



Ukraine's Integrated Air Defence System

Operational Capabilities, Network Resilience and Sustainability, 2026–2030

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Introduction

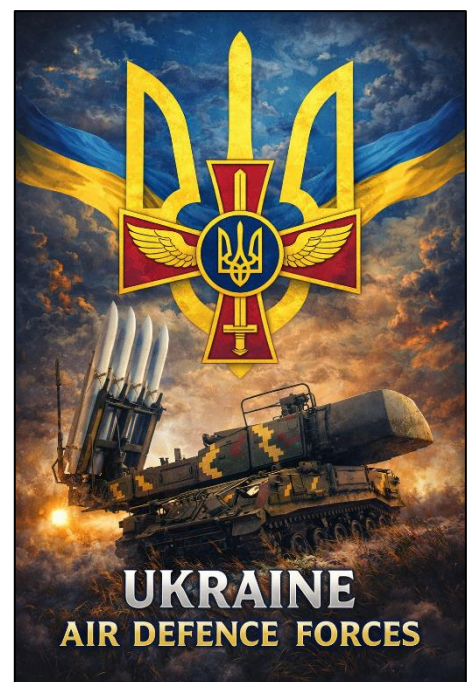
This document provides a comprehensive and updated analytical framework on the **Ukrainian Integrated Air Defence System (IADS)**, understood as the combination of sensors, command and control nodes, firing units and employment procedures aimed at defending national airspace and protecting strategic objectives.

The assessment is based on a corroborated multi-source OSINT approach, including cross-verification of available information, temporal consistency checks of publications, and explicit separation between observable facts, analytical evaluations and inferences. Evidence is treated as distinct elements and only subsequently brought into an interpretative framework in order to avoid unverified linkages or cognitive distortions. Judgments are formulated using probabilistic language and accompanied by a reliability level, taking into account informational gaps and the possible presence of strategic narratives or disinformation.

The document distinguishes between declared nominal capabilities, observable capabilities, and capabilities effectively sustainable over time. The analysis considers not only the technical-tactical dimension of systems, but also logistical resilience, C2 integration, protection of critical nodes and interaction with an operational context characterized by repeated attacks, deliberate saturation, adversary adaptation and structural constraints on ammunition, maintenance and battery rotation.

Due to intellectual property and licensing constraints, the document does not include proprietary satellite imagery or copyrighted material. The assessment nevertheless incorporates a systematic analysis of available OSINT imagery and freely accessible visual evidence, treated as supporting elements for corroboration and temporal reconstruction of events, without direct reproduction of non-reusable content.

Ukrainian Air Defence is therefore not assessed as a static inventory of batteries, but as a dynamic system subjected to continuous stress. Effectiveness does not coincide with the absence of impacts, but rather with the ability to mitigate systemic damage, preserve decision-making continuity, protect critical infrastructure and ensure an operational environment sufficiently stable for the armed forces and essential state functions. The analysis therefore adopts a multi-level perspective, integrating tactical, operational and strategic dimensions. Short-term implications for the protection of urban centers and energy nodes are considered, as well as medium-term implications for ammunition sustainability and wear of high-value sensors, and long-term implications for the future configuration of the IADS network and its degree of interoperability with Western systems.



The resulting framework does not aim to provide a deterministic percentage-based performance estimate, but rather to identify evolutionary trajectories, structural vulnerabilities and resilience points. In this perspective, the Ukrainian IADS is analyzed as an adaptive system in a competitive environment, whose effectiveness must be read in terms of risk management, resource distribution and the ability to absorb and redistribute operational shock over time.

1. Executive Summary, synthetic framework and key judgments

The Ukrainian Integrated Air Defence **network currently constitutes a multi-layered hybrid system**, resulting from the integration of a Soviet-derived architecture and latest-generation Western systems. The IADS operates in a context of continuous pressure, **characterized by saturation campaigns**, combined attacks and adversary tactical adaptation. Its effectiveness must be assessed in terms of reduction of systemic damage and preservation of state functionality, not as a simple percentage of interceptions.

It is highly probable that the network **maintains in the short term a credible denial capability** against subsonic cruise missiles and slow UAVs in priority areas. Coverage nevertheless remains selective and concentrated on strategic nodes, with probable vulnerabilities in the event of simultaneous high-density attacks along multiple axes.

Capability against tactical ballistic vectors depends decisively on the availability of advanced interceptors and the protection of high-value multifunction radars. In scenarios of accelerated consumption or interruption of supplies, **a reduction in defensive depth in the medium term is probable**.

Logistical sustainability and C2 integration represent the dominant strategic factors. System resilience **depends on continuity of ammunition supplies, maintenance capacity and software interoperability among heterogeneous systems**. In the absence of significant discontinuities in external support, it is probable that the Ukrainian IADS will continue to ensure effective protection of decision-making centers and critical infrastructure, albeit within a framework of constant structural stress.

