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Deep Precision Strikes: A New Tool for Strategic Competition?

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Focus stratégique

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Executive summary

Since the winter of 2023, the stalemate on the Ukrainian front has prompted the belligerents to make greater use of deep precision strikes, in search of a military effect that has become impossible to achieve on the front line. Conventional ballistic and cruise missiles are being used jointly with drones and increasingly varied guided munitions, capable of exploiting gaps in the enemy's defenses and attacking different types of high-value targets. This intensive use of deep strikes has made European nations aware not only of their vulnerability to these threats but also of the limits of their own capabilities in this area. Little used since the end of the Cold War, Europe's deep strike capabilities appear limited, relying for the most part on high-performance air-to-ground delivery systems, which have nevertheless been acquired in limited quantities. The ground-to-ground capabilities of European armies have often been reduced to the remnants of systems mostly inherited from the Cold War.

Developed during the First World War as a means of overcoming the blockage of the front line, deep strikes use matured and diversified throughout the twentieth century as long-range bombers, and later rockets and long-range missiles, were improved. From the 1960s onward, deep strikes were closely linked to nuclear issues, but nevertheless retained an important conventional dimension. The end of the Cold War and of the prospect of a high-intensity peer conflict reduced the use of these capabilities, in the absence of a front line capable of determining the depth to be struck. This became a global issue with the successive demonstrations of force by US forces, capable of striking all around the globe at very short notice.

Technological efforts continue unabated, however, with various programs aimed at improving the speed, accuracy, and stealth of deep strike effectors. Other theaters are also seeing the development of major deep strike arsenals. China, for example, is developing capabilities to interdict US forces on its regional approaches, including the development of very long-range delivery systems capable of threatening US bases in Japan, the Philippines, and beyond. In response, the United States, but also smaller players such as South Korea, are acquiring and deploying weapons capable of posing a significant threat in the theater. The autonomous development of long-range strike capabilities is also an integral part of the regional strategy of Iran and its proxies vis-à-vis Israel, as well as its potential regional competitors.

After decades of gradual erosion in the international regulation of these deep strike capabilities, Europe is seeing Russian systems evolve at great speed in the wake of the conflict in Ukraine. Missile salvos are enriched by long-range UAVs, multiplying the flight profiles and complicating the task of

air defense on both sides. Relatively simple to manufacture and less costly than modern cruise missiles, these delivery systems could be used by non-state actors, as the Houthis in Yemen are already doing, and pose a significant threat to European armed forces whose current defenses are primarily designed for threats at the top end of the spectrum. The conflict in Ukraine, therefore, raises questions not only about Europe's deep strike capabilities but also about its ability to defend itself against such threats.

France's capabilities in this area are solid but limited. The French Air and Space Force and the French Navy can rely on the SCALP (*Système de croisière conventionnel autonome à longue portée*) and MdCN (*Missile de croisière naval*) cruise missiles, which are set to be upgraded with more powerful delivery systems by the end of the decade. However, these munitions have been acquired in limited quantities due to a lack of resources, and some of the acquired SCALPs have been sold to Ukraine. The French Army, for its part, now has only a handful of rocket launchers, which are due to be withdrawn from service in 2027. Moreover, the ground forces lack the long-range ammunition found in the inventories of other armies in Europe and cannot fire beyond 80 km. As the conflict in Ukraine has highlighted the need for a longer-range capability to tackle a more spread-out and dispersed adversary, the replacement of these systems should mark a move upmarket to 150 km and beyond for a French land capability that has been rather neglected since the end of the Cold War, due to a lack of need and budgets. Developing a longer-range land fire capability should also enable France to meet its NATO obligations within the framework of an autonomous French army corps, especially as the development of a very deep strike capability, beyond 1,000 km, is being studied within a multinational European framework. Naval and air capabilities are also benefiting from programs to develop faster, more maneuverable, or stealthier delivery systems carried out in cooperation with the United Kingdom.

At a time when international competition is becoming increasingly aggressive and uncompromising, deep strike capabilities are playing a more important role, forcing all players to take an interest in them or risk being put in a vulnerable position from both an offensive and defensive point of view.

Résumé

Depuis l'hiver 2023, le blocage du front ukrainien pousse les belligérants à recourir davantage aux frappes dans la profondeur, à la recherche d'un effet militaire devenu impossible à obtenir sur la ligne de front. Aux missiles balistiques et de croisière classiques viennent s'ajouter des modèles de drones ou de munitions guidées de plus en plus variés, capables d'exploiter les failles de la défense adverses et de s'attaquer à différents types d'objectifs à haute valeur ajoutée. Ce recours intensif aux frappes dans la profondeur a entraîné une prise de conscience des nations européennes quant à leur vulnérabilité face à ces menaces et leurs capacités limitées en la matière. Peu utilisés depuis la fin de la guerre froide, les systèmes de frappes en Europe sont en majorité des vecteurs air-sol très performants mais disponibles en petites quantités. Quant aux capacités sol-sol, elles sont souvent réduites à des reliquats de systèmes pour la plupart hérités de la guerre froide.

Élaborée au cours du premier conflit mondial pour surmonter – déjà – le blocage de la ligne de front, la frappe dans la profondeur se développe et se diversifie tout au long du XXe siècle à mesure que se perfectionnent les bombardiers à long rayon d'action, puis les roquettes et missiles à longue portée. Très liée à partir des années 1960 aux enjeux nucléaires, la frappe dans la profondeur conserve cependant une dimension conventionnelle importante. La fin de la guerre froide et l'éloignement de la perspective d'un conflit en haute intensité à parité réduisent l'utilisation de ces capacités et contraignent une évolution conceptuelle, faute de ligne de front susceptible de déterminer une profondeur à frapper.

L'effort technologique ne s'interrompt pourtant pas, et différents programmes s'attachent à améliorer la vitesse, la précision ou même la furtivité des effecteurs de frappe dans la profondeur. En outre, d'autres théâtres voient se développer d'importants arsenaux en la matière. La Chine travaille ainsi à se doter de capacités susceptibles d'interdire ses approches régionales aux forces américaines, y compris en développant des vecteurs à très longue portée capables de menacer les bases américaines au Japon, aux Philippines voire au-delà. En réaction, les États-Unis, mais aussi des acteurs aux moyens plus réduits comme la Corée du Sud, se dotent et déploient des armes capables de faire peser une menace significative sur le théâtre. Le développement autonome de capacités de frappe à longue portée fait aussi partie intégrante de la stratégie régionale de l'Iran et de ses relais d'influence face à Israël mais aussi vis-à-vis de ses compétiteurs régionaux potentiels.

Après des décennies d'érosion progressive de la régulation internationale de ces moyens de frappe dans la profondeur, l'Europe voit le dispositif russe évoluer à grande vitesse à l'épreuve du terrain ukrainien. Les

salves de missiles s'enrichissent de drones à longue portée, démultipliant les profils de vol et complexifiant d'autant la tâche de la défense anti-aérienne des deux camps. Relativement simples à fabriquer et moins coûteux que des missiles de croisière modernes, ces vecteurs sont utilisés par des acteurs non étatiques comme les Houthis et constituent une menace sensible pour les armées européennes dont les défenses actuelles sont d'abord pensées pour des menaces du haut du spectre. Le conflit en Ukraine interroge donc les capacités européennes de frappe dans la profondeur, mais aussi leur défense face à ces menaces.

La France dispose en la matière de capacités solides, mais peu nombreuses. L'armée de l'Air et de l'Espace ainsi que la Marine nationale peuvent compter sur les missiles de croisière SCALP et MdCN que des programmes en cours doivent compléter par des vecteurs plus performants d'ici la fin de la décennie. Cependant ces munitions ont été acquises en quantités limitées faute de moyens et plusieurs dizaines de SCALP acquis ont en outre été cédées à l'Ukraine. L'armée de Terre, de son côté, ne dispose plus que d'une poignée de lance-roquettes dont le retrait du service doit commencer à partir de 2027. De plus, elle n'est pas dotée des munitions à longue portée présentes dans les inventaires d'autres armées en Europe et ne peut tirer à plus de 80 kilomètres (km). Le conflit en Ukraine ayant souligné le besoin de disposer d'une capacité à plus longue portée pour s'attaquer à un dispositif adverse plus étalé et dispersé au-delà de la portée de l'artillerie-canon standard, le remplacement de ces systèmes doit marquer une montée en gamme à 150 km et plus pour une capacité terrestre française plutôt négligée depuis la fin de la guerre froide, faute de besoin et de budgets. Développer une capacité de feux terrestres à plus longue portée doit aussi permettre à la France de remplir ses obligations vis-à-vis du dispositif OTAN dans le cadre d'un corps d'armée français complet, d'autant que le développement d'une capacité de frappe dans la très grande profondeur, au-delà de 1 000 km est à l'étude dans un cadre européen multinational. Les capacités navales et aériennes bénéficient elles aussi de programmes de développement de vecteurs plus manœuvrant et rapides ou plus furtifs, menés en coopération avec le Royaume-Uni.

Alors que la compétition internationale se fait de plus en plus agressive et décomplexée, les capacités de frappe dans la profondeur y prennent une part plus importante, contraignant tous les acteurs à s'y intéresser, sous peine d'être mis en situation de vulnérabilité, d'un point de vue offensif comme défensif.

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Introduction

Striking the depth of the enemy system to weaken it and facilitate an operational or strategic result is a major goal for armed forces. This capability can be tactical, operational, or strategic depending on the distance of the target from the front line and the type of weapons delivery systems used. Although not exclusive to the contemporary period, the concept of depth gained importance with the industrialization of conflict at the beginning of the twentieth century, which created a sharper distinction between a continuous front line, difficult to break through in a peer conflict, and a relatively safe rear area. Various doctrinal and capability solutions emerged throughout the century to attack this vulnerable zone by passing over and above the front line. The war in Ukraine, meanwhile, has highlighted the development of denser and more effective defenses designed to interdict or limit access to this operational or strategic depth. Although never completely abandoned, European deep strike capabilities have been used less since the end of the Cold War due to a lack of immediate operational need, and there is concern about whether European armies have sufficient power and mass for a high-intensity conflict. European land, air, and naval forces are seeking to gain density, versatility, and performance in order to strike an increasingly well-protected depth.

Technological innovations to increase the accuracy and range of missiles and drones, coupled with the decline of arms control regimes and the return of conflict, have brought penetration of the depth of the enemy back to the top of the agenda. World and regional powers like Russia, China, and Iran are investing heavily in diversified deep strike capabilities that do not need a specially trained air force. In parallel, these states are developing a strategy to contest and interdict airspace, using increasingly powerful air defense systems to more or less successfully counter the threat of enemy strikes. For their part, Western air force fleets are shrinking every year, with a preference for fewer but more powerful aircraft, making attrition less and less sustainable.

In Asia, this reversal of the balance of power has for several years been on the radar of the United States (US) and its allies, who are developing new missiles in response to the Chinese threat. Iranian ballistic proliferation in the Middle East has also alerted the region's states to this new age of deep strikes. The situation in Europe only gained real urgency with the Russian invasion of Ukraine in February 2022. The lack of air superiority and the impermeability of the front have forced the belligerents to rely on other types of weapons and systems to get around it and continue to strike behind the front line. Both Russia and Ukraine are deploying a wide variety of cruise and

ballistic missiles and drones of all sizes to attack weak points in the enemy's system, including in the strategic depth at very long ranges of over 1,000 kilometers (km). This intensive deployment has been met with innovation in defense systems, which are adapting to respond to these different threats more effectively.

In Europe, the conflict in Ukraine heralds the possible end of three decades of operational freedom and raises questions about Western forces' ability to conduct deep strike missions against new, denser defenses. Conversely, the question of the protection of forces and military and civilian infrastructure against more numerous and varied enemy weapons delivery systems also arises. Although not completely defenseless, with the remaining ground-to-ground systems inherited from the Cold War as well as a limited stock of air-to-ground penetrating munitions, the limitations of European forces in this domain remain concerning in the absence of investment. From a political perspective, while the North Atlantic Treaty Organization (NATO) has been strengthened since the beginning of the war in Ukraine thanks to the accession of Sweden and Finland, there is still uncertainty around the US long-term involvement in Europe. However, without the US, Europe would have only limited deep strike capabilities in a peer conflict with Russia. This concern is pushing a growing number of European states to invest more in these capabilities. Investment is also increasing in the domain of air, missile, and drone defense in response to the proliferation of salvo fire systems that can achieve saturation at the same time as accuracy.

France has powerful naval (MdCN) and air (SCALP-EG) deep strike capabilities, but delivery systems have been procured in limited numbers. The French Army, meanwhile, must rely solely on its few remaining rocket launchers, which are due to be withdrawn from service by 2027. The 2024–2030 *Loi de programmation militaire* (LPM, Military Programming Law) provides for their replacement in the medium term, with the goal of reaching a range of 150 km before ultimately moving toward 500 km. This range extension reflects a desire to strike an enemy force that is better defended and more spread-out, while also acquiring capabilities that have previously been confined to the joint-forces level. Naval and air capabilities are also the target of more long-term programs to develop new missiles by 2030. In parallel, discussions have begun around the development of very long-range (over 1,000 km) conventional capabilities following the collapse of the Intermediate-Range Nuclear Forces Treaty (INF), which has forced a reconsideration of escalation below the nuclear threshold between major powers using conventional means.

Given these ongoing developments and the evolution of the operational environment, what adaptations does France need to make over the long term? After initial experiments during the First World War, deep strike continued to evolve throughout the twentieth century (I). As a differentiating capability between nations, it requires a range of modern elements that are

now possessed by a growing number of state actors around the world in very different conflict situations (II). With the war in Ukraine highlighting the development of new deep strike systems that are potentially accessible to non-state actors, we must take a closer look at France's situation and the prospects for the French armed forces in this domain (III).

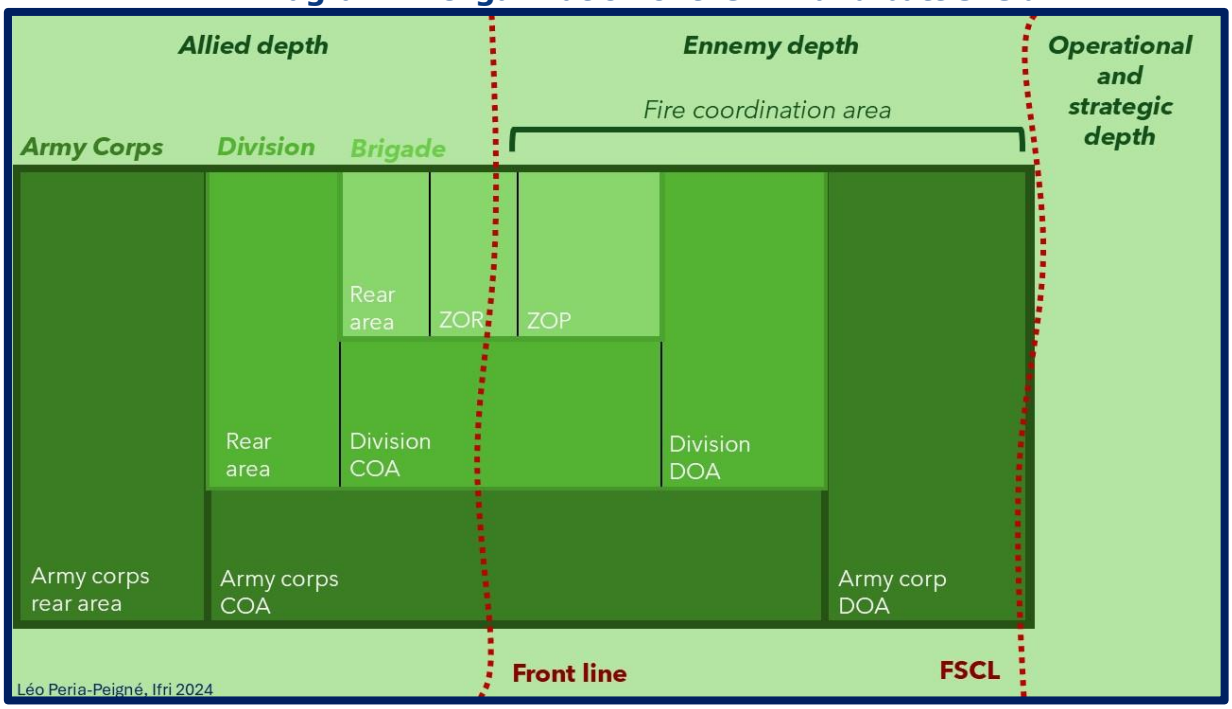
Deep strike: A strategic differential

The characteristics of the contemporary deep strike, combining accuracy, long-range, and targets of high strategic-operational value, are the result of technological and doctrinal changes throughout the twentieth century. From artillery in the First World War to precision strikes carried out during the US "war on terror" via the strategic missiles of the Cold War, this historical overview aims to better understand previous uses of deep strikes in order to identify the major defining trends.

