management and fire control functions of an air defence task force. Due to link implementation in accordance with NATO standards and network-based, encrypted communication facilities, the SAMOC fulfils all requirements to be swiftly integrated into NATINAMDS. Its control algorithms enable the management of air defence in all layers and target spectrums, including Ballistic Missile Defence (BMD). Therefore, the Hungarian SAMOC procurement can be assessed as the prerequisite and first key component to reach the desired national air defence capability as envisaged by the Zrínyi Programme. Its extensive interoperability and flexibility from the early planning phase to mission execution represent an inestimable value for the HDF. Especially when it comes to multinational projects or integration of allied air defence weapon systems, the SAMOC serves strategic level goals and will be key enabling equipment to guarantee the handling of the full Battle Management Command, Control, Communication, Computers and Intelligence (BMC^4I) spectrum as claimed in the national and international strategic foundation documents.

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27 Tömböl et al. 2021a.

28 Kolozsi 2022: 25–27.

29 In addition to the land-related expression "GBAD", the term "SBAD" includes naval surface-based air defence operations in the maritime domain.

NASAMS as the future game changer

NASAMS will undisputedly be a game changer, since it is one of the most advanced western air defence systems to date. Its open architecture and highly flexible modular system design meets the requirements of modern, interoperable air defence systems. Via its modern Fire Distribution Centre (FDC), NASAMS is also capable of simultaneously engaging hostile assets in 360°, network-based, multi-target, multi-channel, beyond-visual-range operations. Different types of missiles can be integrated. The target spectrum encompasses the full spectrum of conventional air threats, namely fixed-wing and rotary-wing aircraft, helicopters, UAS and cruise missiles. Further key features of the NASAMS system are state-of-the-art technological solutions in terms of all-weather capability and high mobility with minimised deployment times. The necessary personnel footprint is relatively low, compared to the number of operators required to run older generation weapon systems. The separate system components can be dispersed within a longer area and distances up to 20-25 kilometres, depending on topography and communication links, which ideally supports passive defence measures and increases the survivability of the system. Due to the high level of integration capability, NASAMS fits ideally into an interconnected NATINAMDS structure. With its flexible architecture, the system would be capable of integrating and linking into a multinational and multi-system environment, even without the SAMOC as the higher echelon system. Looking at the ambitions in terms of protection coverage, NASAMS is – given its range and system characteristics – capable of providing area and point protection, comprising critical infrastructure, air bases, airfields, military installations, troops or populated settlements. From my perspective, especially the procurement of the most modern version NASAMS-3, which is even more flexible and interoperable than the previous configurations,[30] combined with the integration of the long range AMRAAM-ER missile next to the standard effector, implies a huge step forward towards a new weapon system generation, owning a modern and flexible air defence asset with capable effectors.

Even if it is planned to primarily operate the ELM-2084 in the framework of the Hungarian Air Force C2 entities, I consider it a prudent move to also investigate the direct Tactical Data Link (TDL) interface connection to the SAMOC and the NASAMS system. It could thereby produce a powerful complement to the planned weapon system configuration. The detection range and altitude of the ELM-2084 radar is considerably higher than the Sentinel radar, hence providing air surveillance of a larger area and early warning. In combination with the Hungarian Air command and control forces, mainly the Control and Reporting Centre (CRC) in Veszprém, the projected GBAD equipment set will be able to share airborne situational information and thus contribute to producing a high quality recognised air picture (RAP) within the area of responsibility. Moreover, the SAMOC in conjunction with the ELM-2084 and the NASAMS Sentinel radar can provide comprehensive situational awareness and real-time airspace surveillance information also in any kind of multinational contingent or formation to the other participating air

[30] NASAMS-3 adds the capability to fire AIM-9 Sidewinder and IRIS-T SLS short-range missiles and additionally introduces mobile air-liftable launchers.

defence forces. The ELM-2084's software algorithms are also capable of parameter-based classification and threat level allocation for airborne targets, which induces warning messages to connected friendly forces.[31] The ELM-2084 is furthermore capable to adjust to multiple missions as air surveillance, C-RAM and fire control mode. These characteristics provide a high degree of flexibility, since lower radar signature targets can also be detected. Additionally, integrating various sensors into GBAD configurations – whenever technically feasible – is always an added value in terms of redundancy, offering increased jamming resilience and continued operations in the case of equipment outages.