2. Analysis of the IADS Network

a. Organization and chain of command

The structure of Ukrainian Air Defence is organically embedded within the architecture of the **Air Force General Command, headquartered in Vinnytsia**, which constitutes the central level of strategic direction. The General Command oversees regional operational commands, missile units (*Зенитно-ракетные войска – Surface-to-Air Missile Troops*), radio-technical troops (*Радиотехнические войска – Radio-Technical Troops*), communications units and electronic warfare units, ensuring vertical integration between sensors, command and control and effectors. The national **territory is divided into four main regional Air Commands**, representing the intermediate operational level and forming the backbone of sectoral Air Defence management:

- Air Command West, headquartered in Lviv
- Air Command Center, headquartered in Vasylykiv
- Air Command South, headquartered in Odesa
- Air Command East, headquartered in Dnipro

These regional commands control missile brigades and regiments deployed within their respective geographic sectors or in field deployment locations, ensuring layered coverage and local coordination of engagements.

Within the segment of anti-aircraft missile brigades, a distribution coherent with the defence of strategic areas is observed:

- 96th Anti-Aircraft Missile Brigade (Air Command Central), headquartered in Danylivka
- 138th Anti-Aircraft Missile Brigade (Air Command East), headquartered in Dnipro
- 160th Anti-Aircraft Missile Brigade (Air Command South), headquartered in Odesa
- 201st Anti-Aircraft Missile Brigade (Air Command South), headquartered in Pervomaisk
- 208th Anti-Aircraft Missile Brigade (Air Command South), headquartered in Kherson

At regimental level, the structure further articulates into units distributed among the various regional commands:

- 11th Anti-Aircraft Missile Regiment, Shepetivka (Air Command West)
- 14th Anti-Aircraft Missile Regiment, Poltava (Air Command Central)
- 156th Anti-Aircraft Missile Regiment, Zolotonosha (Air Command Central)
- 210th Anti-Aircraft Missile Regiment, Uman (Air Command Central)
- 223rd Anti-Aircraft Missile Regiment, Stryi (Air Command West)
- 301st Anti-Aircraft Missile Regiment, Nikopol (Air Command East)
- 302nd Anti-Aircraft Missile Regiment, Kharkiv (Air Command East)
- 540th Anti-Aircraft Missile Regiment, Kamianka-Buzka (Air Command West)

Originally structured around Soviet-derived systems, **these units now operate within an evolutionary context in which the integration, including and especially of modern Western missile and radar systems**, has progressively expanded operational capabilities, enabling a hybrid and modular configuration of Air Defence.

This distribution highlights a multi-level structure, with brigades responsible for broader areas and regiments providing sectoral coverage or reinforcement capability.

Fundamental to the functioning of the detection–identification–engagement network is the Radio-Technical Troops segment, which provides radar surveillance and feeds the recognized air picture. Among the main units are:

- 1st Radio Technical Brigade, Lypniki (Air Command West)
- 14th Radio Technical Brigade, Odesa (Air Command South)
- 138th Radio Technical Brigade, Vasylkiv (Air Command Central)
- 164th Radio Technical Brigade, Kharkiv (Air Command East)
- 19th Special Purpose Radio Intercept Brigade, Halytsynov (directly subordinated to the Air Force General Command)

Support to the C2 network is ensured by the Signal Corps, with communications regiments deployed in Kyiv, Odesa, Dnipro, Lypniki and Vinnytsia, guaranteeing redundancy and continuity of data flow between sensors and operational units.

Finally, the Electronic Warfare Corps component integrates defence with jamming capability, electromagnetic protection and support to the survivability of sensor nodes, through battalions deployed in Kolomyia, Pervomaïsk and Vasylykiv.

Overall, the chain of command appears structured on three levels: central strategic at Vinnytsia, regional operational through the four Air Commands, and tactical through missile brigades and regiments integrated with radio-technical troops, communications and electronic warfare. This architecture allows distributed but coordinated management of the air picture, with the ability to operate even in degraded mode thanks to regionalization of command and the presence of autonomous sensor and communication nodes in each sector.



It cannot be excluded that, following the outbreak of the conflict, new units have been established and that pre-existing ones have modified their deployment or been repositioned in different areas of the national territory according to operational requirements.

b. Network architecture, command and control, decision-making resilience

From available open sources it emerges that **Ukrainian national Air Defence Command and Control has been restructured in recent periods to survive repeated attack campaigns**, reducing dependence on single nodes and increasing redundancy, dispersion and the ability to operate in degraded modes.

In a heterogeneous network, the decisive variable is not only the quality of individual systems, but the ability to maintain a coherent air picture, assign targets to the best available effector, implement deconfliction in engagements and apply restrictive rules when saturation imposes it. It is probable that a multi-level chain exists, with central definition of priorities and rules of engagement, and with regional or sectoral levels capable of tactical management even when communications are degraded. In operational terms, **resilience derives from three factors that tend to coexist**: reduction of electromagnetic exposure of sensors when possible, mobility and rotation of the most vulnerable complexes, and employment of multiple sensors, including light radars and short-range surveillance, to reduce blind zones and improve detection of low-altitude targets.