Although this study focuses on conventional issues, the very concept of deep strike is complex. Depending on the speaker, conflict, or time period, it can refer to different or even contradictory approaches, making caution essential for analysts. Deep strike has different meanings in the land, sea, and air domains, and it does not refer to the same thing in the context of a high-intensity conflict with defined front lines as in a stabilization operation.

NATO military doctrine defines deep strike in terms of its position in the scale of fires in relation to the front line or Forward Line of Own Troops (FLOT). For the land component, depth depends on the unit level and begins with the Deep Operations Area (DOA) situated beyond the Close Operations Area (COA). A brigade's DOA extends up to 50 km from the FLOT, beyond which point the division's DOA begins. The latter extends up to 150 km from the FLOT and is followed by the army corps' DOA, which runs up to between 300 and 500 km from the FLOT. This subsidiarity takes into account the maximum theoretical range of each scale's sensor and effector capabilities.

Diagram 1: Organization of the AirLand battlefield



Source: © Léo Péria-Peigné, Ifri.

This concept of tactical depth is complemented by one of operational depth, defined by the Fire Support Coordination Line (FSCL). Any action that takes place between these two lines requires close coordination with the land component to prevent friendly fire and prioritize land maneuvers. Beyond the FSCL, the various components coordinate with each other to ensure the deconfliction of fires. From a joint-forces perspective, operational deep strike thus refers to actions conducted beyond the FSCL.

One key distinction in this definition is the difference in range between surface-to-surface and air-to-surface capabilities. In a conflict with defined front lines, the deep strike capability of land forces is limited by the range of their weapons, which rarely reach beyond the FLOT. A ground-to-ground ATACMS (Army Tactical Missile System) fired from the front line can reach 300 km. Air forces can boost the range of their weapons thanks to the autonomy of the delivery systems carrying them. A SCALP-EG missile's 500 km range can be added to the range of the *Rafale* on which it is loaded, which can itself be further extended by in-flight refueling.

Another approach focuses on the relative importance of the target. It is rare for high-value targets (HVTs) to be located close enough to a contact zone to be struck by traditional artillery. Command centers, munitions depots, or even political and military decision-makers tend to be situated beyond the maximum known range of the enemy's strike capabilities for protection, while remaining close enough to maximize efficiency. In this context, therefore, deep strike uses special means to reach targets that are out of range of traditional fires or strike capabilities. The introduction of HIMARS rocket launchers, whose basic missiles have a range of 80 km,

forced the Russian forces in Ukraine to move their depots back from 40 km to over 80 km from the front line in order to keep them safe. A deep strike can, therefore, be defined as an attack on a target located in the operational or strategic depth of the enemy system. The tactical level, meanwhile, is generally limited to around 50 km from the front line, up to the maximum range of the most common weapons delivery systems, and the term "fires" is preferred to "strike" here.

From a functional perspective, deep strike is also defined by the decision-making authority that orders it, in view of both joint-forces deconfliction (for delivery systems) and political-strategic concerns (based on the value of the target). In the Ukrainian context, the use of various long-range ground-to-ground or air-to-ground missiles by the Ukrainian forces is subject to approval at a high level in the military hierarchy, and even at the political level for the rarest systems. Greater availability of these long-range weapons could bring down the level at which they must be approved, if only to avoid overloading the relevant general staffs. The concept of deep strike is linked to the targeting process, which reserves a proportion of sensors to identify targets that offer operational or strategic advantages. Once such a target has been identified and located, effectors are allocated in line with criteria such as range, readiness, risk of collateral damage, or even target hardening.

These approaches are suitable for a high-intensity conflict with an identifiable front line where the concept of depth has a meaningful geographical sense. Because counterterrorism operations are rarely so well defined, however, they have led to the development of a different approach to deep strike, understood as the organizational depth of the enemy's system. In the absence of a front line, depth is no longer conceived in terms of geographical distance—although the global scale of counterterrorism campaigns does come into play—but in terms of the ability to eliminate the masterminds and critical nodes of a clandestine organization. The targeting process, in this case, is very similar to that described above.

Breaking the tactical stalemate: The origins of deep strike

The concept of the depth of the enemy system emerged in response to industrial warfare and the growing impermeability of front lines. The need to be able to attack the depth led to the development of new weapons capable of going over the top of the front line by various means. The experiments of the First World War were followed by the widespread use of such weapons during the Second World War, before the development of nuclear missiles and weapons changed the stakes at the beginning of the Cold War. The end of the Cold War, which reduced the risk of a major, high-intensity conflict, once again inspired new approaches to a capability now seen as indispensable.

First attempts in the industrial era

The concept of deep strike is linked to the increasing range of weapons throughout the nineteenth century. Bronze Napoleonic cannons could send a spherical cast-iron projectile several hundred meters via direct fire. Half a century later, in 1870, the steel field gun used by Prussia in the Franco-Prussian War could propel a conical shell over 3 km via direct fire. Four decades after that, the French 75 mm gun used in the First World War doubled that range again, carrying a shell over 6 km via indirect fire. At the same time, the industrialization and massive growth of militaries changed the nature of warfare and led to the emergence of more or less continuous front lines stretching hundreds of kilometers, as well as the idea of a protected rear area, theoretically inaccessible to the enemy, behind the front line.

In 1915, the Western Front ground to a halt and dug in. Successive attacks in both directions were thwarted by increasingly sophisticated defensive lines, creating a deadlock. In response, both sides turned to alternative strategies to force the enemy to surrender, or at least to achieve operational effects.[1] The enemy's rear area, its military apparatus, its population, and its economic potential became targets in their own right, requiring the development of specialized weapons capable of overcoming the obstacle of the front line. Two solutions were envisaged: aviation and long-range artillery.

Used for the first time in 1911 by the Italian armed forces against the Ottoman Empire in Libya, the aerial bombardment had been proposed as a military tool since the turn of the century by thinkers such as Clément Ader in his seminal work Military Aviation.[2] The first aircraft designed specifically for bombing was developed in 1913 for the British and Italian forces. For its part, Germany placed its bets on Zeppelin airships as very long-range bombers, particularly for raids on England.[3] Capable of carrying between 100 and 400 kg of bombs for almost 500 km, the first bomber aircraft could fly over the front line to deliver their load as close to their target as possible. Despite a lack of navigation instruments and sights, their value was recognized, and they were produced in large numbers, such as the Breguet 14, of which 5,000 were made.

The development of indirect-fire guns with longer ranges also made it possible to reach beyond the front line. Naval artillery initially had the longest range, reaching 60 km from a fixed mount. The German Army sought to exploit the front's proximity to the French capital by developing extremely long and heavy artillery pieces. The Paris-Geschütze or "Paris Guns" were around 30 m long and could fire projectiles 120 km. They hit the Paris region

1. H. Strachan, *The First World War*, London: Simon & Schuster, 2003.
2. C. Ader, *Military Aviation*, Maxwell, AL: Air University Press, 2003.
3. J. Poirier, *Les Bombardements de Paris: Avions, Gothas, Zeppelins, Berthas 1914-1918*, Paris: Éditions Payot, 1930.

around 400 times, leaving 256 dead and more than 600 injured. Because of their insufficient numbers and poor accuracy, the German command saw them more as "psychological" weapons for attacking Parisians' sense of security.[4]

Although a technical feat, very long-range guns turned out to be operational dead-ends whose results did not match the investment made in them.[5] Although they were used again by the Germans in the Second World War, they were primarily employed to destroy fortifications. There was also a project to develop a very long-range gun that could bombard London from the Pas-de-Calais, but it was destroyed by Allied planes before it could be completed. Compared to the advantages of an air force with ever-increasing range and carrying capacity, the lack of mobility and the logistical and industrial complexity of these artillery systems counted heavily against them. The question of depth was discussed frequently during the interwar years, including by Soviet military thinkers such as Aleksandr Svechin,[6] Mikhail Tukhachevsky,[7] and Vladimir Triandafillov.[8] Noting the lessons learned from the stalemate during the First World War, they put forward the theory that real battles (decisive or not) had been replaced by continuous attrition made possible by the industrialized nature of the combatants, which were able to keep mobilizing considerable volumes of forces indefinitely. War thus acquired a logistical, geographical, industrial, social, and political "depth" far beyond the occasional battles of previous centuries. The goal became to exert constant pressure on the enemy, ultimately pushing it to a breaking point that could produce significant operational results. According to Soviet teachings, depth meant raising the industrial and logistical stakes to enable this continuous pressure in the form of successive and simultaneous operations. The goal, therefore, was no longer to decisively destroy the enemy forces in a confrontation of limited duration, but to be able to sustain an industrial war effort over the long term in a fight to the death with an equally mobilized adversary.

Bombers thus showed the most promise from as early as the First World War. Although their endurance and carrying capacity were still limited by their weak engines and their structure, a whole new strategic approach developed around the potential of long-range bombing and of aviation in general, which continued to be debated throughout the 1920s and 1930s. The Italian air power theorist Giulio Douhet suggested that strategic bombing could be the future of war, offering a way to reduce the enemy's industrial and military potential from the air by attacking a nation's vital centers.[9]

4. A. Huyon, "La Grosse Bertha des Parisiens", *Revue historique des armées*, Vol. 253, 2008, pp. 111–125.
5. Ibid.
6. A. Svechin, *Strategy*, Minneapolis, Minnesota: East View Information Service, 1992.
7. M. Tukhachevsky, *Écrits sur la guerre*, Paris: Plon, 1967.
8. V. Triandafillov, *The Nature of the Operations of Modern Armies*, New York: Routledge, 1994.
9. G. Douhet, *Aerial Warfare*, Maxwell, AL, 1933.

In a speech he gave in 1932 on the failure of the disarmament policies of the time, the British politician Stanley Baldwin expressed his fear that "the bomber will always get through" against fighters still struggling to keep pace. This perception had serious consequences during the Second World War.

Attempts by German and Allied air forces to put this vision into practice were hampered by breakthroughs in fighter aviation and air defense, which inflicted heavy losses on attackers. The Combined Bomber Offensive agreed at the Casablanca Conference in 1943 was intended to allow American and British bombers to attack German industrial centers to hasten the end of the war. Relying on the power of hundreds of planes to strike deep into the economic and military fabric of German territory, the Allied command found itself facing loss rates as high as 30%. This improved significantly from the end of 1943, although efficacy was still limited by poor-quality sights.[10]

With the loss rate among Allied bombers surpassed only by that of German submarines, the development of missiles by Germany raised the possibility of carrying out deep strikes without putting personnel at risk. However, the first V1 cruise missiles and V2 ballistic missiles were still fairly primitive weapons, given that bombers at the time could deliver many more explosives with greater accuracy for the same cost, as well as being reusable. Like the long-range guns of the First World War, they could not compare when it came to cost efficiency. Although these missiles did not have any concrete effect on the outcome of the war, the German technology opened up a new field of possibilities that the two future superpowers, the US and the USSR, were quick to develop and build on, especially as it coincided with the use of the first nuclear fission weapons.

Deep strike during the Cold War: From nuclear to conventional

The invention of the atomic bomb in the US and its use in 1945 completely transformed the global strategic landscape.[11] Initially, American officers saw the new weapon as a very powerful conventional bomb that could only be carried by a strategic bomber and dropped from a high altitude. After the first Soviet nuclear tests in 1949 and the evolution toward fusion weapons, tested in 1952, the two superpowers started to orient their strategy toward deterrence.[12] The increased range and quality of weapons delivery systems also played a key role, allowing both superpowers to target a large portion of each other's territory. The first American (SM-65 *Atlas*) and Soviet (R-7 *Semyorka*) intercontinental ballistic missiles (ICBMs) were operational in 1959. Both countries also had shorter-range nuclear capabilities, from nuclear artillery shells to ground-to-ground missiles with ranges between a

10. M. Gladwell, *The Bomber Mafia*, New York: Allen Lane, 2021.
11. B. Brodie (ed.), *The Absolute Weapon: Atomic Power and World Order*, San Diego: Harcourt Brace, 1946.
12. Speech by Robert McNamara, San Francisco, 1967, available at: www.atomicarchive.com.

few hundred to several thousand kilometers. The first nuclear ballistic missile submarines (SSBNs) came into service in the 1960s. By stealthily approaching enemy coastlines, they compensated for the short range of the first submarine-launched ballistic missiles (SLBMs) and maximized the survivability of a preemptive strike. Nevertheless, the air force was still seen as the most reliable of the three branches of the armed forces, even when only using gravity bombs (the first air-to-ground cruise missiles did not come into service until the 1980s). It was the technical revolution in accuracy (see below) at the turn of the 1970s that made ballistic missiles a more credible prospect for tactical and operational use. Some intermediate-range missiles were also deployed in the European theater on both sides of the Iron Curtain.

Due to their low accuracy and difficulty of use, Soviet medium-range ballistic missiles (SS-4 and SS-5 systems) did not initially cause any concern among NATO countries. However, the development of the SS-20 and its deployment in 1977 upset the balance of nuclear power between West and East, culminating in the Euromissiles crisis.[13] This new delivery system, with an estimated range of between 3,000 and 4,000 km and a CEP (circular error probable)[14] of a few hundred meters, gave Moscow the ability to strike at depth into Western Europe from Soviet territory. In addition to limiting the risks to bomber pilots, these missiles were also designed to cause controlled damage thanks to the ability to adjust the yield of the nuclear warhead. The US felt that the Soviet Union had moved beyond deterrence and that it could use the SS-20 to support a large-scale conventional attack by first destroying NATO's nuclear sites in Europe and its command-and-control centers. In response, Washington deployed Pershing II ballistic missiles in West Germany—with a maneuverable warhead, a range of 1,500 km, and increased accuracy, they posed a threat to Russian bunkered command centers—as well as BGM-109G ground-launched cruise missiles in five NATO countries.

These first concerns around deep precision strikes, which persist today, involved the ability to target strategic sites (logistical hubs, munitions depots, C2 centers) using operational or even tactical-level weapons instead of exclusively with strategic weapons as in the past. Accuracy is less important for nuclear weapons, given their power, although their modularity (low yield) makes it possible to implement doctrines like flexible response.[15]

Nevertheless, the nuclear parity achieved in the mid-1970s, which acted as a mutual deterrent between the two blocs, made it necessary to rethink conventional sub-threshold confrontations. The Soviets thus developed a conception of conventional operations in the deep area, enabled by tactical

13. L. Nuti (ed.), *The Euromissile Crisis and the End of the Cold War*, Stanford: Stanford University Press, 2015.
14. A measure of the accuracy of a missile or projectile, used to determine the likely effectiveness of a weapon against its target.
15. I. Parisi, "L'indépendance européenne en question: La France et la crise des euromissiles (1977-1987)", *Relations internationales*, Vol. 178, No. 2, 2019, pp. 57–71.

deep strike innovations, such as new air-to-ground and sea-to-ground cruise missiles, artillery, precision rockets, and laser guidance.

According to Soviet doctrine, these technological advances and the coordination between conventional and nuclear forces have four major consequences: the ability to destroy clusters of enemy forces throughout the entire theater; the need to achieve victory rapidly in order to avoid escalation to the use of nuclear weapons; the need to fight in a nuclear environment if the enemy uses nuclear weapons first; and the need to target the enemy's nuclear systems as a priority, even in conventional wars. Overall, "strategic operations", including deep strikes, must serve to acquire and retain the initiative.[16]

These fears intensified following the revolution in military affairs (RMA) in the US and the technological improvement of the NATO systems deployed in Europe for long-range and precision strikes.[17] After the failures and loss of confidence of the US armed forces in Vietnam, Europe established itself as the new theater of engagement, but its depth necessitated reflection on concepts and better coordination of the roles of the US Army and the US Air Force. The result was the AirLand Battle concept, which was implemented in Europe by US forces in 1982 and remained in place until the late 1990s.[18] Certain contemporary deep strike systems, such as the HIMARS, were born out of this innovative concept of the "extended battlefield". Soviet strategists were worried that the US would establish a "reconnaissance-strike complex" combining precision munitions, sophisticated radars with broad coverage of the theater of operations, and automated C2, enabling a much faster response. This strategy, slightly overblown by the Soviets, was ultimately never put into practice due to the sudden end of the Cold War and, above all, the absence of direct confrontation, although it was used in other theaters that were less difficult to penetrate, such as Iraq in 1991.[19]

A capability back at the top of the agenda

The world that emerged following the end of the Cold War was stable and unipolar, reaping peace dividends and built around arms control and economic growth. Existing conflicts saw more limited use of deep strikes. The absence of front lines or a concrete threat in the "war on terror" saw deep strikes start to be used against less accessible adversaries. In parallel,

16. D. Johnson, "Russia's Conventional Precision Strike Capabilities, Regional Crises, and Nuclear Thresholds", *Livermore Papers on Global Security*, No. 3, Lawrence Livermore National Laboratory, Center for Global Security Research, February 2018, pp. 30 ff.
17. M. J. Sterling, "Soviet Reactions to NATO's Emerging Technologies for Deep Atack", *RAND Note N-2294-AF*, RAND, August 1985.
18. R. K. Laughbaum, "Evolution of Deep-Battle Doctrine During the Cold War", in *Synchronizing Airpower and Firepower in the Deep Battle*, Maxwell, AL: Air University Press, 1999.
19. B. D. Watts, "The Evolution of Precision Strike", Center for Strategic and Budgetary Assessments, 2013.