Assessing the overall operational performance of the future Hungarian GBAD forces, in my opinion, the combination of the chosen weapon system components represents an extremely modern set of key capabilities for medium-range GBAD operations. As laid down in the NSS 2020 and the NMS 2021, more tangible military cooperation and integration into the international security architecture of NATO and EU has been declared as one prime driver for Hungarian defence policy. Technical and doctrinal interoperability serves as a key prerequisite. Therefore, the ongoing development in the HDF of gradually decommissioning the weapon systems of the Soviet-era and procuring modern interoperable products has to be recognised by all allies as a purposive and determined process.[32]

Interoperability implies operational flexibility

As already noted previously, the SAMOC has in the given system composition been assigned to serve as a reliable management system primarily for joint operations in a multi-service and multinational context, including missions under national, NATO, or EU command. With its tactical data linkages and military message processing algorithms and its open architecture, the system does not only offer full compatibility and interoperability with current weapon systems and C2 facilities, but it is also ready for further developments and future standard messaging protocols. This implies that any upcoming system in the near future can be integrated, which makes the SAMOC the ideal battle management system in both force and engagement operations with regard to allied interoperability. The German GBAD forces have already collected broad experience in operating the SAMOC in various configurations. Most prominent examples during the recent years were the "Tobruq Legacy" (TOLY) exercise series between 2015 and 2020, bi-national German–Dutch live firings, the "Joint Project Optic Windmill" (JPOW)[33] as well as "Ramstein Legacy 2022" (RALY22) exercises. These exercises include the full spectrum of Integrated Air and Missile Defence (IAMD) activities, covering all phases from peacetime across crisis to conflict, namely deployment of the multinational contingent into theatre, establishment of a NATO C2 structure, ensuring full interoperability in air defence operations and integrating of airborne assets and their data flows into a multi-system network-centric environment. Various allied GBAD weapon systems (Patriot, NASAMS, SA-6, SA-8) and

31 Kolozsi 2022: 30–35.
32 Bak et al. 2021: 12.
33 Scharschmidt 2016.

FDCs as well as higher echelon command facilities have been successfully connected to and operated by the DEU SAMOC. Despite the different levels of technical development and configurations of the weapon systems from different decades and several nations, full operational readiness has always been achieved, based on existing experience of the SAMOC specialists and on excellent multinational cooperation.[34]

Next to the SAMOC as the key element, the NASAMS system and the ELM-2084 radar both offer widespread options to finally ensure interoperability for various weapon system constellations. For example, the sensor data of the Sentinel radar can be processed either via the NASAMS system or via TDL to the SAMOC to produce a local air picture (LAP) on SAM wing level and to contribute to the higher echelon's air situational awareness by complementing the RAP. If operating the ELM-2084 within a GBAD constellation, it can – in a functioning TDL network – flexibly be connected in similar configurations. It is also a feature of interoperability that the NASAMS architecture is generally capable of integrating different types of radars and effectors. Additionally, the mere fact that NASAMS has been purchased and deployed by 13, soon to be 15 countries so far, provides a certain degree of interoperability. All new components of the future Hungarian medium range air defence capability have been designed with having flexibility and integration options with other weapon systems in mind. In this regard, the respective system compositions and architectures are perfect and the combination of SAMOC and NASAMS ensures a high degree of interoperability. However, the SAMOC will remain the central building block and the prime guarantor of interoperability for the Hungarian GBAD forces.

Capability gap analysis

The new medium range air defence capability of the HDF will be state-of-the-art and exceptionally flexible. However, even the most advanced system is not capable of countering all current and future aerial threats on its own. Therefore, a short capability gap analysis[35] is necessary to fully examine the Hungarian GBAD forces' capability spectrum. Looking to the upper layer, it is obvious that NASAMS does not possess a BMD capability. The AMRAAM missiles are originally designed to destroy conventional air-breathing targets, but they can effectively be applied against cruise missiles and UAS as well. Due to their launch profile, speed and maximum height of target destruction, they are not considered effective to intercept ballistic missiles.[36] The ELM-2084 sensor will be able to partially contribute to air situational awareness for the upper layer, given its flexibility in different acquisition modes. Frequently has the SAMOC proven its performance in providing command & control in ATBM missions with different weapon systems. Therefore, the HDF will be capable of limited contributions to NATINAMDS within the upper layer, but

[34] Schmidt 2022 and Rasquin–Gottschlich 2019.