The most significant gap **remains the effective degree of real-time technical integration among all sensors and all firing units, in particular between legacy systems and Western systems with different architectures and protocols**, because this integration directly conditions engagement economy and probability of penetration in the event of simultaneous multi-axis attacks.

c. Technical inventory by layer, Soviet legacy systems

The legacy component provides mass and sector coverage, but its availability is constrained by missile stocks, radar wear and spare parts. S-300PT/PS variants and Buk-M1 remain relevant against aircraft and cruise missiles where sensors and missiles are available. Slovakia transferred an S-300 system to Ukraine in April 2022. The public announcement did not establish that the donated equipment matched the later S-300PMU-1/2 (SA-20) variants; this classification remains uncorroborated.

In technical terms, the engagement envelope depends on the variant and available interceptor, with an order of magnitude against aerodynamic targets that may lie, for the most widespread versions, within an indicative interval of approximately 50 to 90 km, with engagement altitudes on the order of tens of kilometers. Real performance is however conditioned by survivability of the sensor segment and by maintenance level, and tends to degrade in prolonged wars not only due to kinetic losses but also due to erosion of readiness and cannibalization.



The **Buk-M1 (SA-11 Gadfly)** remains with high probability the legacy pillar of the medium range. From a technical standpoint, a typical Buk-M1 envelope against aerodynamic targets lies in an order of magnitude of approximately 30 to 35 km, with engagement capability at medium-high altitudes and good aptitude against low and medium altitude targets, including cruise missiles under compatible profiles, within the limits of the sensor picture and saturation. Among previous-generation systems, the **2K12 Kub (SA-6 Gainful)**, where still present as residual capability or reactivated in limited form, provides a medium-short layer with indicative envelopes on the order of 20–25 km. However, vulnerability to modern electronic countermeasures and radar obsolescence reduce its effectiveness in a high-intensity scenario. Similarly, the **S-125 Neva/Pechora (SA-3 Goa)**, conceived for medium-short range defence against low-altitude targets, presents indicative envelopes on the order of 20–25 km with lower altitude ceilings compared to the S-300 line. In the current context, its operational survivability is strongly conditioned by integration into modern C2 networks and by availability of local upgrades.



In the short and very short range layer, systems such as **9K33 Osa (SA-8 Gecko)** and **9K35 Strela-10 (SA-13 Gopher)**, where available and maintained in efficiency, provide point defence and accompaniment, with indicative envelopes respectively on the order of 10–12 km for Osa and 4–5 km for Strela-10, with low altitude ceilings, therefore particularly useful against drones, helicopters and slow or terminal-phase targets.

The S-200 (SA-5 Gammon), an older and less mobile long-range system, has limited verified relevance to the current ground-based air-defence network. Reports of reuse or adaptation of legacy equipment must be distinguished from evidence of a consistently available anti-aircraft engagement capability. More broadly, refurbishment can recover selected capabilities, but fleet-wide readiness and remaining missile stocks cannot be reliably quantified from open sources.



As is evident, **numerous legacy systems previously set aside or formally decommissioned have been recovered, overhauled and progressively reactivated**, optimizing every still available and functioning component in order to maximize mass and density of Air Defence in the context of prolonged conflict.

d. Technical inventory by layer, Western systems and external contributions

The high-performance layer for selective defence and missile defence is dominated by the **MIM-104 Patriot** and, to an increasing extent, by the **SAMP/T**. The Patriot, in configurations compatible with tactical ballistic threats and with interceptors of the PAC-3 family, provides the most credible capability for selective interception of high-energy vectors and for protection of very high-value objectives. In technical terms, the envelope against aerodynamic targets may lie within a broad order of magnitude, typically between approximately 70 and over 150 km depending on radar, interceptor and target profile. Capability against tactical ballistic threats is more constrained and depends strongly on engagement geometry, interception point and type of missile employed, with narrower windows compared to aerodynamic defence.



The structural limitation remains sensitivity to saturation and the strategic cost of the interceptor, factors that impose selective rules of engagement and concentrated employment on a limited number of priority objectives. The SAMP/T, based on Aster 30 interceptors, adds a high-priority theatre defence bubble. The typical envelope against aerodynamic targets lies in the order of

approximately 100–120 km, with selective missile defence capability against tactical threats increasing if more recent interceptor versions are available. Also in this case, the limiting factor is not so much employment logic as missile availability and sustainability of consumption in a war of attrition.

The Western medium-range layer with high probability constitutes the modern backbone against cruise missiles and the more advanced UAV component. **NASAMS**, based on interceptors of the AMRAAM family, offers envelopes varying according to missile version, with a typical order of magnitude of approximately 25–40 km for standard AMRAAM and up to approximately 40–50 km for AMRAAM-ER, with medium-high altitude ceilings adequate for urban and infrastructural defence. The strength of the system lies in multi-target management and in a relatively modern integration architecture, but real performance remains conditioned by sensor density and interceptor availability.



IRIS-T SLM represents a major medium-range layer, with a published engagement range of up to 40 km and altitude of up to 20 km. It supports defence of critical infrastructure against aircraft, cruise missiles and UAVs, subject to sensor coverage and interceptor supply. IRIS-T SLS provides a shorter-range element, with published ranges up to 12 km and altitudes up to 8 km. Its launch equipment may use different mobile configurations; association with tracked vehicles is not an intrinsic distinction between SLS and SLM.