Russian rearmament and the rise of the Chinese threat prompted technological and doctrinal changes in the rest of the world, facilitated by the lack of a regulatory framework.

Doctrinal and technological advances

The success of the US precision-strike campaign on Iraq in 1991, along with the West's strategic and technological superiority after the Cold War, allowed the US to continue with the previous decade's approach to precision conventional strikes, ultimately leading to today's hypersonic weapons programs.[20] The counterinsurgency wars of the 1990s and 2000s were very different from the envisaged conflict against the Warsaw Pact armed forces. However, facing less effective integrated air defense systems (IADS) in Iraq or Afghanistan than in the Soviet Union, it was easier for planes to approach targets and use guided bombs, which are less accurate but cheaper than long-range precision munitions. This compromise between the risk to the carrier and the cost of the delivery system (which rises when range is combined with accuracy) is now back in the spotlight.

The preservation of civilian lives was a major political concern at a time of expeditionary wars with limited stakes and a duty to respect international humanitarian law.[21] This fact was at the heart of the RMA in the 1980s, turning long-range precision weapons and modern intelligence techniques into tools that could reduce the need for intervention on the ground and prevent stalemate thanks to a new form of "remote warfare". Long-range precision strikes were used extensively in the war on terror, demonstrating their effectiveness but also revealing their limitations.[22]

This strategy gained momentum in 2003 with the launch of the US Department of Defense's Prompt Global Strike (PGS) program, part of Donald Rumsfeld's "Transformation" strategy designed to maximize the potential of information technologies for targeting and stand-off strikes. The program was supposed to give the US military a conventional capability for striking high-value targets, including moving targets, anywhere in the world within one hour, without relying on US forward bases.[23] The projects envisaged initially included ground, air, or submarine-launched ballistic missiles with conventional warheads that were equipped, as technology improved, with a hypersonic maneuverable reentry vehicle.

20. J. Birkler (ed.), "A Framework for Precision Conventional Strike in Post-Cold War Military Strategy", RAND, 1996, available at: www.rand.org
21. E. Tenenbaum, "Intervenir aujourd'hui: Contraintes intérieures et opérations extérieures", in T. de Montbrial and P. Moreau Defarges (eds.), *Ramses 2013. Gouverner aujourd'hui?*, Dunod/Ifri, 2012.
22. M. van Creveld, *The Age of Airpower*, New York: PublicAffairs, 2012, p. 331.
23. A. F. Woolf, "Conventional Prompt Global Strike and Long-Range Ballistic Missiles: Background and Issues", Congressional Research Service, July 2021, available at: crsreports.congress.gov.

Nevertheless, the considerable cost of the program to develop a nascent technology and the concentration of US resources on the "war on terror" in the Middle East acted as a brake on the development and procurement of PGS capabilities.[24] Moreover, firing an American ballistic missile at a country that could not easily identify the nature of the warhead (conventional or nuclear) carried a serious risk of enemy overreaction in the form of defensive nuclear weapon use. Washington also had to confront the dilemma of the quantity needed for a significant impact. The proliferation and hardening of potential targets required cheaper, more numerous systems. At the same time, there was a need to find a solution for demonstrating the strength and will at the conventional level with a weapon whose strategic nature would come from its rarity. This dilemma is still featured in the current debate around deep strikes, which were restarted in the US by innovations in hypersonic glide vehicles and hypersonic cruise missiles. The penetration of air and missile defenses and theater strike capability were the two principal justifications given by US officials for pursuing the PGS program, which underwent multiple mutations before becoming Conventional Prompt Strike, itself divided into several programs for different environments.[25]

Over the same period, although the Russian Federation had to cut back on defense spending, it continued to invest in deep strike assets. Most of the systems in current use (*Iskander, Kalibr,* Kh-101) were developed in the 1990s and 2000s.[26] They diversified the non-nuclear strategic weapons at Moscow's disposal, seen as essential in Russian thinking, and formed the basis of a "cross-domain" deterrence/coercion strategy.[27] In parallel, the threshold for the use of nuclear weapons, which had been lowered following the end of the Cold War to compensate for conventional weakness, was gradually raised again. Russia's most recent non-nuclear strategic weapons programs were publicly presented by Vladimir Putin in his speech at the Moscow Manege in 2018.[28] Some were described as capable of penetrating all existing Western missile defense systems thanks to their hypersonic nature. As well as reinforcing the psychological dimension of these weapons, Putin's speech also confirmed the lack of clear distinction between the tactical, operational, and strategic levels in Russia's deep strike approach.

Finally, the proliferation of peripheral conflicts and the emergence of regional powers are the first signs of a democratization of deep strike capabilities, which, although less technically sophisticated than those of the

24. C. Brustlein, "Conventionalizing Deterrence? U.S. Prompt Strike Programs and Their Limits", *Proliferation Papers*, No. 52, Ifri, January 2015, available at: www.ifri.org.
25. E. Maitre, "20 ans après CPGS: Où en est la frappe conventionnelle longue portée américaine?", *Bulletin de l'Observatoire de la Dissuasion*, No. 95, Fondation pour la recherche stratégique (FRS), February 2022.
26. Interview with an analyst at the French Ministry of Armed Forces, October 2024.
27. D. Adamsky, "Cross-Domain Coercion: The Current Russian Art of Strategy", *Proliferation Papers*, No. 54, Ifri, November 2015.
28. R. Connolly, "Advanced Military Technology in Russia", Chatham House, September 2021, available at: www.chathamhouse.org.

US, have real potential for use on the battlefield or as a deterrent. In the Middle East, the weakness of Iran's air force during the Iran-Iraq War and the damage caused by the use of Scud missiles prompted Iran to invest heavily in its ballistic and cruise missile programs, which are currently being used against Israel. The simultaneous development of nuclear weapons by India and Pakistan in 1998 and the use of dual-capable weapons delivery systems also gave rise to new forms of coordination between precision conventional strikes and nuclear weapons within this volatile dyad. Lastly, in East Asia, China stepped up its military spending at the beginning of the twenty-first century, while the first North Korean nuclear test in 2006, which was accompanied by an expansion of Pyongyang's ballistic arsenal, forced South Korea and the US to invest in offensive as well as defensive capabilities on a scale that continues to grow today.

Deep strike without depth

Although the end of the Cold War temporarily took the prospect of a high-intensity conventional conflict between major powers off the table, the nature of conflict became more asymmetrical after the attacks on September 11, 2001, which opened a new era of military operations against terrorism. With no real front line to define the concept of depth as clearly as during the Cold War, the use of strikes changed significantly to focus more on speed and accuracy.

This new approach was exemplified by the US strikes on Al-Qaeda training camps in Afghanistan in 1998[29] and the strikes by France, the United Kingdom (UK), and the US on chemical weapons storage and production sites in Syria in 2018. Both operations involved a salvo of around a hundred long-range munitions and attacked a symbolic component of the enemy's system, located several thousand kilometers from US and allied bases, with no accompanying operations. They were political and symbolic actions that demonstrated each country's ability to strike at a great distance from its bases or anywhere in the world, as in the American case. Even the name of the 1998 US operation—Infinite Reach—emphasized the now global scope of the old concept of operational depth.

Deep strike can also be a way to wage war in and of itself. During Operation Allied Force in Kosovo in 1999 or Operation Odyssey Dawn in Libya in 2011, the US and its allies sought to achieve the political goal of protecting Kosovar or Libyan civilians by relying solely on massive air campaigns designed to eliminate the enemy's military potential without intervening on the ground. After the apparent success of the intervention in Kosovo, the prospect of a conflict fought essentially by the air force seemed set to become a reality. In the absence of adequate interception capabilities

29. T. R. Phinney, "Airpower Versus Terrorism: Three Case Studies", School of Advanced Air and Space Studies, March 2007.

on the enemy's side, the bomber once again "got through," and airpower became an attainable ideal.

Deep strike is also used as the prelude to large-scale ground operations. The invasions of Iraq (Desert Storm in 1991 and Iraqi Freedom in 2003) and Afghanistan (Enduring Freedom in 2001) were preceded by a phase in which air superiority was acquired by destroying enemy air defenses, and by a second phase of strikes on the enemy's entire political, military, and economic system to facilitate the entry and progress of coalition ground forces and their local partners. The First Gulf War in 1991 consisted of 42 days of long-range strikes on civilian and military infrastructure throughout Iraqi territory, followed by a lightning-ground offensive lasting 100 hours that culminated in Iraq's withdrawal. The air campaign involved over 100,000 air sorties, thousands of tons of bombs, and several hundred missile strikes.

The lessons learned during that operation formed the basis of the "shock and awe" doctrine that was formalized in the mid-1990s. It relied on a massive strike campaign against critical nodes in order to stun and paralyze the enemy's decision-making systems to the point of total collapse. This vision was based heavily on the supremacy and quasi-omnipotence of the air force, which is related to the idea of airpower.[30] The invasion of Afghanistan in 2001 diverged from this model: in the absence of operational targets to strike in an Afghanistan ravaged by three decades of conflict, the majority of strikes were for close air support rather than true deep strikes.

The initial success of these strike campaigns did not stop the Afghan and Iraqi conflicts of the twenty-first century from getting bogged down in long-term stabilization and counterterrorism campaigns. The latter saw a new evolution of deep strike. With no identifiable front or enemy infrastructure, the focus shifted from geographical to organizational depth. The aim was to attack the leaders of terrorist groups that could not be fought directly on the ground. In this context, drones became an invaluable tool thanks to their ability to remain in an area for long periods in order to carry out dynamic strikes on targets of opportunity. In 2004, President Bush described the US ongoing conflicts as "an international manhunt",[31] and the MQ-1 Predator drone, operated from the US, and its Hellfire missile became symbols of the global war on terror. This development also affected targeting processes, which involved closer cooperation between the intelligence services and the armed forces. Some of the targeted eliminations carried out in Pakistan and Yemen were directed by the Central Intelligence Agency (CIA).

During the conflicts of the 1990s and the early 2000s, however, the military efficacy of Western strike campaigns was unable to compensate in the long term for the absence of troops on the ground or clear political projects. Their value was in allowing states to demonstrate their ability to

30. B. S. Lambeth, *The Transformation of American Air Power*, Ithaca, NY: Cornell University Press, 2000.
31. Speech by George W. Bush, Roswell, 2004, available at: georgewbush-whitehouse.archives.gov.

carry out deadly attacks well beyond their borders, becoming a symbol of power that distinguished between those who could engage in them and those who could not.

A breakdown of regulation

As discussed in the previous section, there is currently no universal definition of deep strikes. For that reason, it seems difficult to regulate the numerous and widely diverse weapons that can be used to carry them out, from long-range artillery to medium-range ballistic missiles and glide bombs. Nevertheless, the principal obstacle is the absence of political will from states to regulate these delivery systems because of their growing importance in modern warfare. Attempts have focused solely on limiting their spread, with moderate success.

These regulatory difficulties are exacerbated by the wider context of the breakdown of conventional and nuclear arms control. The Intermediate-Range Nuclear Forces Treaty (INF Treaty) was the only treaty to impose restrictions on deep strike systems: Signed in 1987 between the USSR and the US, it ended the Euromissiles crisis and stipulated the elimination of ground-launched ballistic and cruise missiles with a range between 500 and 5,500 km, regardless of warhead.[32] Missiles launched from submarines (SLBMs, SLCMs) and aircraft (ALBMs, ALCMs) were not affected, and nor were weapons possessed by countries other than the USSR and the US, despite intensive discussions around including the French nuclear arsenal in the American pool.

Nevertheless, the development by Russia of the SSC-8/9M729 cruise missile, with a range of 1,000 km, prompted the US to denounce the treaty and withdraw from it in 2019. The discovery of the SSC-8 system ultimately seems to have been nothing more than an excuse for the US, which shortly afterward announced the development of the Long-Range Hypersonic Weapon (LRHW) project, an intermediate-range missile carried on a glide vehicle. The confrontation also played out at the level of communications: In response to the US denunciation of the treaty violation, Russia criticized the deployment of NATO's Aegis Ashore missile defense system in Romania and Poland, asserting that it amounted to a potential breach of the INF because the Mk-41 system is capable of launching *Tomahawk* missiles, which can, in certain configurations, have a range of over 500 km.[33] But although the normative pressure exerted by the INF on Washington and Moscow was undeniable, it is important to note that other non-European states capable of developing such weapons did not feel a need to comply. In

32. The treaty text can be found on the United Nations website: treaties.un.org.
33. "Russia Slams US Aegis Ashore Missile Deployment in Europe as Direct Breach of INF Treaty", TASS, November 26, 2018. Currently, the Aegis system is strictly defensive.

parallel, the development of ALCMs, ALBMs, and SLCMs, which were not covered by the INF, also accelerated in the absence of further regulation.

There are currently a few initiatives in place to try to limit the proliferation of these delivery systems, particularly ballistic missiles, because of the fear that they could be used as weapons of mass destruction by terrorist groups. Russia proposed a post-INF moratorium following the announcement of the US withdrawal in February 2019, specifying that Moscow would not deploy short- or medium-range weapons in Europe or elsewhere unless the US deployed such weapons in those regions.[34] But on top of the Trump administration's clear lack of interest in resuming negotiations, this proposal was judged too vague to be effective, despite appeals from experts to consider it for reasons of strategic stability. In April 2024, the Russian government announced a possible "review" of the moratorium, which it considered itself bound by, in response to US plans to deploy medium-range missiles in Asia.[35] The use of the new IRBM Orechnik against Dniepro in November 2024 (this with a range of 900km) seems to confirm the development by Russia of systems that were forbidden under the INF[36].

In parallel, two other initiatives are supposed to improve the regulation of deep strike systems for reasons of strategic stability: the Missile Technology Control Regime (MTCR) and the Hague Code of Conduct (HCoC). The 35 member states of the MTCR, established in 1987, are committed to following recommendations regarding the transfer of arms or components that could be used to develop delivery systems for weapons of mass destruction (WMD), regardless of their range or type of warhead. The goal is to limit the proliferation of complete rocket systems (ballistic missiles, space-launch vehicles) and unmanned systems (including cruise missiles and drones).[37]

Nevertheless, the MTCR is not a binding regime, and its members do not include proliferating states. Not a single Middle Eastern country is a signatory, and neither is China or North Korea. Moreover, the MTCR only covers transfers and so does not restrict national innovations: Its principal aim, when it was established, was to reduce the risk of WMDs being acquired by terrorist groups or certain states rather than to limit deep strike capabilities altogether. South Korea, which is becoming established as an exporter of short- and medium-range ballistic missiles, has admitted that in

34. D. Stefanovich, "How to Address the Russian post-INF Initiatives", European Leadership Network, January 20, 2020, available at: www.europeanleadershipnetwork.org.
35. "МИД: Россия может пересмотреть мораторий на ракеты средней дальности" (Ministry of Foreign Affairs: Russia could reconsider the moratorium on medium-range missiles), *Kommersant*, April 11, 2024, available at: www.kommersant.ru.
36. E. Maitre, « Que savons-nous de l'Orechnik ? », Observatoire de la dissuasion, *Bulletin*, No. 126, FRS, décembre 2024.
37. "Guidelines for Sensitive Missile-Relevant Transfers", MTCR, available at: www.mtcr.info.

response to increasing demand, it will no longer limit exports to systems with a range of under 300 km, despite being a signatory of the MTCR.[38]

The HCoC is based on the MTCR and focuses on the use of ballistic missiles. It requires subscribing states to provide pre-launch notifications on all ballistic missile and space-launch vehicle launches and test flights, regardless of range.[39] It also stipulates that subscribing states must submit information about their arsenals to the Secretariat on an annual basis. The HCoC, which was first signed in 2002 and now has over 145 signatories, is intended to supplement bilateral initiatives such as the 1988 Ballistic Missile Launch Notification Agreement between the USSR and the US, which is still in force despite tensions between the two countries. Like the MTCR, however, the HCoC has shortcomings that mean it cannot exert the same normative pressure as the INF. In particular, it lacks a mechanism for verifying the accuracy of declarations. Moreover, it has not been signed by the principal countries that pose a strategic risk in terms of deep strike capabilities (China, Iran, and North Korea).[40]

These limited initiatives demonstrate a lack of political will to regulate these weapons, which are seen as indispensable for winning future high-intensity conflicts, particularly from the perspective of initial entry operations or long-range strategic targeting.[41] By contrast, the end of the INF and its regulation of deep strikes presents an opportunity for technologically capable states to invest significantly in the sector and to derestrict their ground-to-ground systems: The range of the US Precision Strike Missile (PrSM) was previously artificially limited to 499 km, and its first post-INF tests exceeded this by a wide margin.[42] Naval and air deep strikes, meanwhile, which were never restricted by the INF, have proliferated continuously since the end of the Cold War and are now a feature of all theaters of conflict.