[35] The AMD layers according to the European Sky Shield Initiative categorisation will be used for the gap analysis: short range (5–15 km downrange and up to 6 km ceiling); medium range (15–50 km downrange and up to 25 km ceiling); long range (above 50 km downrange and up to 35 km ceiling); upper layer BMD (above 50 km downrange and above 35 km ceiling).

[36] Ismay 2022.

will not possess any organic engagement capacity. In the long range layer, the Hungarian GBAD forces can again contribute with air surveillance data and C2 capabilities, but not with an effector capacity. However, the question is whether a separate long range engagement capability to counter air-breathing targets is necessary, whilst an appropriate medium layer capability exists. Covering this long range layer can therefore be considered to be the lowest priority behind all other capability subareas of AMD.

In the medium range layer, the future capabilities will be state-of-the-art and comprehensive as was pointed out before.

As previously deduced, the Mistral system currently represents the only capability in the short range layer. Even though the modernisation process might mitigate the concerns to a certain extent, the system in the current configuration is not capable to adequately meet the requirements. At the same time, compared to modern weapon systems, it is relatively personnel-consuming. Not actually representing a capability gap – since a SHORAD system exists – but still connected to this topic is the fact that the GBAD competence within the HDF is merged solely in Győr, in the Hungarian Air Force, in one single air defence missile regiment. So there is currently no real air defence expertise in the Hungarian Land Forces. Now that the war in Ukraine has demonstrated how important an organic and accompanying air defence cover is for the land forces, the missing AOAD proficiency has to be considered as a notable capability gap. It is an illusion – and the examples of several other nations like Germany prove it – that air cover for manoeuvring land forces units can easily be provided by the SHORAD air force capacity. Thinking about the layered system, there is definitely a way to coordinate all air defence efforts within a collective defence scenario in this way that protection against air threats is ensured in most areas of the battlefield. From my perspective, however, coordination and deconfliction of all measures with regard to air defence operations is vital, especially with today's multifaceted target spectrum. The land force commanders also need to be aware about the adjacent GBAD troops. Recent experience has shown that, therefore, the solution of having an organic air defence capability, which can counter at least short range assets, helicopters and UAS including LSS and RAM targets will be the best option. In conclusion, a capability that includes mounting a sensor and effector suite on armoured vehicles, ideally with a prudent mix of various effectors like agile short range missiles, cannons with air burst ammunition, is necessary in the current threat environment. The current Hungarian intentions to procure the Skyranger 30 system are intended to close this gap. A more detailed consideration of this option will follow in a separate article, when feasible ways forward will be looked at.

It could appear like a subordinate remark, but assessing the overall air defence capabilities, the lack of training and exercise should not be underestimated. Since large numbers of personnel across the HDF were sent to the Hungarian borders to support the migration control or helped in the organisation to counter the Covid–19 pandemic, the training and thus the professional capabilities of the GBAD specialists have naturally suffered. This is not specifically a Hungarian issue, since in many allied nations, the support by military experts to completely different and often civil tasks has taken place in the last few years. Thus, with the new equipment in place, a strong emphasis has to be put on sufficient training and exercise to finally reach adequate GBAD proficiency for technicians and operators.

Conclusion

The strategic impact of the previously described capability gains for the HDF will be considerable. The current modernisation measures imply that Hungary will join the group of NATO's most advanced air defence nations.

Since a GBAD posture will never be intended to cover the full territory in an area defence mission, Hungary with the final capability will be very well prepared to protect selected centres of gravity and critical infrastructure, either within its or in an allied nation's terrain.

Even though the newly procured equipment will lay the foundations for a very solid air defence capability for the HDF, it is obvious that there are still options to complement SAMOC and NASAMS with capabilities that meet the demands of today's conflict scenarios. Therefore, subsequently potential options of achieving an AMD capability increase, nationally and multilaterally, will have to be identified and scrutinised at a later stage of my publication series.

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