The reinforcement and density band includes previous-generation systems employed for sector coverage or site protection, with the primary function of reducing pressure on more advanced systems. The **MIM-23 Hawk**, in updated versions, offers a typical envelope on the order of 40–50 km and altitude ceilings up to approximately 18–20 km. It remains useful against aerodynamic targets

and part of the cruise threat, but is less suited against modern saturation threats if not integrated into an efficient C2 network. Italian contributions based on **Aspide 2000**, integrated in configurations such as **Spada** or **Skyguard**, reinforce limited-area defence. In technical terms, the engagement envelope lies on the order of approximately 20–25 km, while detection depends on the associated radar and architecture of the complex. The main value is protection of infrastructure, logistical nodes and sensitive sites, that is, the belt that increases density and persistence.



Western point and very short-range defence has assumed increasing structural weight in relation to the UAV threat. Systems such as **Gepard**, with 35 mm cannons, provide a high-rate kinetic solution, with practical effectiveness against drones and low-altitude targets within a typical envelope of a few kilometers, often on the order of 3–5 km depending on target profile. Operational value is high because it allows avoidance of consumption of expensive interceptors against low-cost threats. On the sensor side, lightweight three-dimensional radars for short-range surveillance, such as **Giraffe 1X**, contribute to improving the detection–classification–target assignment chain against UAVs and very low-altitude targets, reducing false alarms and waste of ammunition. In a saturation context, efficiency of the sensor chain becomes as determining as the nominal envelope of weapon systems.



Overall, the Western component introduces qualitative capabilities superior to the legacy stock, but remains constrained by interceptor availability, radar protection and sustainability of consumption in a prolonged conflict.

e. Evolution of Air Defence (SAM) system donations in support of Ukraine (2022–2026)

Starting from 2022, the international effort to support Ukrainian Air Defence has translated into a progressive diversification and expansion of SAM systems available in the operational theatre, with significant contributions from a plurality of European countries, the United States and NATO allies. In the first year of the conflict, while Ukrainian forces were facing the progressive depletion of

ammunition for Soviet legacy systems, Western donations began to fill some critical gaps, albeit in modest quantities and with non-negligible logistical delays.

In 2022 Slovakia transferred its S-300 system to Ukraine, supplementing the existing Soviet-derived layer. Germany delivered the first IRIS-T SLM fire unit in autumn 2022. France provided Crotale short-range equipment, while Spain and other partners contributed legacy and point-defence assets. The United States supplied the first two NASAMS fire units in 2022 and contracted six additional units in November; a contract award or commitment is not equivalent to a completed delivery. The earliest Western additions therefore improved selected defended areas but did not immediately create nationwide coverage.

In 2023 Ukraine received further Western air-defence capabilities, including its first Patriot systems and the Franco-Italian SAMP/T. The US Patriot commitment was announced in December 2022, while the first system became operational in Ukraine in spring 2023; the document must not date that delivery to 2022. A second IRIS-T SLM unit was delivered by May 2023, as confirmed by the manufacturer. Germany and other partners continued to expand medium-range and point-defence support. NASAMS procurement and deliveries also progressed, but delivery schedules varied by donor and by contracted fire unit, making aggregate totals sensitive to reporting date.

At short range, successive IRIS-T SLS launchers, anti-aircraft guns and refurbished systems reinforced local defence against UAVs and low-altitude threats. Their role was to increase available firing points and conserve longer-range interceptors where possible. The precise dates and completeness of individual donated fire units are unevenly disclosed; some inventories count launchers, others batteries or integrated complexes. These categories should not be combined into a single count.

In 2024 additional Patriot, NASAMS and IRIS-T equipment strengthened the layered network. Romania confirmed the transfer of a Patriot system in September 2024. In September 2024 Germany reported four IRIS-T SLM fire units in Ukrainian service; this provides a more reliable cumulative benchmark than attributing all four to the first year of the war. The evolution was qualitative as well as quantitative: sector protection improved, but integration, interceptor stocks, radar survivability and maintenance remained decisive constraints. Announced future purchases should be distinguished from assets delivered and deployed.

During 2025 support increasingly focused on sustaining the force and replenishing interceptors, not merely delivering launchers. In January 2026 the Ukrainian defence ministry reported that 23 long- and medium-range air-defence systems and 11,000 associated missiles had been received during 2025, including four Patriot systems. This is an official Ukrainian aggregate, not an independently verified inventory of currently operational batteries: its counting conventions, serviceability and unit composition are not fully public. It nevertheless indicates the scale of attempted regeneration under high consumption.

By December 2025 Ukrainian officials publicly reported receipt of a ninth IRIS-T system from Germany. German representatives subsequently referred to additional Patriot transfers at the end of 2025. Open-source delivery trackers reported further IRIS-T SLM units during 2026, including an eleventh by early October; precise readiness and launcher composition remain unverified. The official delivery counts should not be treated as simultaneous operational availability.

This growth expanded the modern layer, but did not eliminate dependence on foreign interceptor production, compatible spares or trained maintenance personnel.