38. D.-H. Kim, "South Korea to Extend Export Missile Range from 300 km to 500 km", *The Korea Economic Daily*, August 20, 2024, available at: www.kedglobal.com.
39. Details can be found on the HCoC website: www.hcoc.at.
40. L. Héau and E. Maitre, "The Hague Code of Conduct in the Middle East", *HCoC Issue Brief*, March 2022, available at: www.nonproliferation.eu.
41. C. Brustlein, "Entry Operations and the Future of Strategic Autonomy", *Focus stratégique*, No. 60, Ifri, November 2016.
42. P. McLeary, "Army Readies Long-Range Missile Tests – Post INF", *Breaking Defense*, July 19, 2019, available at: breakingdefense.com.

The global dissemination of new capability

Under the threefold influence of technological advances (accuracy, range, penetration, speed), lower costs, and increased strategic competition, the democratization of access to deep strike assets can now be seen in all theaters of conflict. These capabilities are no longer the preserve of the major powers, although the latter are still able to use them more effectively thanks to their intelligence-reconnaissance-strike complex. Other military actors, both partners and competitors of France, are also developing these technologies and transmitting them to their proxies, including non-state actors, such as Iran and its militias in the Middle East.

Three theaters are particularly affected by this dissemination of deep strike capabilities. The first is the Asia-Pacific region, which is structured around two rivalries that both have a deep strike dimension: Sino-American competition over Taiwan and the protection of US assets in the region, and the Korean Peninsula. Second, Europe's Eastern flank and the war in Ukraine are a textbook case for the massive use of deep strikes to achieve results that are unattainable on a deadlocked front line. Finally, the use of deep strikes is on the rise in the Middle East, particularly due to Iran's desire to wield influence in the region and the destabilizing actions of non-state groups.

The Asian theater: Depth and immensity

Faced with China's growing power, the majority of East Asian countries have started to rearm, or at least to think seriously about their strategic partners and defense strategies. Given concerns around the reliability of the American security guarantees vis-à-vis its allies, China's territorial ambitions, and the rise in power of North Korea, the region has become something of a laboratory of deep strike capabilities. Disparities in strategic depth and a wide variety of environments (high seas, coast, ground, air) also give the region, and the systems developed by its states, a unique character.

China: Deep strike as a means to regional power

In East Asia, the People's Liberation Army (PLA) has since the early 2010s been working to keep the US and its allies at bay in the China Sea, which Beijing sees as its own territory. This anti-access/area-denial (A2/AD) strategy is exemplified by the use of non-kinetic (electronic warfare, cyberattacks) and kinetic (ground-to-ground and ground-to-surface) means

to neutralize US projection capabilities or keep them at a distance, or at least to act as a deterrent.

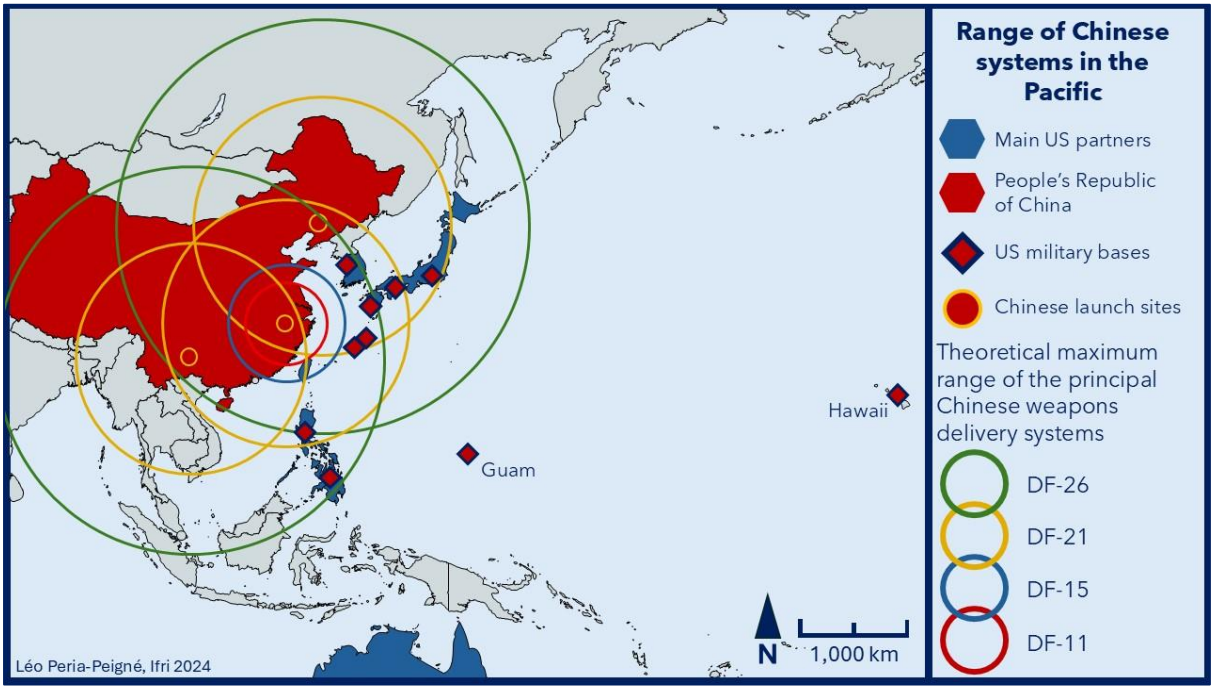
These developments in long-range precision strikes have been ongoing for the last decade and were highlighted by China in its most recent military strategy document (*Science of Military Strategy*).[43] Beijing profited from record economic growth to double its defense spending between 2010 and 2022 (from 150 to 300 billion dollars a year),[44] as well as benefiting from rather slow progress in US and Russian programs in this sector. While naval and air deep strike systems are the responsibility of the PLA Navy and Air Force, respectively, medium- and long-range precision-strike capabilities are the preserve of the PLA Rocket Force, which is also responsible for nuclear weapons. They are used to strike strategic enemy targets in line with the doctrine of "active defense"[45] and "strategic anti-air attack". The goal is to be able to neutralize the enemy's air assets before they are used and to prevent enemy forces from approaching Chinese territory.[46] This doctrine also stresses that the quantity of weapons delivery systems is more important than their quality because of the large number of targets to be struck in the event of conflict in the region.[47]

Exempt from any arms control restrictions and with regional, if not global ambitions, the PLARF deploys a diversified arsenal of ground-to-ground missiles (see table below) with ranges from 600 km (the DF-11A missile, in service since 1992) to over 8,000 km (the DF-27 missile with hypersonic glide vehicle). Intermediate ranges are covered by other hypersonic glide vehicle systems (DF-17) and maneuverable ballistic missiles (DF-21 and DF-26), some versions of which have notable anti-ship capabilities.[48] Beijing also maintains a certain ambiguity around the dual-capable nature of some missiles, particularly the DF-26 and the future DF-27 glide vehicle: When not upright, a conventional DF-26 is indistinguishable from a nuclear DF-26.[49] This is useful as a deterrent against a US preemptive strike on these systems. If a kinetic attack on a conventional mobile missile system could lead to escalation, destroying a nuclear weapons delivery system would have an even more destabilizing effect. Finally, technical innovations in Chinese nuclear systems, the number of which is

43. National Defense University, *Science of Military Strategy*, 2020. Translated by the US Air University's China Aerospace Studies Institute in 2022.
44. In comparison, the US annual defense budget for 2023 was 773 billion dollars. The 2024 defense budget for all NATO countries, not including the US, rose to 506 billion dollars.
45. M. Taylor Fravel, *Active Defense: China's Military Strategy since 1949*, Princeton: Princeton University Press, 2019. See also A. Yanan Zhang, "L'évolution de la doctrine chinoise depuis la guerre du Golfe (1991): Quelle implication pour l'armée de l'Air?", in *L'armée de l'Air chinoise*, *Vortex*, No. 5, June 2023.
46. National Defense University, *Science of Military Strategy*.
47. A. Panda, "Indo-Pacific Missile Arsenals: Avoiding Spirals and Mitigating Escalation Risks", Carnegie Endowment for International Peace, October 31, 2023, p. 18, available at: carnegieendowment.org.
48. V. Nouwens, T. Wright, E. Graham, and B. Herzinger, "Long-Range Strike Capabilities in the Asia-Pacific: Implications for Regional Stability", IISS, January 18, 2024, available at: www.iiss.org.
49. Interview with an arms manufacturer, October 2024.

growing, are contributing to advances in conventional missiles and the targeting chain.

Map 1: Range of the principal Chinese systems in the Pacific Ocean



Source: Ifri, based on IISS and CSIS data.

Launch sites shown in Chinese territory are not exhaustive and have been chosen for illustrative purposes.

Because of the great depth of its territory, China relies principally on mobile ground-to-ground ballistic and cruise missile systems, which are more difficult to detect and so to neutralize pre-launch. The PLA Air Force and Navy have also invested heavily in this area, although not as effectively as the PLARF. The most recent version of the H-6 bomber has an estimated combat range of 3,500 km and can carry cruise missiles with a range of 1,500 km as well as air-launched ballistic missiles. China's Type 093 nuclear-powered attack submarine will be equipped with sea-to-ground missiles, while its Type 055 cruiser already has YJ-12A anti-ship missiles. The US is not so concerned about other, less advanced projects, such as the H-20 stealth bomber, which is supposed to rival the American B-21 but would have significantly inferior capabilities when unescorted, particularly in terms of stealth.[50]

50. M. Marrow, "China's New H-20 Stealth Bomber 'Not Really' a Concern for Pentagon, Says Intel Official", *Breaking Defense*, April 22, 2024, available at: breakingdefense.com.

Table 1: Principal Chinese deep strike systems

Name (Chinese classification)	Type	Declared warhead	Entered service	Range
DF-11A	Short-range ground-to-ground ballistic missile	Conventional	1992	500–600 km
DF-15	Short-range ground-to-ground ballistic missile	Conventional	1991 (DF-15A), 2009 (DF-15B), 2013 (DF-15C)	Between 600 and 900 km (depending on version)
DF-16	Short-range ground-to-ground ballistic missile	Conventional	2011	Over 700 km
DF-17	Medium-range ground-to-ground ballistic missile equipped with a hypersonic glide vehicle	Conventional	2020	Unknown
DF-21D	Medium-range anti-ship ballistic missile	Conventional	2006	Over 1,500 km
DF-26	Intermediate-range ground-to-ground ballistic missile	Conventional or nuclear	2016	Over 3,000 km
DF-26B	Intermediate-range ground-to-ground ballistic missile	Conventional	2016	4,000 km
DF-27	Intermediate-range ground-to-ground ballistic missile equipped with a hypersonic glide vehicle	Unknown	Not in service yet	Between 5,000 and 8,000 km
CJ-100	Ground-to-ground cruise missile	Conventional	2009	2,000 km
CJ-10	Ground-to-ground cruise missile	Conventional	2019	2,000 km

Source: V. Nouwens et al., "Long-Range Strike Capabilities", op. cit.

Although these missiles have so far only been used for exercises, sometimes with live missiles, such as following Nancy Pelosi's visit to Taiwan in August 2022,[51] China's precision-strike capability is becoming an increasingly credible threat to the US and its allies in the region. Short-range missiles threaten the entire "first island chain", particularly Taiwan, while medium- and long-range missiles pose a threat to US bases in the Philippines, Japan, or even Guam. Anti-ship missiles keep US surface ships at a distance, particularly aircraft carriers, whose potential vulnerability to "carrier killers" is a constant source of anxiety.[52] Chinese media outlets stoke fears around precision missiles in the event of a war over Taiwan, for example, by announcing the simulation of strikes on strategic sites on the island in April 2023 in videos that went viral on social media, giving these weapons a high propaganda value.[53]

Nevertheless, this fear of Chinese capabilities is slightly excessive when it comes to mobile targets due to persistent difficulties within the PLARF in terms of target acquisition, C2, and radar coverage, which still have room for improvement despite recent investment.[54] The PLARF, seen as the elite of the Chinese armed forces, also suffered serious corruption incidents in summer 2023 and spring 2024, leading to the dismissal of a number of its senior officials, potentially hindering its effectiveness in terms of capabilities.[55] These difficulties, along with operational and strategic considerations, may have partly motivated the public test of an ICBM fired toward the Pacific in September 2024.[56] It thus seems likely that China would be more effective against static targets, like US facilities within missile reach, which are currently less well-defended than the carrier battle groups operating in the region.

How the United States and its allies are adapting

In response to the increasingly concrete threat posed by China in the region, the US must do three things: ensure freedom of navigation in the China Sea and the surrounding area by preventing Beijing from imposing a denial of access and shipping; protect its own bases and interests in the Asia-Pacific, especially Guam and the US forces deployed in South Korea and Japan; and reassure its numerous allies. To do so, Washington has numerous means and assets at its disposal, including a massive naval presence and frequent

51. Y. Lee and S. Wu, "Furious China Fires Missiles Near Taiwan in Drills After Pelosi Visit", Reuters, August 5, 2022, available at: www.reuters.com.
52. K. Osborn, "China's DF-26 'Carrier Killer' Missile: Hype vs. Reality – How Will the Navy Stop Them?", *Warrior Maven*, June 21, 2023, available at: warriormaven.com.
53. A. Panda, "Indo-Pacific Missile Arsenals", op. cit., p. 20.
54. V. Nouwens et al., "Long-Range Strike Capabilities", p. 14.
55. E. Ji, "Rocket-Powered Corruption: Why the Missile Industry Became the Target of Xi's Purge", *War on the Rocks*, January 23, 2024, available at: warontherocks.com.
56. C. Hoorman and E. Vincent, "La Chine a mené son premier essai de missile balistique hors de ses frontières depuis 1980", *Le Monde*, September 26, 2024.

deployments in the region, sometimes involving units from outside the Seventh Fleet. The deep strike domain is also being developed both offensively (preventive strikes on Chinese systems, capability transfers to allies) and defensively (improved missile defense systems and a capability mix that strengthens the deterrence posture). Mobility is also crucial to reduce the risk of enemy targeting and attack.

Because of this need for mobility and the "tyranny of distance" in the Asia-Pacific, the US Air Force and the US Navy are still the only forces able to carry out deep strikes in the region, each with its own strategy and weapons. The latter are being modernized to incorporate the latest technological innovations (including hypersonic technology), improve the ability to penetrate enemy defenses and sustain a salvo competition in the long term in the event of a confrontation with China.

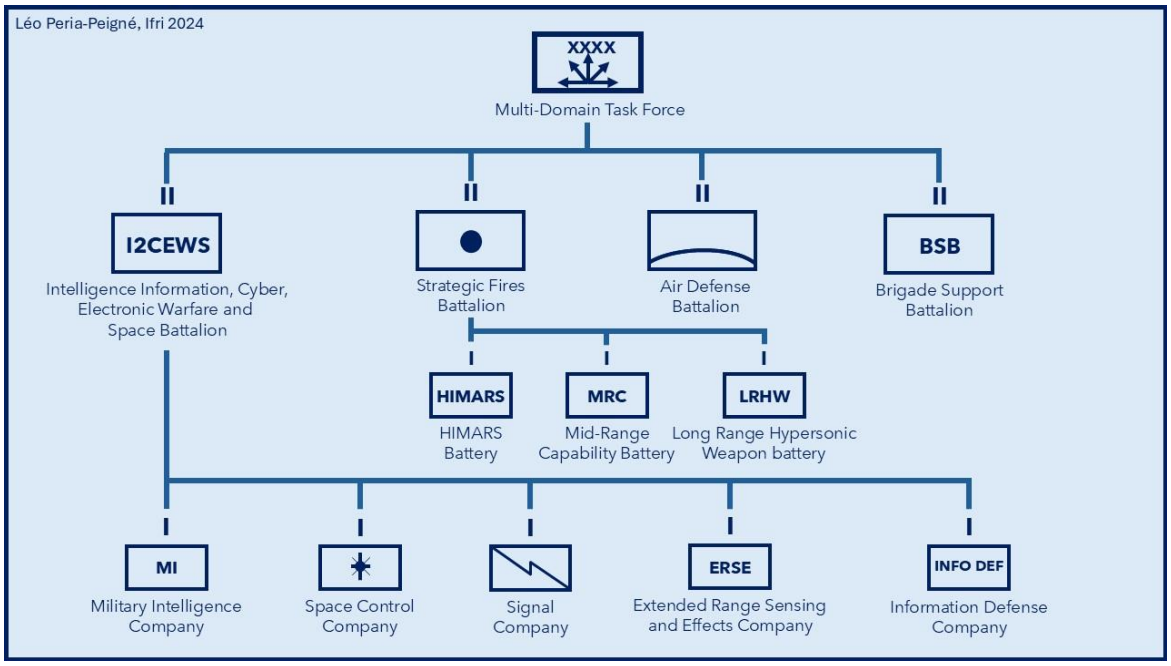
Carrier battle groups are at the heart of the US Navy's strategy in the Indo-Pacific, with significant weaponry to carry out deep strikes on Chinese territory or precision strikes on Chinese surface ships. The US destroyers escorting its aircraft carriers are equipped with Tomahawk missiles in surface-to-surface configuration (or air-to-surface for the Naval Air Force), and SLAM-ER missiles are currently being deployed. Finally, the Conventional Prompt Strike hypersonic missile, built on the same model as the US Army's Long-Range Hypersonic Weapon, is slated to be deployed on two *Zumwalt*-class destroyers in 2025.[57]

Thanks to the numerous US and allied (Japan, Australia, Philippines, South Korea, etc.) airbases in the region, which can extend the range of carriers, the US Air Force is another key asset for the US when confronting the Chinese threat in Asia. With China's air defenses unproven and its air force lacking experience, Washington likely still has air superiority. Carriers and weapons are constantly being upgraded: US fighters are now equipped with JASSM and JASSM-ER missiles, as well as the Tomahawk for air-to-ground strikes. A new version of the SM-6 can also be used for air-to-surface strikes. The B-21 bombers currently in development are also intended to counter China, as is Raytheon's air-to-ground Hypersonic Attack Cruise Missile,[58] although the AGM-183 Air-Launched Rapid Response Weapon project was canceled in 2023. Nevertheless, some analysts suggest that the continuing development of China's air defense systems and the limited number of US aircraft available in the theater mean that US air strategy must evolve toward "air denial",[59] in other words saturating the enemy's airspace

57. "Conventional Prompt Strike (CPS) Programme, USA", *Naval Technology*, March 15, 2024, available at: www.naval-technology.com.
58. U. Lee Harpley, "US and Australia Making 'Significant Progress' on New Hypersonic Weapon", *Air & Space Forces Magazine*, August 9, 2024, available at: www.airandspaceforces.com.
59. M. K. Bremer and K. A. Grieco, "In Defense of Denial: Why Deterring China Requires New Airpower Thinking", *War on the Rocks*, April 3, 2023, available at: warontherocks.com.

with inexpensive weapons so that aircraft and cruise missiles can penetrate it more easily.

Diagram 2: Structure of a Multi-Domain Task Force (MDTF)



Source: US Congressional Research Service.

Moreover, the US Navy and the US Air Force are still facing problems with distance and carrier endurance, as well as potential advances in Chinese defenses and a reluctance to risk engaging pilots or having an American surface ship destroyed. As a result, the US Army is also investing in the deep strike domain, mirroring the trend seen in Europe. This recovery of a strategic role for the ground forces is being driven in particular by the Multi-Domain Task Force (MDTF), a doctrinal innovation introduced in 2017 to combine different strategic capabilities (intelligence, effects in intangible domains, deep strike) that can be used by the ground forces.[60]

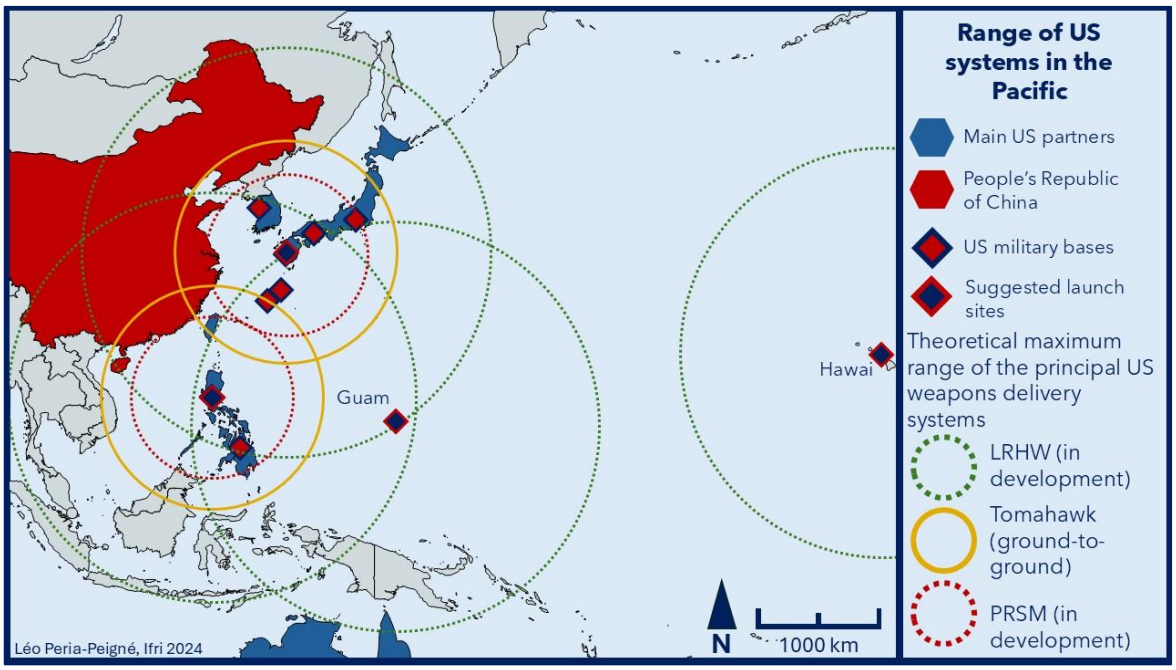
The Valiant Shield 2024 SINKEX (sinking exercise) saw the US Army's 3rd MDTF[61] successfully destroy a mobile naval target from Guam for the first time, using the PrSM ballistic missile (successor to the MGM-140 ATACMS) launched from the ground-based Autonomous Multi-Domain Launcher (AML).[62]

Besides the PrSM, the US Army can draw on various other technological innovations in the deep strike domain. The Tomahawk missile was deployed for the first time in ground-to-ground configuration (estimated range of 1,600 km) from the Typhon launcher during an exercise in the Philippines in

60. A. Feickert, "The Army's Multi-Domain Task Force (MDTF)", Congressional Research Service, March 2024, available at: sgp.fas.org.
61. W. Olson, "Army Stands Up Its Third Multi-Domain Task Force in Hawaii", *Stars and Stripes*, September 24, 2022, available at: www.stripes.com.
62. "U.S. Army Conducts First Anti-Ship Ballistic Missile SINKEX Using PrSM", *Naval News*, June 23, 2024, available at: www.navalnews.com.

April 2024.[63] The Typhon could also, in the future, launch SM-6 missiles, which are more recent, more accurate, and have a longer range than the Tomahawk. Finally, the US Army has its own hypersonic weapons program, the Long-Range Hypersonic Weapon (Dark Eagle). Its first successful test was carried out in summer 2024 in Hawaii, emphasizing the system's importance to the Pacific theater.[64]

Map 2: Range of US systems in the Pacific Ocean



Source: © Ifri, based on IISS and CSIS data.

The launch sites shown are not an exhaustive list of current US positions and represent suggested deployments.

Nevertheless, the problem facing the US is how to defend its sites, whether ground-based systems or airbases, against air and missile attacks, and what's more to do so in foreign countries. Although hosting a deep strike system can offer benefits in terms of a potential technology transfer and demonstrating a strong relationship with the US, it can also increase the risk of a Chinese strike (in the case of the Pacific) on the host country's territory in order to destroy the American system. These fears must be addressed with additional guarantees of protection from the US, such as the deployment of defense systems, which may themselves cause tensions with Beijing. The deployment of a THAAD battery in South Korea in 2017 was viewed by China as an attempt to use the system's radars to spy on its territory.[65]

63. J. Johnson, "U.S. Deploys Midrange Missile System in Indo-Pacific for First Time", *The Japan Times*, April 16, 2024, available at: www.japantimes.co.jp.
64. A. Feickert, "The U.S. Army's Long-Range Hypersonic Weapon (LRHW): Dark Eagle", Congressional Research Service, September 9, 2024.
65. T.-H. Kim, "China, South Korea Clash Over THAAD Anti-Missile System", *Defense News*, August 10, 2022, available at: www.defensenews.com.

Table 2: Principal US deep strike systems

Name	Type	Entered service	Theoretical maximum range
Tomahawk Block IV	Surface-to-surface	2006	1,600 km
Tomahawk Block V	Ground-to-ground (with the Typhon launcher)	Tested in 2024	1,600 km
ATACMS	Short-range tactical ballistic missile	1991	300 km
AGM-158C LRASM	Anti-ship cruise missile	2018	370 km
AGM-158 JASSM	Air-to-surface cruise missile	2009	370 km
PrSM (Precision Strike Missile)	Short- or medium-range ballistic missile	2023	499–1,000 km
LRHW (Long-Range Hypersonic Weapon)	Sea-to-ground and ground-to-ground missile with hypersonic glide vehicle (CPS project)	In development	Over 2,700 km
AGM-158B JASSM-ER	Air-to-surface cruise missile	2014	1,000 km
SM-6	Missile with different configurations depending on platform (ground-to-ground, air-to-surface, or missile defense)	Depends on model	Depends on platform
HACM (Hypersonic Attack Cruise Missile)	Air-to-ground hypersonic cruise missile	In development	Over 500 km

Source: IISS; CSIS Missile Defense Project; interviews with defense manufacturers.

In response to the Chinese threat, the US allies are developing their own precision weapons internally and continuing to procure them from Washington. Japan, one of the US main allies in Asia, has drastically modified its defense strategy. In a set of documents published in December 2022, Tokyo acknowledged that its missile defense system was no longer sufficient given the proliferation of missiles in the region, whether from China or North Korea.[66] It thus recognized the need for substantial procurements of active defense assets, including deep strike capabilities,

66. M. Yeo, "New Japanese Strategy to Up Defense Spending, Counterstrike Purchases", *Defense News*, December 20, 2022, available at: www.defensenews.com.

taking it even further from a defense policy that is supposed to be pacifist according to the Japanese Constitution.[67]

These strategic developments are being supported by a significant increase in the ceiling on Japan's defense spending (up to 2% of GDP) and by major investment in long-range strike systems: April 2023 saw the announcement of a 380-billion-yen contract (around 3 billion dollars) signed with the Japanese manufacturer Mitsubishi to improve the ground-to-ground, anti-ship, and air-to-ground missiles already in the Japanese arsenal.[68] The contract also covers the development of a ballistic missile with a maneuverable warhead, which started tests in the spring of 2024, as well as submarine-launched anti-ship cruise missiles. Despite all this, Japan remains heavily dependent on the US for its defense. With no dedicated facilities in Japan, missiles are tested at US launch sites, and Tokyo continues to buy off the shelf. The US Department of State approved the sale of 50 JASSM missiles to Japan through a Foreign Military Sales (FMS) contract in September 2023,[69] while a 1.8-billion-dollar contract for 400 Tomahawk cruise missiles (estimated range 1,300 km) was signed in January 2024.[70] Finally, the provision of radar data to detect incoming missiles is still strongly correlated with the US presence in the region, despite the establishment of a new, tripartite system for sharing data between South Korea, Japan, and the US.[71]

Korea(s): Striking a nearby depth

Washington and Beijing are not the only actors preparing to use deep strikes in the Asia-Pacific. The Korean Peninsula also offers valuable lessons thanks to its smaller distances. The proximity of all of South Korea's sensitive facilities to North Korea puts them within range of Pyongyang's less sophisticated but numerous systems, but the strategic dimension of the targets justifies considering a potential North Korean attack as a deep strike.

Like the Russian and Pakistani doctrines, which prioritize dual-capable systems and a wide variety of ranges to increase strategic ambiguity and make up for the weakness of conventional forces, the North Korean regime has a considerable arsenal of rockets, artillery shells, and short-, medium-, and long-range missiles that can carry conventional, biological, or nuclear warheads. Moreover, Kim Jong Un recently announced a change to North Korean nuclear doctrine with the creation of "another function"

67. C. Pajon, "Nouvelle stratégie de sécurité et de défense au Japon: Comment dit-on *Zeitenwende* en japonais?", *Lettre du Centre Asie*, No. 101, Ifri, December 19, 2022, available at: www.ifri.org.
68. M. Yamaguchi, "Japan Signs $2.8 Billion Deals for Long-Range Missile Development", *Defense News*, April 11, 2023, available at: www.defensenews.com.
69. M. Yeo, "US State Department Approves JASSM-ER Missile Sale to Japan", *Defense News*, August 30, 2023, available at: www.defensenews.com.
70. "Tensions en Asie: Le Japon finalise l'achat de 400 missiles américains *Tomahawk*", *La Tribune*, January 18, 2024.
71. "Japan, U.S., South Korea Swiftly Share Radar Info for First Time, Letting Japan Track North Korean Missile More Quickly", *Yomiuri Shimbun*, February 4, 2024.

complementing defensive deterrence, which has been interpreted as the possibility of tactical nuclear strikes on South Korean territory.[72] This hypothesis is all the more credible because of the recent development of an arsenal of short-range, dual-capable rockets and ballistic missiles.[73] In a conflict, the diversity and accuracy of its systems would enable North Korea to target strategic sites while remaining under the threshold of a large-scale nuclear attack or even below the nuclear threshold. This move is intended to reduce the risk of a nuclear response from the US. Although South Korea is protected by US extended deterrence, it is not a given that Washington would be willing to risk an attack on its territories within range of North Korean nuclear missiles in the event of North Korean retaliation for an attack on Pyongyang.

This crisis of confidence in the US, along with recent changes to North Korean doctrine that seem to suggest tactical nuclear weapons could be used for preemptive strikes, are prompting questions within South Korea about its own nuclear and conventional arsenal.

In 2013, Seoul developed the "3K" strategy to strengthen its deterrence against an attack from its northern neighbor.[74] The first stage is the kill chain, a cluster of systems (intelligence, detection, target acquisition, strike, and BDA) used to carry out preemptive strikes on North Korean missile and nuclear facilities. These strikes must be conducted by national systems (the Hyunmoo ground-to-ground[75] and surface-to-ground ballistic missile, the Haesong cruise missile, and the F-35A fighter).[76] The Korea Air and Missile Defense System is the second component of this 3K defense strategy, allowing the chain of command to react rapidly in the event of a North Korean attack thanks to a network of surveillance aircraft, radars, Cheongung II ground-to-air interceptors, and American Aegis and Patriot systems. Finally, should the first two layers fail, the third component is the Korea Massive Punishment and Retaliation Plan, which was put in place after the fifth North Korean nuclear test in 2016.[77] Similar to the kill chain but with a wider scope, it aims to conduct actions against all of the North Korean

72. A. Bondaz, "Corée du Nord, évolution d'un État nucléaire", FRS, December 21, 2023, available at: www.frstrategie.org.
73. E. Maitre, A. Bondaz, S. Delory, and C. Maire, "L'importance des systèmes de courte portée pour la Corée du Nord", *Bulletin de l'Observatoire de la Dissuasion*, No. 105, FRS, January 2023, available at: www.frstrategie.org.
74. C. Work, "Navigating South Korea's Plan for Preemption", *War on the Rocks*, June 9, 2023, available at: warontherocks.com.
75. The Hyunmoo-5 was unveiled in October 2024 with an eight-ton conventional military warhead, one of the largest in the world for non-nuclear medium-range missiles. See K. Lemkadmi, "La Corée du Sud dévoile son nouveau et très lourd missile Hyunmoo-5", *Air & Cosmos*, October 7, 2024, available at: air-cosmos.com.
76. V. Nouwens et al., "Long-Range Strike Capabilities", op. cit., p. 32.
77. "South Korea Announces 'Massive Punishment and Retaliation' in Response to Fifth Nuke Test", *Hankyoreh*, September 13, 2016, available at: english.hani.co.kr.

regime's strategic sites, including its political leaders, by combining deep strikes, special forces ground operations, and cyberattacks.[78]

This system, which is coordinated by the Korea Strategic Command and uses US systems, is clearly American in inspiration. However, South Korea has its own very dynamic defense industry that designs most of the offensive and defensive weapons needed for this strategy. The existential nature of the threat demands high standards but also mass production, which means its products are suitable for export. Seoul has had multiple commercial successes with its long-range strike systems, such as the K239 Chunmoo multiple rocket launcher, of which 300 units were sold to Poland in 2022. Heavily inspired by the American M142 HIMARS, it can fire a wide range of long-range ballistic munitions—up to almost 300 km—developed in South Korea. A version of the Ure ground-to-ground ballistic missile with a range of 500 km is also available for export.