In 2026 the centre of gravity continued to shift toward ammunition availability and the restoration of fire capacity. Ukraine publicly identified shortages affecting Patriot, NASAMS and IRIS-T; in October 2026 President Zelensky reported delays in the US approval of critical Patriot and NASAMS missiles purchased by allies. Deliveries and financing mechanisms are therefore not reliable proxies for missiles available at the firing unit. France and Italy also set out commitments concerning Aster 30 production and future SAMP/T NG arrangements. These are forward-looking industrial or transfer plans, not evidence that the next-generation systems were already fielded in Ukraine.

Overall, the 2025-2026 period shows an effort to maintain a sustainable layered network. Patriot and SAMP/T underpin selective defence against high-energy threats; NASAMS and IRIS-T contribute medium-range protection; guns, short-range missiles, electronic warfare and interceptor drones absorb much of the lower-cost UAV threat. However, the rapidly growing use of faster jet-powered Russian drones requires new detection and interception arrangements. Interceptor supply, radar protection, C2 continuity and the ability to train and rotate crews remain the principal limiting factors. Delivered equipment, available batteries and daily engagement capacity are different measures of combat effectiveness.

f. Estimated Order of Battle

The defensive missile Order of Battle cannot be established with precision from open sources. Published donation totals measure systems, batteries, launchers and missiles inconsistently, and do not reveal availability after damage, repair or rotation. Patriot remains a limited high-value capability deployed selectively, but a precise count of fully operational batteries at any given date is not independently corroborated. The Franco-Italian SAMP/T capability is likewise relevant, although recent French-Ukrainian announcements include temporary transfers, new-generation orders and future modules rather than a verified current operational count. Any numerical total must therefore be described by date, donor, equipment type and delivery status, not presented as an audited wartime inventory.

In the medium-range segment, Ukrainian President Zelensky stated in February 2026 that Ukraine had received more than ten NASAMS systems. This supersedes earlier estimates of only four to eight fire units, although exact composition and combat availability remain undisclosed. Ukraine reported nine IRIS-T systems by December 2025, and specialised open-source trackers identified further IRIS-T SLM deliveries in 2026. Launchers, complete fire units and readiness should be counted separately. HAWK, Crotale, Aspide and other donated systems add locally useful capacity but cannot be counted reliably as equivalent batteries. German-supplied Gepard vehicles constitute a significant gun-based anti-UAV capability; their operational utility depends on ammunition, radar maintenance and local deployment.

Soviet-derived S-300P/S-300V and Buk-M1 equipment remains difficult to quantify because combat losses, missile stocks, radar serviceability and refurbishment are not fully visible. S-300PT/PS batteries and Buk-M1 launchers probably retain selective capability, but a published list of inherited platforms is not an inventory of units operational in October 2026. Older Kub, S-125, Osa and Strela-10 equipment may have been refurbished or locally employed; the current scale and readiness are uncertain. Ukrainian forces have captured Russian Tor and Pantsir systems, including a documented intact Pantsir-S1 captured in 2022. Capture and technical exploitation do not, however, establish that such equipment entered sustained Ukrainian air-defence service. Accordingly, captured Tor-M1 or Pantsir-S1 units are excluded from the confirmed operational Order of Battle unless separate evidence of service and use can be substantiated.



g. Associated sensors and radars, role in the detection–tracking–guidance cycle

Long-range Soviet-derived S-300P and S-300V systems and Western Patriot and SAMP/T employ specialised or multifunction sensors within wider surveillance networks. In the S-300P family, search and low-altitude detection may involve radars such as 36D6 and 76N6, while the 30N6 provides engagement tracking and missile-guidance functions. The 76N6 performs low-altitude detection rather than precision engagement tracking. The exact radar fit varies by S-300 version. Long-range surveillance, sector command and fire control are distinct functions whose separation can support redundancy but complicates interoperability across mixed fleets.



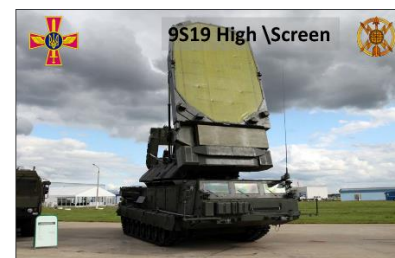


In final analysis, a limited number of **1L13-3 Nebo-SV Box-Spring** early warning and target acquisition radars, as well as **9S18M Snow-Drift** acquisition radars associated with mobile Buk SA-11 systems, should also be present. Buk systems are nevertheless capable of operating autonomously even in the absence of these assets.



The S-300V family includes the Gladiator (9A83) and Giant (9A82) launcher variants. Open imagery has shown vehicles and radar components belonging to this family, but isolated observations do not establish the number of complete Ukrainian batteries, their locations, or operational readiness in October 2026.

Open-source references to reconstituted S-300V equipment or the presence of associated 9S15, 9S19 and 9S32 radars do not establish a complete, serviceable battery at any given date. The S-300V family was part of Ukraine's inherited legacy capabilities, but current operational completeness and deployment cannot be inferred solely from isolated images of vehicles or sensors. Credible capability assessment requires evidence of sensors, command elements, launchers, interceptors and sustainment functioning together.