The European theater: A deep strike laboratory

Russia has a substantial arsenal of deep strike assets, which occupy a prominent position in Russian doctrine. The war in Ukraine has highlighted shortcomings and prompted swift adaptations on both sides, which have procured new systems, including unmanned systems, for carrying out deep strikes at low cost. The war has been a wake-up call for many NATO armed forces, which are now seeking to redevelop modern deep strike capabilities, even if it means importing systems in the absence of European alternatives.

Evolution and improvisation on the Ukrainian front

Compensating for the rigidity of the Russian model

The concept of depth is integral to Russian strategic culture, which has been shaped by the conceptual legacy of the operational art developed in the 1920s and 1930s,[79] allowing it to coordinate and balance efforts against multiple centers of gravity or directions. Attacking targets located in depth causes a shock that can destabilize the entire enemy infrastructure, producing significant operational effects. To achieve this result, Russian doctrine, continuing the Soviet model, "scales" forces according to their depth of action and the value of the targets they can neutralize.[80] The different scales are strategic, at over 500 km, operational-strategic between 200 and 500 km,

78. A. Panda, "South Korea's 'Decapitation' Strategy Against North Korea Has More Risks Than Benefits", Carnegie Endowment for International Peace, August 15, 2022, available at: carnegieendowment.org.
79. A. Svechin, *Strategy*, op. cit.
80. P. Gros et al., "Intégration multimilieux/multichamps: Enjeux, opportunités et risques à horizon 2035", FRS, March 28, 2022, available at: www.defense.gouv.fr.

and tactical-operational, between 100 and 200 km.[81] But this model should not be reduced to a mechanical, linear vision of the battlefield. It does not simply reflect the technical characteristics of strike systems in terms of range, but uses them to enable the distribution and dynamic allocation of weapons delivery systems in line with priority objectives. Each scale corresponds to a specific concept of operations with its own command structure, information systems, and dedicated sensors and effectors.

The strategic scale aims to tip the balance in a campaign or a war. At this level, strike assets are structured around two types of mission and are generally under the control of the General Staff. The first mission is deterrence, or rather the strategic intimidation of European governments. Its aim is to threaten the infrastructures and centers of power that sustain the political, economic, and even cultural life of the countries concerned. The second mission has a more operational objective: gaining or challenging fire superiority in the theater of military operations (TVD). Its aim is to check and prevent NATO's increasing power by targeting the infrastructures and command centers critical to the West's ability to first conduct an "aerospace salvo" and then transfer and concentrate material and human reinforcements to strengthen the Eastern flank. Still following the model of Soviet planning, the relevant targets are deep strike launch sites and delivery systems, airfields, IADS, ISR, and logistics and troop assembly hubs. Operation Desert Storm was a wake-up call for Russia in terms of its vulnerability to Western air campaigns. As a result, a significant proportion of its strategic deep strike missions are part of a kind of large-scale counterbattery mission to preempt enemy salvos as far as possible and, in conjunction with its air and missile defense systems, to degrade and ultimately intercept engaged aircraft and weapons delivery systems. This mission primarily relies on the Russian systems with the best penetration: Kinzhal, Iskander, and air- or sea-launched cruise missiles such as Kh-101, Kh-555, and Kalibr. In Russian nomenclature, environments or services are subordinate to the objectives of the plan: in this case, to repel a "large-scale, integrated air attack". The overarching idea is to exploit synergies between offensive and defensive assets, whether ground-based or aerial, kinetic or "informational". In this respect, it is no coincidence that the Russians consider their IADS action as "anti-air strike" and not just as interception. The importance placed on stand-off missile launches should enable them to carry out strikes even if they cannot win air superiority against a more powerful or numerous Western air force.

This approach exploits the dual-capable nature of systems and missiles. For example, the S-300 surface-to-air missile system can also at a push strike ground targets to bolster Russia's deep interdiction salvos. The Russian Navy and the fleet of long-range bombers (Tu-22M, Tu-95M, and Tu-160) can

81. P. Gros et al., "Intégration multimilieux/multichamps", op. cit.

launch both nuclear or conventional missiles,[82] increasing uncertainty for Western IADS about the nature of the attack. This versatility of strike assets is intended to make up for Russia's technological and numerical inferiority in the air domain and in targeting capabilities. In terms of ISR, the Russian Federation cannot rely on space or air coverage because its satellites and platforms are few in number and insufficiently modernized. Russia thus relies essentially on coverage by unmanned ground radars, which, although scalable, is more limited. In this context, asset versatility allows Russia to saturate targets or to literally "screen" a threatened aerospace direction.

The operational-strategic scale, organized into different reconnaissance and strike complexes or "circuits", is primarily the expression of the fire superiority objective at the level of the theater of operations. Again, targets are ordered hierarchically: similar strike assets on the enemy's side, the enemy's C2, its IADS, its sensors, its logistics, etc. In that respect, as the name suggests, numerous "strategic" weapons delivery systems, such as Kh-101, Kh-555, and Kalibr cruise missiles and Iskander ballistic missiles, can also be used to ensure better fires coverage or hit particularly well-protected and hardened targets. At this scale, heavy rocket launchers like the BM-30 Smerch (200 km) and its eventual successor, the Tornado, can also play a role. ISR missions are performed by medium-altitude long-endurance (MALE) UAVs like the Altius, but above all by specialized machines such as the Il-22 airborne command post and the declining fleet of Su-24MR reconnaissance aircraft.

The tactical-operational scale is responsible for interdiction missions and the destruction of enemy combat strength. It is under the control of a combined arms army, which reports to the relevant military district. Strikes can be carried out by less powerful bombers like the Su-34 and Su-24 or by rocket launchers. ISR missions are performed by lighter UAVs such as those in the *Forpost* class, which have a range of 250 km, but also by Orlan-10 and Orlan-30 UAVs. Before the war, Russia was planning to automate this sector even further with the addition of the Orion strike drone and the total replacement of the Su-24MR fleet. It is important to note that this distribution of resources and ranges can vary depending on context, requirements, or target value. In March 2024, two Patriot air defense systems deployed near the front line were destroyed by Iskander missiles, which are technically for more long-range strikes.[83]

82. M. Pinel, "L'instrument de puissance de la diplomatie aérienne russe", *Revue Défense Nationale*, Vol. 824, No. 9, 2019, pp. 101–106.
83. D. Axe, "A Russian Drone Spotted a Ukrainian Patriot Air-Defense Crew Convoying Near the Front Line. Soon, A Russian Hypersonic Missile Streaked Down", *Forbes*, March 9, 2024.

Table 4: Principal Russian deep strike systems

Name	Type	Entered service	Theoretical maximum range
Kh-101	Air-to-ground cruise missile	2010 (estimation)	2,500–2,800 km
Kh-55	Air-to-ground cruise missile	2004	2,500 km
Shahed-136/ Geran-2	Programmable munition	2020	2,500 km
3M-54 Kalibr	Surface-to-ground cruise missile	1994	1,500–2,500 km
Kh-47M2 Kinzhal	Air-to-ground air-launched ballistic missile	2017	1,500–2,000 km
SS-N-33 Zircon	Sea-to-ground cruise missile	2017	500 km
9K720 Iskander	Ground-to-ground ballistic missile	2006	500 km
P-800 Oniks	Anti-ship missile	2002	300 km
9K515 Tornado-S	Ground-to-ground rocket	2016	120 km

Source: CSIS Missile Defense Project.

This organization of weapons delivery systems from all forces is designed to maximize the Russian armed forces' considerable firepower. The different systems are strictly subordinated to the chosen operational concept for a given strategic, operational, and tactical direction, at the cost of a rigidity of use that was clear well before the war in Ukraine. Moreover, even before 2022, Russia's strategic conventional strike capabilities already seemed hampered by an insufficient arsenal of cruise missiles, as well as space and air ISR assets that were too limited to ensure optimum effectiveness.[84]

The Russian model, which had already been partially put into practice in Ukraine in 2014 and 2015, and to a lesser degree in Syria,[85] encountered a very different reality right from the beginning of the conflict in Ukraine in 2022. Given the nature of the terrain, this deep strike model turned out to have major shortcomings during the first two years of the war. Too sophisticated for troops with a variety of training backgrounds, lacking appropriate ISR and targeting resources, and hampered by defective communication systems and an overly centralized command structure, it was unable to achieve its objectives when faced with a more mobile Ukrainian force with better intelligence.[86] Caught in the trap of its own "saturation" model, it was swiftly overwhelmed by the task of prioritizing targets, which were also too numerous for the volume of available munitions.

84. P. Gros and S. Delory, "L'évolution des feux dans la profondeur à l'horizon 2035", *Note de l'Observatoire des conflits futurs*, FRS, November 19, 2020.
85. M. Goya, "Les expériences récentes de forces terrestres russes", *Défense & Sécurité internationale*, special issue, No. 71, April–May 2020.
86. Interviews with Ukrainian civilian and military experts, summer 2024.

Serious issues in the reconnaissance-strike complex in the operational depth were also brought to light as soon as the conflict started. The planned ISR capabilities for this depth, particularly in terms of UAVs, turned out to be insufficient in number or unsuitable. Weapons capable of striking the enemy's depth at a range of 100 to 500 km were inadequate or in too short supply to achieve the desired fire superiority over the whole sector or to compensate for ISR failings and delays in information transfers.[87] The BM-30 Smerch multiple rocket launcher, which has powerful saturating capabilities, in reality rarely goes beyond 130 km, while the Iskander ballistic missile, which can reach 500 km, is not a saturation weapon. By contrast, internal procedures such as information sharing and targeting seem to have improved after two years of conflict. The first months of 2024 saw a series of successful strikes on high-value targets. Fighter aircraft on the ground, munitions depots, Patriot defense systems, and troop concentrations were struck more rapidly and effectively, while Ukraine lacked the munitions to maintain a satisfactory interception rate.[88]

Ukraine: Adapt to survive

The Russian salvos launched during the first few hours of the conflict with the aim of eliminating Ukraine's air defenses failed to achieve their objective.[89] Warned in advance by US intelligence, the latter managed to conserve most of their strength by moving location shortly before the hostilities began. They were then gradually reinforced thanks to deliveries of more modern systems from spring 2022, including the IRIS-T and MIM-104 Patriot missile systems supplied by Germany and the US, respectively, in October 2022 and April 2023. This strengthened air defense allowed Kyiv to intercept a portion of the Russian missile salvos against its military, energy, and industrial infrastructure. It is worth noting that according to Ukraine's own statements, the interception rate of subsonic weapons delivery systems—UAVs and cruise missiles—remains many times higher than that of supersonic and hypersonic delivery systems, although the latter are not invulnerable. The Russian attacks, combining cruise and ballistic missiles fired from planes and surface ships, intensified during the winter of 2023, particularly against Ukraine's power plants. Recovered missile debris suggests that the weapons were manufactured shortly before use, hinting at a just-in-time consumption model for Russian missiles.[90]

Lacking a sufficient number of high-quality weapons delivery systems, since September 2022, Russian salvos have increasingly included the Iranian Shahed-136 missile, which has a 2,000 km range.[91] Traveling at less than

87. P. Gros and S. Delory, "L'évolution des feux", op. cit.
88. Interviews with civilian and military experts, spring 2024.
89. J.-C. Noël, "Quelle campagne aérienne au-dessus de l'Ukraine? Premiers éléments de réflexion", *Briefing de l'Ifri*, Ifri, March 31, 2022.
90. J. Watling, "In Ukraine, Russia Is Beginning to Compound Advantages", Royal United Services Institute, May 14, 2024, available at: rusi.org.
91. "A Year of the Shahed", *Airwars*, September 8, 2023, available at: airwars.org.

200 km/h and carrying a small warhead, it was procured in large quantities by Moscow before being manufactured in Russia under the name Geran-1 and Geran-2. The unit price was initially presented as 20,000 dollars but could be as much as ten times higher.[92] Launched in large numbers, they can saturate the enemy's air defenses, boosting the chances of more sophisticated missiles reaching their target. These mixed salvos increase the variety of flight profiles in terms of speed, range, and maneuverability, making things more difficult for air defenses. Less powerful and easier to intercept because of its low speed, the Shahed-136 nevertheless poses a real threat, forcing Ukraine to organize specialist units to destroy these missiles, using diverse equipment ranging from the German Gepard armored anti-aircraft gun to multiple machine guns mounted on pickup trucks.[93] The Shahed-136 sits in a problematic gray area in current nomenclature. It is not really comparable with modern cruise missiles because of its inferior specifications, but it is not a loitering munition either, because it lacks a permanent remote-control capability. Meanwhile, its use as a munition means it cannot be considered as a UAV, as the latter are supposed to be able to return to base. As a stopgap, the terms "one-way drone" or "programmable munition" can be used for this new type of system.

The first Patriot battery arrived in April 2023 and proved its worth that June by intercepting a Kinzhal missile.[94] This success allowed Kyiv to counter Russian rhetoric around the superiority of hypersonic weapons, which have been promoted intensely since the mid-2010s. Nevertheless, because a large number of interceptors are needed to intercept these systems, their use increases the attrition of Ukraine's air defense systems, which then lack ammunition to deal with slower systems. The Russian forces do not have a monopoly on the use of inexpensive UAVs; however, Ukraine has had very similar equivalents to the Shahed-136 and Shahed-238 since summer 2022. The Chinese Mugin-5 militarized civilian UAV and the Soviet Tu-141/142 reconnaissance UAV were quickly succeeded by models developed specifically for the conflict.[95]

Not content with simply countering Russian salvos, Ukraine also soon started to use deep strikes. Ukraine's arsenal in 2022 contained a number of systems inherited from the Soviet era, including several hundred Tochka ground-to-ground ballistic missiles, with a range of under 100 km.[96] Although Kyiv has a few domestically developed options like the Neptune anti-ship missile, it lacks significant production capacity in this sector. The arrival of the M270 MLRS and M142 HIMARS multiple rocket launchers in

92. E. Tegler, "$375,000 – The Sticker Price for an Iranian Shahed Drone", *Forbes*, February 7, 2024, available at: forbes.com.
93. Interview with Ukrainian soldiers, July 2024.
94. J. Saballa, "US Confirms Patriot in Ukraine Shot Down Russian Hypersonic Missile", *The Defense Post*, May 12, 2023, available at: www.nytimes.com.
95. H. I. Sutton, "Guide to Ukraine's Long Range Attack Drones", *Covert Shores*, June 23, 2024, available at: www.hisutton.com.
96. "OTR-21 Tochka (SS-21)", *CSIS Missile Threat*, April 23, 2024, available at: missilethreat.csis.org.

summer 2022 shifted the balance of power by giving Ukraine the ability to strike the Russian operational scale, although Ukraine remained unable to carry out strategic strikes despite the delivery of ATACMS missiles at the end of 2023. These cluster munitions, with a range of under 200 km, have turned out to be very effective against a Russian military that has gradually been abandoning armored vehicles in favor of more vulnerable infantry masses. But the density of electronic jamming has revealed the weaknesses of other types of operational strike systems, like the Ground Launched Small Diameter Bomb developed by Saab and Boeing or the JDAM guided air-to-ground bomb, which are too sensitive to jamming to be used effectively.[97] Other shorter-range systems, like the Excalibur precision artillery shell, have also turned out to be vulnerable in this area.