For Patriot, the AN/MPQ-53 or AN/MPQ-65 multifunction radar supports detection and engagement. Guidance differs by interceptor: PAC-2 employs track-via-missile methods, whereas PAC-3 uses an active terminal radar seeker and hit-to-kill interception. Concentration of functions in a high-value radar also creates survivability and maintenance demands.

system employs multifunction radars such as Arabel or Kronos, capable of volumetric search, simultaneous multi-target tracking and guidance of Aster missiles via uplink and active terminal seeker.



In the medium-range Soviet legacy layer, Buk-M1 (SA-11) normally uses the 9S18 Kupol (Snow Drift) acquisition radar and the 9S35 Fire Dome engagement radar integrated with a TELAR. By contrast, Straight Flush denotes the 1S91 radar associated with the older Kub (SA-6), not the Buk-M1's 9S35. Western NASAMS uses networked sensors, often including AN/MPQ-64 Sentinel or other compatible radars, with distributed launchers. Gepard combines search and fire-control radars with a twin 35 mm gun installation. Tor-family vehicles integrate detection and tracking radars on a single platform, but their capture does not establish current Ukrainian service. Overall IADS performance depends on reliable track correlation, target assignment and engagement coordination across disparate sensors and fire units, not simply on individual radar detection ranges.



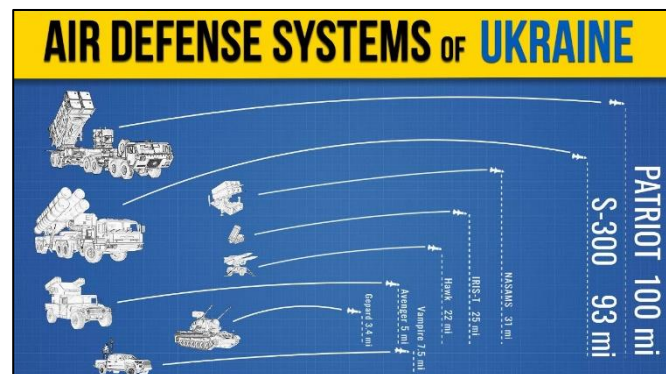
h. Capabilities against specific threat categories

Against tactical ballistic missiles, capability remains concentrated in systems equipped with high-energy interceptors and endo-atmospheric engagement profiles, such as Patriot in PAC-3 configuration and SAMP/T with Aster-30-B1, which combine high angular-resolution radars and missiles with active seekers and high terminal maneuver capability. S-300P systems in older versions offer limited capability against ballistic targets, with a restricted interception window and dependence on correct trajectory prediction.

Against low-altitude cruise missiles, ground clutter and terrain-following flight complicate radar discrimination. Layered radar coverage and electro-optical sensing are therefore important. Medium-range systems such as NASAMS and Buk may engage cruise missiles when geometry and readiness permit, while short-range guns and missiles protect selected points. Slow Shahed-type UAVs raise a severe cost-exchange challenge, making guns, electronic warfare and interceptor drones important complements to missile defence. By September 2026 Reuters had documented a marked increase in Russian jet-powered attack drones, which compress reaction time and challenge existing low-cost interceptors. The suitability of any interceptor depends on closure rate, sensor tracking, engagement geometry and available weapons, not the nominal range of a system alone. Real effectiveness is also shaped by simultaneous raids, multi-axis attack timing and the ability to keep sufficient ammunition in the relevant sector.

i. Practical rules of employment to avoid saturation and degradation

In a context of combined attacks and swarms, **management of saturation requires discipline in the engagement cycle**. Reaction times must be calibrated according to altitude and target speed, avoiding premature activation of long-range fire-control radars that expose the battery to suppression missions. **Distribution of fire channels is a critical factor**: each fire-control radar can manage a finite number of tracks and simultaneous interceptions, and automatic assignment must prioritize threats with higher kinetic energy or strategic value. Reload constraints represent a vulnerable point, since many platforms require significant time for missile replenishment; operational **survivability therefore imposes dispersion, mobility and rotation of units among pre-prepared sites**. Radar



protection is a priority: controlled shutdowns, use of emission control, decoys and integration with passive sensors reduce the probability of targeting by anti-radiation missiles. A consolidated practice consists of delegating engagement of low-priority targets to short-range systems or to ground-based fire, preserving long-range missiles for high-value threats. An effective IADS is not the one that intercepts everything, **but the one that selects**, distributes and preserves capability over time, maintaining resilience even under prolonged pressure.

j. Operational employment, engagement economy, saturation and survivability measures

Operational employment of Ukrainian SAMs highly probably **follows a logic of priority defence, mobility and fire discipline**. Priority tends to concentrate the high-performance layer over Kyiv and a limited number of strategic nodes, while the medium range constitutes the backbone against cruise missiles and more capable UAVs over infrastructure and urban areas, and the short-range, kinetic and electronic layer absorbs the economic saturation threat.

Saturation is the technical variable that defines real performance, because a multi-axis attack forces allocation choices and may exceed simultaneous tracking, target assignment and rate-of-fire capacity. It is highly probable that Ukraine **applies restrictive rules to avoid unnecessary double engagement and to assign targets based on the best ratio of effectiveness, cost and availability**, reserving rarer interceptors for high-energy threats or vectors directed toward critical objectives. Network survivability depends on mobility, camouflage, reduction of emissions when possible, use of decentralized decision-making in case of communication degradation, and above all on continuity of the sensor–decision–effector chain. This implies that striking or degrading sensors and links **may produce operational effects greater than striking a single launcher**, because it induces delays, assignment errors, ammunition waste and higher probability of penetration.

k. Comparative assessment with the Russian threat, launch tempo and sustainability

Russian pressure must be assessed by separating short-duration peaks from a sustainable multi-vector launch tempo. Throughout 2026 Russian forces expanded the use of attack UAVs and increasingly fielded faster jet-powered variants alongside missiles. These developments compress reaction times, complicate low-cost interception and reinforce the need for redundant sensor and C2 channels. Their effects depend on sortie and production rates, the mix of real targets and decoys, and the ability to mass simultaneous attacks over several axes. No fixed nominal interception percentage adequately captures those changing conditions.

Long-term sustainability, however, is more constrained, because it requires continuous industrial availability, stockpiles, logistical planning and the ability to rapidly regenerate the vector inventory. It follows that the most realistic threat to the Ukrainian network is not a single decisive wave, **but a sequence of alternating and adaptive waves** designed to maintain a constant level of attrition.

Within this framework, the endurance of the IADS depends on Ukrainian capacity to preserve high-performance interceptors for high-energy threats and to absorb volume with lower-cost solutions, reducing the risk that episodic peaks translate into irreversible cumulative erosion of coverage.

l. Indirect operational implications

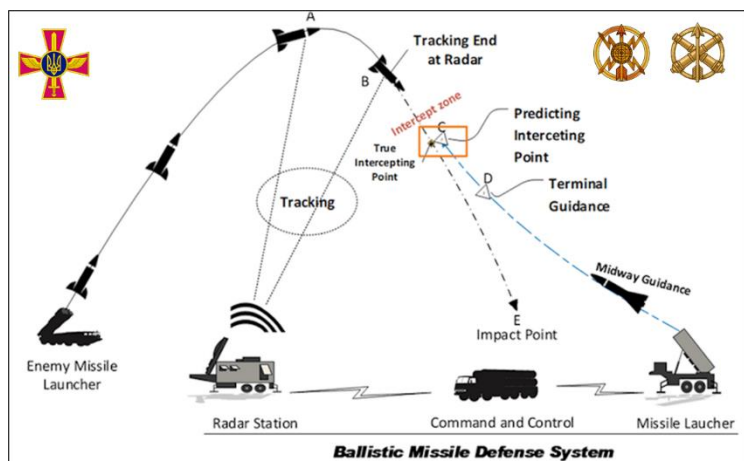
Maintenance of a credible Ukrainian IADS imposes operational constraints on Russia that go beyond the simple protection of individual objectives. First, it limits the use of tactical aviation in depth and renders medium-altitude profiles over defended areas more risky, **incentivizing a conduct based on stand-off operations by tactical and strategic aviation and naval units**, that is, employment of cruise missiles, glide weapons and vectors launched from safe distances. Second, it reduces Russian freedom of action in timing and predictability of attacks, because the need to saturate and confuse defence requires complex combinations, multi-axis coordination and stock management, increasing costs and planning constraints. Third, **persistence of Ukrainian Air Defence contributes to preserving internal operational continuity, maintaining a more favorable environment for logistical mobility and protection of decision-making centers**.



It follows that the IADS, even if it does not prevent impacts, performs a strategic function of “containment” of Russian air and missile power, orienting the adversary toward slower and less decisive attritional campaigns, with direct effects on the duration and trajectory of the conflict.

m. Systemic vulnerabilities

The primary vulnerability of the Ukrainian IADS network does not lie so much in the loss of individual firing units, but in **deterioration of the entire detection–assessment–engagement cycle**, that is, the process that enables identification of a threat, decision on how to react and coordinated engagement. In a scenario in which high-value multifunction radars or nodes responsible for fusion and distribution of tracks are neutralized or temporarily suppressed, the expected effect is a non-linear reduction of effective coverage, with increased detection times, deterioration of track quality and increased probability of sub-optimal engagement. In practice, the network tends to “fragment” into less coordinated local bubbles, with greater risk of duplication, interceptor waste and penetration windows along secondary axes. By contrast, loss of launchers, if not accompanied by loss of sensors and C2, often produces a more gradual impact, because the network can redistribute priority and exploit remaining effectors. In a saturation context, it is therefore probable that the adversary will seek to obtain operational advantage not so much by destroying mass, but by forcing periods of “partial blindness” and degradation of the air picture, inducing delayed reactions or economically unfavorable engagements.



n. Sustainability 2026–2030, industrial constraints, risk of progressive degradation

Interceptor availability remains a central constraint in late 2026. Even a tactically effective network degrades when replenishment fails to match consumption. Ukrainian statements in May and October 2026 described missile shortages or delayed supplies for Patriot, NASAMS and IRIS-T. Ballistic-missile defence consequently remains selective, while the increasing share of faster UAVs complicates allocation between low-cost interceptors and higher-value missiles. In a prolonged campaign Russia can attempt to exhaust missile stocks or impose cumulative infrastructure damage by combining massed UAV waves with cruise and ballistic weapons.