Ukraine's capability gap in national systems with a range of over 100 km has been partially filled by the very rapid development of a series of long-range UAVs. Initial improvised solutions that adapted Soviet systems have been superseded by new types of UAV specifically developed for deep strike missions over 1,000 km from the front line. Several Russian strategic bombers and transport aircraft were destroyed at bases over 1,000 km from the front at the beginning of 2023, some by rudimentary UAVs launched from Ukraine or even from Russian territory.[98] The sheer number of these UAVs, the variety of models and specifications, and the attention paid to these capabilities all testify to the dynamism of this sector in Ukraine. They have been used for interdiction strikes tens or even hundreds of kilometers from the front, but also as part of a strategic campaign against Russia's energy infrastructure, causing significant fluctuations in oil production.[99] Some strikes have been carried out several thousand kilometers from the front, as far away as Tatarstan.[100] Both fragile and indispensable for the Kremlin's war effort, refineries can be damaged by very small warheads that can be mounted on very long-range UAVs. With the front line having hardly changed following the two sides' offensives and counteroffensives in 2023, Ukraine is attempting to bypass the stalemate by attacking the Kremlin's financial resources in order to achieve more impactful results. As in 1916, deep strike is making it possible to escape the tactical deadlock.[101]

Nevertheless, the use of these very long-range "one-way drones" relies on the existence of gaps that can be exploited. They have neither the power nor the maneuverability to inflict significant damage on a hardened or

97. T. Withington, "Jamming JDAM: The Threat to US Munitions from Russian Electronic Warfare", Royal United Services Institute, June 6, 2023, available at: rusi.org.
98. D. Kaminski-Morrow, "Pskov Airport Closed as Drone Attack Apparently Damages Military Il-76s", *Flight Global*, August 30, 2023, available at: www.flightglobal.com.
99. S. Vakulenko, "How Serious Are Ukrainian Drone Attacks for Russia?", Carnegie Endowment for International Peace, April 5, 2024, available at: carnegieendowment.org.
100. L. Gozzi, "Ukraine War: Deepest Ukraine Drone Attack into Russian Territory Injures 12", *BBC*, April 2, 2024, available at: www.bbc.com.
101. J. Hudson, "Ukraine's Attacks on Russian Oil Refineries Deepen Tensions with U.S.", *The Washington Post*, April 15, 2024, available at: www.washingtonpost.com.

defended target. This was confirmed in interviews with experts in Kyiv in summer 2024. A system capable of going beyond the "wall" of 50 km from the front opens up a vulnerable "free zone" where lack of speed or agility is no longer a problem.[102] This is food for thought for European militaries, which have a serious shortfall of the short-range air-defense (SHORAD) systems on which Ukraine relies, although, as Ukrainian improvisations have shown, they are relatively easy to develop.

It is not just strategic and operational deep strikes that are increasingly using UAVs. Lacking traditional artillery munitions, the Ukrainian armed forces can turn to a dynamic civil society that has been interested in UAVs since the beginning of the 2010s. The first few months of 2022 saw the establishment of a number of civilian structures capable of developing, testing, and mass-producing different types of small fighter drones for the armed forces, mostly with a range of between 2 and 15 km. The consumption of small UAVs with a range of around 10 km went from 10,000 per month in 2023 to 100,000 per month in 2024, with an increasingly wide variety of uses.[103]

Medium-range UAVs, from 25 to 50 km, are rarer because they have to operate in a fiercely contested air domain characterized by intense electronic warfare and GPS jamming activities. Ukrainian officials are well aware of this gap, emphasizing the efficacy of the ZALA Lancet loitering munition used extensively by the Russian military. More than 300 Lancet UAVs were launched each month in 2024, particularly for counterbattery missions on valuable systems like the CAESAR.[104] Beyond this formidable "wall" of electronic warfare, which stretches around 50 km from the front line, Russia's air defenses have become much less dense, making it worthwhile to develop drones with a range of over 2,000 km that have sufficient autonomy to navigate and potentially acquire a target without human interaction. The use of AI algorithms for navigation raises the possibility of autonomous swarm formations that could overcome the problem of frequency congestion.

Alongside UAVs, Ukraine also has higher-end systems from older programs. The Hrim-2 missile, also known as Sapsan, is a tactical ballistic missile developed in the mid-2000s to replace the aging Tochka-U. The rather chaotic development program, which was halted and resumed several times, received financial support from Saudi Arabia. The system's maximum range remains unknown but could be over 500 km. It seems to have been used at least once in 2023 and represents an opportunity for Ukraine to deploy a genuinely national missile without the political restrictions imposed by its partners on the equipment they transfer. It is very difficult to establish a reliable list of representative weapons delivery systems on the Ukrainian side. Other than Western systems like SCALP or ATACMS, locally developed systems are often produced in small quantities and tend to have very short

102. Interview with Ukrainian experts and soldiers in Kyiv, July 2024.
103. Ibid.
104. Ibid.

life cycles, reflecting the constant evolution of Ukraine's needs as well as the country's difficulties with scaling up.

The conflict in Ukraine is also instructive when it comes to traditional missiles. Subsonic cruise missiles are vulnerable to an abundant air defense ecosystem that requires a greater number of weapons delivery systems or more carefully planned strikes. Several Russian missiles have been downed by Gepard anti-aircraft guns, which were designed to counter other types of targets, like helicopters. In these conditions, even a minor mission relying on such systems requires meticulous and time-consuming preparation, increasing the chance that the target will move or become less valuable. As for ballistic missiles capable of maneuvering in the terminal approach phase, although not invulnerable, they are difficult to intercept, often at the cost of a high number of interceptors.[105]

Future capabilities for Europe

Faced with the prospect of a high-intensity conflict, especially without full US support, few European nations have deep strike assets that can be used without first gaining air superiority. The UK, France—French Air and Space Force and French Navy—, Italy, and Greece have SCALP/Storm Shadow air-to-ground missiles developed by MBDA, which can be launched from *Rafale* or *Eurofighter* fighter-bombers and can hit targets over 500 km away.[106] Paris and London have transferred an indeterminate number to the Ukrainian armed forces. Germany and Spain, meanwhile, have the Taurus missile, which has similar specifications. It was developed jointly by MBDA Deutschland and Saab and can be launched from German *Eurofighters* and Spanish F/A-18s. The US Air Force's assets in this sector include the AGM-158 JASSM, the improved version of which can reach almost 1,000 km. Usable on most US fighter-bombers, it can also be launched from the B-2 Spirit stealth bomber, which is designed to be able to infiltrate a contested airspace without being detected.[107] Germany, Poland, Finland, and the Netherlands are already using or are soon to use the JASSM to arm their own F-35 fleets.[108] Eventually, the whole F-35 community should be able to use these weapons.

European nations also have sea-to-ground deep strike capabilities. The Royal Navy has been using the American Tomahawk missile since the mid-1990s and is set to be joined by the Netherlands by 2024.[109] Since 2015, the

105. Interview with military and industrial specialists, fall 2024.
106. CSIS Missile Defense Project, "SCALP EG/Storm Shadow/SCALP Naval/Black Shaheen/APACHE AP", *CSIS Missile Threat*, December 2, 2016, available at: missilethreat.csis.org.
107. "Northrop Grumman Continues B-2 Spirit Modernization", Northrop Grumman, August 25, 2022, available at: news.northropgrumman.com.
108. B. Rosenberg, "The State of European Security Is About Procurement, Interoperability, and Air and Missile Defense", *Breaking Defense*, September 13, 2023, available at: breakingdefense.com.
109. M. Eckstein, "Dutch Navy Improves Radar, Adds Tomahawk Missile to Fleet", *Defense News*, September 13, 2023, available at: www.defensenews.com.

French Navy's multi-purpose frigates (FREMM) have been able to launch naval cruise missiles (MdCN), which are also equipped on the new *Suffren* class of nuclear-powered attack submarines and on the future French and Greek *Frégate de Défense et d'Intervention* (FDI, defense and intervention frigate).[110] Initially presented as an evolution of the SCALP, the MdCN has certain components in common with it but is fairly different in terms of capabilities and internal structure.

These capabilities are complemented by long-standing ground-to-ground systems. France, Finland, Germany, Italy, Norway, Turkey, Greece, and the UK have the American M270 MLRS tracked rocket launcher, around 15 of which have been transferred to Ukraine. Initially conceived as saturation weapons, some M270 units have been modernized to comply with the international convention on cluster munitions and become long-range precision weapons. They use "combined" rockets, like the M31 used in the French LRU, which can reach up to 70 km. The Hellenic Armed Forces also have an ATACMS tactical ballistic missile developed by the US in the 1980s to strike targets up to 300 km away. Romania has a wheeled, modernized, lightweight version of the M270, the M142 HIMARS, which Poland also ordered in 2019.[111] As well as its dozen M270 units, Turkey has around a hundred TRG-300 systems, a national model with a range of 120 km, and is also developing ballistic missiles that could have a range of over 1,000 km.

Other than the latter, European national military inventories only contain limited numbers of most of these systems and their munitions, with levels of availability and modernization differing greatly.[112] With deep strike missions left to air forces, they have been used very rarely since their procurement.[113] Now that the war in Ukraine has demonstrated their usefulness in a conventional conflict without air superiority, however, numerous European countries have announced the purchase of new systems from non-European suppliers. In 2023, Spain, Germany, and the Netherlands respectively signed deals to procure 16, 5, and 20 Israeli PULS rocket launchers, which can use a wide variety of munitions up to 300 km in range. In 2022, Poland opted for the South Korean K239 Chunmoo, placing a record order that could eventually reach 288 units.[114] Poland's decision was influenced by the promise of rapid delivery, with the first vehicles delivered less than a year later. Meanwhile, Estonia, Latvia, and Lithuania acquired long-range strike capabilities for the first time, with the respective

110. L. Lagneau, "La Marine confirme son intention d'armer ses frégates de défense et d'intervention avec des missiles de croisière", *Opex360-Zone militaire*, November 22, 2020, available at: www.opex360.com.
111. J. Adamowski, "Poland to Sign $414 Million Deal for Rocket Launchers", *Defense News*, February 11, 2019, available at: www.defensenews.com.
112. L. Petersen and J. Groeneveld, "Software-Probleme, Ärger mit Griechenland, lange Lieferzeiten: Wie schwierig es um die versprochenen schweren Waffen aus Deutschland steht", *Business Insider*, June 13, 2022, available at: www.businessinsider.de.
113. Interview with French and European officers, fall 2023.
114. L. Lagneau, "La Pologne va acquérir 300 lance-roquettes multiples K239 'Chunmoo' auprès du sud-coréen Hanwha", *Opex360-Zone militaire*, October 17, 2022, available at: www.opex360.com.

procurement of 6, 6, and 8 M142 HIMARS from the US, a system that Italy also seems to be interested in.[115] The fact that the Baltic states, which have very limited military potential, have decided to procure deep strike capabilities is a clear signal that this long-neglected sector is once more attracting attention.

Table 5: Principal deep strike systems in Europe

Name	Type	Countries using it	Theoretical maximum range
M270	Rocket launcher	France, Germany, Finland, Greece, Italy, Norway, Turkey, United Kingdom	80–300 km (ATACMS)
M142 HIMARS	Rocket launcher	Romania, Poland	80–300 km (ATACMS)
EURO-PULS	Rocket launcher	Netherlands, Denmark, Germany, Spain	40–300 km
K239 Chunmoo	Rocket launcher	Poland	40–200 km
TRG-300 Kasırga	Rocket launcher	Turkey	20–120 km
SCALP/Storm Shadow	Air-to-ground cruise missile	France, Italy, Greece, United Kingdom	Over 250 km
SOM	Air-to-ground cruise missile	Turkey	Over 250 km
Taurus	Air-to-ground cruise missile	Germany, Spain	Over 500 km
AGM-158 JASSM	Air-to-ground cruise missile	Poland, Finland	Over 900 km
MdCN	Sea-to-ground cruise missile	France, Greece	1,000 km
Tomahawk	Sea-to-ground cruise missile	United Kingdom, Netherlands	Over 1,000 km

Source: CSIS Missile Defense Project, manufacturers' websites.

Finally, the US forces deployed on European soil with NATO or under bilateral agreements are also turning their attention back to ground-to-ground strikes: the 56th Artillery Command, which was in charge of Pershing missiles during the Cold War, has been reactivated in the form of the US Army's 2nd Multi-Domain Task Force (MDTF),[116] on the same model as the 3rd MDTF already deployed in the Pacific (see above). At the NATO summit in Washington in July 2024, the US and Germany explained how the 2nd MDTF would be structured. Its headquarters is based in US territory but with a permanent structure in Wiesbaden. Episodic deployments of Tomahawk missiles (in ground-to-ground configuration), SM-6 missiles, and hypersonic weapons (probably the LRHW project once it has been certified)

115. "Italy to Join Global HIMARS Family", *Defence Connect*, December 19, 2023, available at: www.defenceconnect.com.
116. Description of the 2nd Multi-Domain Task Force (MDTF), available at www.56ac.army.mil.

are planned from 2026.[117] This announcement provoked heated debate in Germany, with some analysts describing the deployments as a "new Euromissiles crisis" that could lead to escalation with Russia and a new arms race in the post-INF context.[118] As discussed above, however, Russia already has similar systems, which is precisely what prompted the end of the treaty; other researchers, therefore, see the US deployment as strengthening NATO's deterrence posture[119] and suggest extending it to other countries.[120]

Reinventing defense

In parallel, another Cold War debate has resurfaced. Mastering deep strikes does not just mean being able to perform them but also protecting against them. Again, the lessons of the conflict in Ukraine have raised concerns about the situation in Europe, both in terms of detection and interception. In the first few days of the conflict, a ten-ton Ukrainian UAV crashed in Zagreb, Croatia, after having mistakenly crossed half of Europe without being destroyed, despite its detection.[121]

Already cooperating on air and (cruise) missile defense since the beginning of the 2000s through NATO's Integrated Air & Missile Defense (IAMD), NATO members are now seeking to strengthen the joint Ballistic Missile Defense (BMD) system. The latter is officially directed against middle powers likely to procure or develop intermediate-range missiles that could strike European territory, particularly Iran, its proxies in the Middle East, and the countries of the Maghreb. To that end, US Aegis Ashore systems are deployed in Poland and Romania, while Spanish frigates are equipped with the sea-based Aegis system. The BMD system relies essentially on US detection and interception capabilities provided by the European Phased Adaptive Approach (EPAA) program announced by Barack Obama in 2009, which was met with strong opposition from Russia.[122] The integration of European assets remains a long-term objective requiring more effective and faster information sharing.[123]

117. G. Powis, "Trois systèmes lance-missiles longue portée américains prochainement déployés en Allemagne", *Air & Cosmos*, July 17, 2024, available at: air-cosmos.com.
118. A. Graef, T. Thies, and L. Mengelkamp, "Alles nur Routine?", *IPG*, July 16, 2024, available at: www.ipg-journal.de.
119. J. Schneider and T. Arnold, "Gewichtig und richtig: weitreichende US-Mittelstreckenwaffen in Deutschland", *SWP*, July 18, 2024, available at: www.swp-berlin.org.
120. A. Kacprzyk, "Zapowiedź rozmieszczenia amerykańskich pocisków średniego zasięgu w Niemczech", *PISM*, July 18, 2024, available at: pism.pl.
121. R. Loss and A. Mehrer, "Striking Absence: Europe's Missile Gap and How to Close it", European Council on Foreign Relations, November 21, 2023, available at: ecfr.eu.
122. S. Delory, "Perception russe de l'EPAA", *Note de l'Observatoire de la défense antimissile*, FRS, February 2015.
123. S. Girardeau, "La défense antimissile balistique de l'Otan, une réalité en devenir", *Revue Défense Nationale*, Vol. 776, No. 1, 2015, pp. 30–33.

Moreover, given NATO's potential vulnerability to Russian missiles and motivated by industrial and economic considerations, in October 2022, Germany launched the European Sky Shield Initiative (ESSI), which now numbers around 20 European states. It aims to establish a multi-layered defense based on the German IRIS-T system (medium range), the US Patriot system (long range), and the Israeli Arrow 3 system (very long range).[124] Berlin's stated goal is to possess a system of systems that will be operational by the end of the 2020s. A joint production line between Raytheon, the designer of the Patriot, and MBDA Germany is also planned to meet increased European demand.[125]

However, this approach has been criticized for two reasons by certain European countries, including France and Italy. As well as not being European, the Israeli-US Arrow 3 system is apparently unsuitable for intercepting Russian ballistic missiles because the flight trajectory of Iskander missiles or other projectiles would be too low.[126] The ESSI also implies an evolution in NATO's posture, which would henceforth assume the objective of intercepting Russian conventional ballistic missiles, with inadequate evaluation of medium-term strategic consequences. Paris is thus calling for a rebalancing of offensive and defensive capabilities and of the mix between nuclear deterrence, deep strikes, and missile defense rather than opting solely for a potentially ineffective defense posture.[127]

Besides missile defense, the situation in Europe is also concerning from the perspective of UAV defense. Designed to deal with high-spectrum threats, European air defense systems and their missiles are both too few in number and too expensive to deal with cheap targets that can be deployed in large numbers and sometimes operate outside monitored spectra. Developed during the Cold War to protect forces from the threat of attack helicopters and ground-attack aircraft, anti-aircraft artillery (AAA) has turned out to be a valuable complement to ground-to-air missile systems in Ukraine. Although few militaries retained this capability after the Cold War, Romania still has around 40 German-origin Gepard anti-aircraft systems.[128] The Gepard entered service in 1974 and consists of a Leopard I tank hull with a turret containing a detection and targeting radar unit and a pair of 35 mm anti-aircraft guns. More than 70 Gepard units have been bought and delivered to the Ukrainian armed forces, which appreciate their versatility and their ability to provide effective close-in protection against UAVs and

124. S. Arnold and T. Arnold, "Germany's Fragile Leadership Role in European Air Defence", *SWP Comment*, No. 6, Stiftung Wissenschaft und Politik, February 2, 2023, available at: www.swp-berlin.org.
125. G. Powis, "Giga-contrat pour MBDA et Raytheon: Jusqu'à 1000 missiles *Patriot* à produire en Allemagne", *Air & Cosmos*, January 8, 2024, available at: air-cosmos.com.
126. Interview with defense manufacturers, September 2024.
127. S. Arnold and H. Fayet, "Entre ambitions industrielles et contribution à l'OTAN, les défis de la European Sky Shield Initiative", *Notes de l'Ifri*, Ifri, October 2024.
128. J. Palowski, "Gepard Anti-Aircraft Systems Deployed to Poland", *Defense24*, October 28, 2020, available at: defence24.com.

missiles.[129] These systems, while not overly complex, are likely to develop in the coming years, with most industrial actors in the sector taking a close interest in them. Several militaries are seeking to regain or reconsolidate close-in air defense capabilities, including France, with specialized turret development programs underway, or Germany, with the MANTIS and Skyranger systems.[130] Faced with the proliferation of threats from UAVs, the aim is to protect combat forces with mobile systems as well as to defend command posts. Counter rocket, artillery, and mortar (C-RAM) systems must be developed to confront the democratization of access to long-range unmanned systems.