In this scenario, **the most realistic risk is not sudden collapse, but progressive degradation**, that is, percentage reduction of effectiveness, increased penetrations and growing cumulative damage to infrastructure, especially energy and logistical nodes. In 2026, with constant replenishment, **it is highly probable that the network remains sufficient for effective selective defence of critical nodes**. In the 2026–2030 timeframe, if flows of interceptors, maintenance and training become intermittent or insufficient, there exists a non-negligible possibility that coverage narrows to a few very high-priority bubbles, with greater impacts elsewhere and systemic effects on economic resilience and infrastructural continuity.

3. Priority information requirements, indicators and warnings, courses of action

Priority information requirements concern first and foremost estimation of actual stockpiles and consumption rates for each layer, Patriot, SAMP/T, NASAMS, IRIS-T, and for the legacy components S-300 and Buk, because without this variable **any sustainability judgment beyond the short term remains conditioned**. Second, it is necessary to clarify the real distribution of missile defence and its evolution over time, because even small increments or losses may alter Russian choices between ballistic, cruise and UAV vectors. Third, the degree of integration and the ability to operate in degraded modes must be assessed, including restoration times following attacks against sensors and links. Fourth, readiness of legacy components must be monitored, because loss of effectiveness may be silent and not immediately visible in OSINT, yet directly affects overall density.

The most relevant warning indicators include **signals of persistent reduction in interception of priority targets, increased impacts on infrastructure theoretically protected, more rapid or more visible rotations of high-performance batteries**, and Russian attack patterns privileging multi-axis simultaneity to stress command and control.

MLCOA – Most Likely Course of Action: in a more probable operational scenario, Ukraine will likely consolidate a selective high-priority defence, with increasing optimization of engagement economy and strengthening of the short range and anti-UAV measures in order to preserve modern interceptors for cruise and ballistic threats.

MDCOA – Most Dangerous Course of Action: in a more dangerous operational scenario, a sustained increase in Russian pressure combined with insufficient replenishment would lead to progressive degradation and narrowing of coverage to a few bubbles, with increased cumulative damage to critical infrastructure.

4. Final considerations

The Ukrainian integrated Air Defence network **has evolved from a predominantly Soviet architecture to a hybrid multi-layer system**, with heterogeneous sensors and interceptors integrated within a single C2 chain. Overall resilience is today superior compared to 2022, particularly against cruise and UAV threats, thanks to stratification and data fusion. Structural vulnerabilities nevertheless remain against complex saturations and against tactical ballistic vectors launched in coordinated salvos, an area in which limited availability of high-performance interceptors represents a critical factor. In the medium term, sustainability of the IADS will depend less on individual platforms and more on three variables: **continuity of missile supplies, software integration capability among non-homogeneous systems and protection of high-value radar nodes**. In the absence of significant logistical interruptions, the network will likely maintain an effective denial capability over priority urban and infrastructural areas; however, coverage will remain selective and non-homogeneous across national territory, with constant necessity for dynamic allocation of batteries according to threat evolution.

5. Assessments

In the 2025–2030 framework, the most transferable operational lesson is that **an effective integrated Air Defence is not a purely “defensive” capability nor an inventory of systems, but an ecosystem combining agile integration, industrial sustainability and, when available, complementary offensive action**. It is highly probable that continuity of ammunition and maintenance constitutes the true center of gravity, because even a technologically advanced network degrades rapidly if it cannot regenerate interceptors and critical components.

It is also probable that the ability to rapidly integrate sensors, C2, effectors and non-military contributions, including commercial solutions and distributed procedures, **significantly increases overall resilience, partially compensating for heterogeneity and losses**. Finally, reduction of the threat “before launch” through strike and interdiction capability, when applicable, produces a strategic effect superior to terminal interception, because it limits the sustainable tempo of salvos and reduces saturation pressure, improving overall network sustainability over time. In assessing sustainability of Ukrainian Air Defence in prolonged campaigns, it is useful to frame the IADS as a component of a broader integrated defence system, based on a logic of load distribution among three levels that compensate one another over time.

Active defence, understood as interception with short-, medium- and long-range systems, absorbs the main share of the threat but is intrinsically exposed to saturation and cost-effectiveness dilemmas, therefore **it cannot be the sole determinant of endurance**. Offensive action, when available and employable, reduces upstream fire mass by striking launch nodes, depots and support chains, lowering the sustainable tempo of attacks more than terminal interception can, with indirect effects on preservation of stockpiles and survivability of high-value radars.

Passive defence, that is, early warning, civil protection and continuity of essential functions, **absorbs what penetrates and reduces the strategic effect of impacts**, preserving command capability and socio-economic resilience. From this perspective, the decisive variable is not the nominal performance of individual platforms, but the capacity of the system as a whole to adapt and redistribute pressure among layers under stress, preserving state functionality and combat capability even when interception is not total.