As well as drawing Europe's attention to conventional deep strikes, the war in Ukraine has also brought about an evolution of attitudes toward certain landmark post-Cold War treaties. The signing of the Oslo Convention on Cluster Munitions in 2008 led to the rapid elimination of all cluster munitions in Western Europe. This regulatory initiative was motivated by the observation that an unacceptably high proportion of cluster munitions do not explode immediately but remain dangerous, creating a long-term humanitarian risk for civilian populations.[131] The M26 cluster rockets for the MLRS were thus dismantled in favor of more precise, long-range rockets.

The Middle East: Long-range escalation

The Middle East, characterized by a different type of conflict, less sophisticated defense industries, and shorter distances, does not pose the same challenges for the great powers as Asia or Europe. Nevertheless, the upheavals in the region since October 2023 and the waning of inhibitions around the use of force are making it necessary to rethink the use of deep strikes, or more specifically long-range strikes in this case. Iran is an emblematic example of a middle power that has gained these capabilities and disseminated them to its proxies, such as the Houthis or Hezbollah, causing problems for the missile defenses of targeted countries (Israel and the Gulf states).

Other states in the region with a defense budget that can stretch to legal procurements from abroad, particularly from China[132] or the US,[133] or that have a dynamic domestic defense industry (Saudi Arabia, United Arab Emirates, Egypt), are also continuing to develop their long-range strike capabilities, with an emphasis on aviation and, to a lesser extent, ground-to-

129. Interview with Ukrainian soldiers, summer 2024.
130. L. Lagneau, "Lutte antidrone: Le Véhicule de l'avant blindé ARLAD 'fait son entrée' dans les rangs de l'armée de Terre", *Opex360-Zone militaire*, April 14, 2024; L. Höller, "Germany Buys Rheinmetall's Skyranger to Reinstate Mobile Air Defenses", *Defense News*, February 28, 2024, available at: www.defensenews.com.
131. Text of the 2008 Oslo Convention, United Nations.
132. J. Masterson, "Saudi Arabia Said to Produce Ballistic Missiles", *Arms Control Today*, January 2022, available at: www.armscontrol.org.
133. "US Approves $1.2 Billion Sale of GMLRS Rockets and ATACMS Missiles to UAE", *Global Defense News*, October 13, 2024, available at: armyrecognition.com.

ground systems. This development of long-range strikes ultimately raises questions about the security of French and Western bases in the area.

Iran: The great destabilizer?

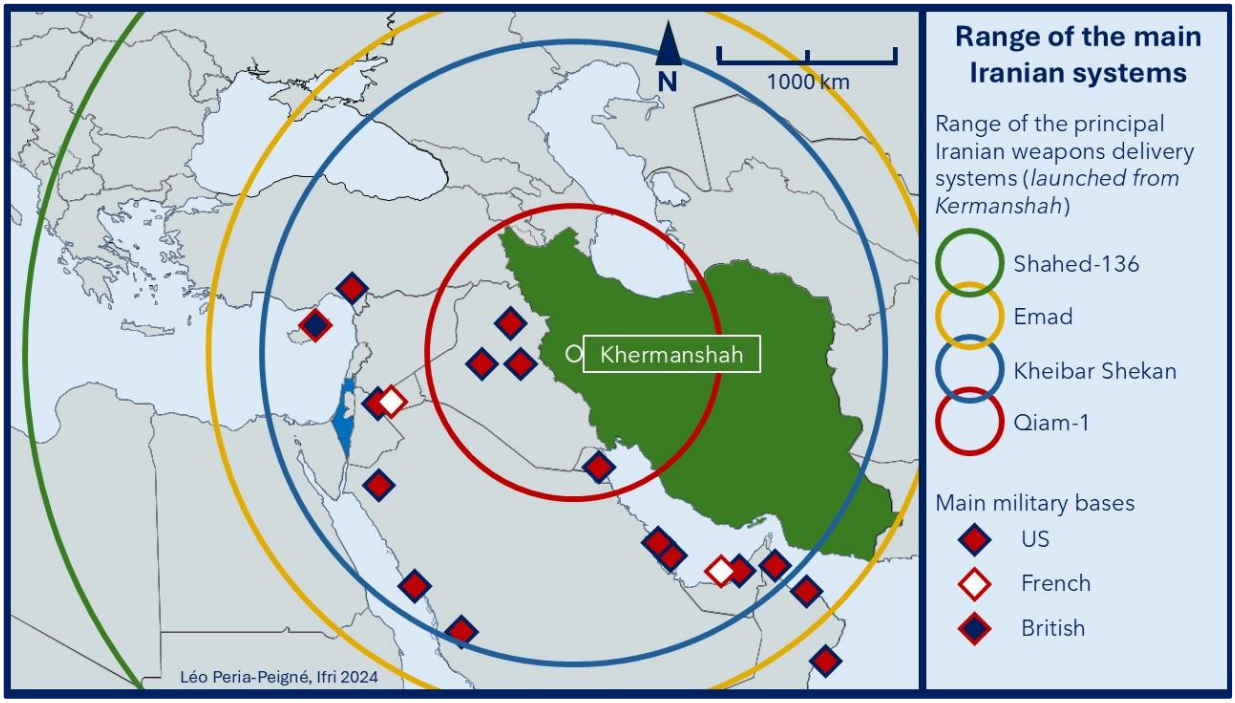
Since the destruction of Iraq's stocks of ballistic missiles by the US armed forces after 2003 and the civil war in Syria, which drained the Damascus regime's missile reserves, Iran has positioned itself as a leader in the long-range strike sector.[134] It has a diversified arsenal of short-, medium-, and long-range ballistic missiles, cruise missiles, and UAVs that can perform deep strike missions. This diversity makes up for an ineffective and aging air force that has been impacted by embargos and sanctions.[135]

Iranian doctrine emphasizes the strategic effects of strikes (show of force, economy of means), integrating them into a broader strategy of "mosaic defense" that aims to construct a buffer zone around Iranian territory.[136] The development of a ballistic arsenal in Iran must also be understood in relation to Tehran's nuclear ambitions. Although no signs of the weaponization of its nuclear program have been observed since 2003, the accumulation of uranium enriched to 60% is not compatible with civilian nuclear activities and is causing concern in the international community. If Iran were to take the decision to cross the nuclear threshold and weaponize the program, its substantial arsenal of ballistic and cruise missiles would speed up the process of developing a nuclear weapon.[137]

This potential dual use for Iranian missiles and the threat they pose to neighboring countries prompted the reference to its ballistic program in United Nations Security Council Resolution 2231. Annex B of the resolution called upon Iran not to develop ballistic and cruise missiles that could be used to deliver nuclear weapons and prohibited any export or import of components to that end. Nevertheless, the expiration of this resolution in October 2023 lifted restrictions on the Iranian ballistic program.[138] Although it never really prevented the program's modernization, its expiration facilitates the dissemination of Iranian technologies abroad, particularly to support Russia in the Ukrainian theater (see above).

134. H. Fayet, "Les proliférations balistique et nucléaire, les deux faces d'une même pièce?", *Moyen-Orient*, No. 59, July-September 2023.
135. "The Deadly Missile Race in the Middle East", *The Economist*, November 7, 2023, available at: www.economist.com.
136. M. Eisenstadt, "Iran's Gray Zone Strategy: Cornerstone of its Asymmetric Way of War", Washington Institute for Near East Policy, March 19, 2021, available at: www.washingtoninstitute.org.
137. H. Fayet, "L'impasse nucléaire iranienne: La non-prolifération au défi de crises multiples", *Briefings de l'Ifri*, Ifri, May 26, 2023.
138. J. Hansler, "US Unveils New Sanctions on Iran's Missile and Drone Programs as UN Restrictions Expire", *CNN*, October 2023, available at: edition.cnn.com.

Map 3: Range of the principal Iranian systems in the Middle East



Source: Ifri, based on data from the CSIS Missile Defense Project, the Federation of American Scientists, and the Begin-Sadat Center for Strategic Studies.

As for other maps, not all Iranian weapons delivery systems are represented, and not all can be launched from the Kermanshah base.

Iran had already demonstrated its ability to carry out long-range strikes in January 2020, when the Pasdaran air force fired more than a dozen missiles at Western bases in Iraq in response to the elimination by the US of General Qasem Soleimani, commander of the Quds Force of the Revolutionary Guards. According to some analysts,[139] the high accuracy of the missiles (circular error probable of less than 10 meters) and Iran's knowledge of the bases' layouts allowed it to target buildings that were unoccupied at the time of the strikes. This precaution, intended to avoid uncontrolled escalation with the US, was accompanied by warnings sent to the Iraqi government that allowed Western soldiers to take appropriate protection measures.[140]

139. S. Delory, A. Levallois, and V. Tourret, "Opération iranienne contre les bases d'el-Asad et d'Erbil: Qu'enseigne l'imagerie?", *Images stratégiques*, No. 1, FRS, 2020, available at: www.frstrategie.org.
140. Interviews with analysts at the French Ministry of Armed Forces, September 2023.

Table 4: Principal Iranian deep strike systems

Name	Type	Range
Fateh-110	Short-range ground-to-ground ballistic missile	300 km
Shahab-1	Short-range ground-to-ground ballistic missile	350 km
Shahab-2	Short-range ground-to-ground ballistic missile	750 km
Zolfiqar	Short-range ground-to-ground ballistic missile	750 km
Qiam-1	Short-range ground-to-ground ballistic missile	750 km
Khorramshahr	Medium-range ground-to-ground ballistic missile (with MIRV capability)	2,000 km
Fattah-2	Medium-range ground-to-ground ballistic missile with maneuverable warhead	1,500 km
Shahab-3	Medium-range ground-to-ground ballistic missile	1,200–2,000 km
Emad	Medium-range ground-to-ground ballistic missile	2,000 km
Ghadr-110	Medium-range ground-to-ground ballistic missile	2,000–3,000 km
Shahed-136	Loitering munition	Over 1,700 km
Shahed-238	Turbojet-powered loitering munition	Around 1,000 km
Paveh	Ground-to-ground cruise missile	1,600 km

Source: CSIS Missile Defense Project; Federation of American Scientists; The Begin-Sadat Center for Strategic Studies; interviews with defense manufacturers and analysts at the French Ministry of Armed Forces.

Nevertheless, the increasing power of Iran's long-range strike arsenal became clear in April and again in October 2024 in the context of tension between Iran and Israel.[141] Following an Israeli strike on the Iranian consulate in Damascus, Tehran launched a large attack directly at Israeli territory during the night of April 13 to 14. As in January 2020, Iran had prewarned those principally affected that a response was imminent. Consisting of over 300 projectiles (UAVs, cruise missiles, and ballistic missiles) to enable saturation, the mixed salvo was largely intercepted by

141. E. van Veen and H. Azizi, "Playing with Fire: Patterns of Iranian-Israeli Military Confrontation", *War on the Rocks*, June 25, 2024, available at: warontherocks.com.

Israel's missile and air defenses (principally the David's Sling and Arrow systems), as well as by US systems and the intervention of US, French, and British fighters present in Jordan, which were responding to the violation of Jordanian airspace by the UAVs and cruise missiles.[142] Some ballistic missiles did hit their presumed target, however, prompting debate around how well Israel's defenses would perform in less favorable circumstances.[143]

These doubts were confirmed on October 1, 2024, which saw the second direct Iranian attack on Israel, this time in retaliation for a series of targeted assassinations of leading figures in the Axis of Resistance, including Ismail Haniyeh in Tehran in July and Hassan Nasrallah in Beirut in September. With less prior warning and a salvo composed exclusively of the most penetrating ballistic missiles, including the Fattah model with a maneuverable warhead, Iran created problems for Israel's missile defense and achieved direct hits on strategic sites, primarily Nevatim Airbase. Nevertheless, the strong performance of the Arrow system and the ability to prioritize which projectiles to destroy on the basis of estimated impact points allowed Israel to limit damage in civilian areas.[144]

In response to this Iranian threat, Israeli missile defenses were reinforced with the deployment of a THAAD battery and its personnel (around 100 US soldiers), suggesting that stocks of anti-missile Patriot and Arrow missiles were running low.[145] Israel also has its own deep strike assets, particularly thanks to its modern air force—the fruit of its relationship with the US—and a defense industry that prolifically produces cruise missiles, ballistic missiles, UAVs, and guided bombs.[146]

Israel's response to Iran's attack in April, a precise strike on a ground-to-air defense system on Iranian soil, near the Natanz nuclear complex, seems to have been carried out from Syrian airspace using a Blue Sparrow air-launched ballistic missile fired from an F-15 or F-16, confirming Iran's vulnerability.[147] A similar operational approach seems to have been used for Israel's response at the end of October, which was on a much larger scale and was openly claimed by Israel. Around a hundred aircraft were mobilized to destroy strategic military sites in Iran, including anti-missile radars and factories essential to the production of ballistic missiles.[148]

142. B. Carter and F. W. Kagan, "Iran's Attempt to Hit Israel with a Russian-style Strike Package Failed… for Now", Institute for the Study of War, April 14, 2024, available at: understandingwar.org.
143. S. Vakil and B. Y. Saab, "Iran's Attack on Israel Was Not the Failure Many Claim But It Has Ended Israel's Isolation", Chatham House, April 16, 2024, available at: www.chathamhouse.org.
144. F. Hoffmann, "Missiles in the Air, Tensions Everywhere: What We Can Learn From Iran's Missile Attack", *Missile Matters*, October 6, 2024, available at: missilematters.substack.com.
145. M. Olay, "Austin Deploys Missile Battery, Personnel to Israel", *DOD News*, October 15, 2024, available at: www.defense.gov.
146. "Missiles of Israel", *CSIS Missile Threat*, August 10, 2021, available at: missilethreat.csis.org.
147. J. P. Rathbone and N. Zilber, "Military Briefing: The Israeli Missiles Used to Strike Iran", *The Financial Times*, April 19, 2024, available at: www.ft.com.
148. D. Cenciotti, "Israel Strikes Iran: Complete Debriefing", *The Aviationist*, October 26, 2024, available at: www.theaviationist.com.

Uncontrolled proliferation?

As well as using its ballistic capabilities and UAVs to protect its territory and for strategic strikes on its enemies, Iran also exports them to its proxies in the region (Hezbollah in Lebanon, Hamas, certain Iraqi Shiite militias, the Houthis, etc.). Although these exports are limited to the short-range segment (under 250 km for the Fateh-110) to avoid technology leakage, they have significant destabilizing potential because they give these non-state groups a technological base on which to build, with improvements seen particularly in terms of range. The Houthi Palestine 2 missile may be derived from the Iranian Fattah missile, with a range of over 1,600 km.

While these concerns have been brought to the forefront of the regional scene by Houthi strikes on merchant ships since November 2023 in the name of support for the Palestinian cause, as well as rockets and missiles launched by Hezbollah and Hamas, they date back to before the current crisis. The strategic effects of deep strikes in the Middle East by Iran's proxies were made clear by the strikes on Saudi oil facilities in Abqaiq in September 2019[149] and by the attack on the Emirati capital, Abu Dhabi, in January 2022, which used ballistic and cruise missiles and UAVs.[150] The latter prompted the UAE to activate the defense agreement it has had with France since 2009, leading to the intensification of patrols by *Rafale* based in the UAE and to the deployment of additional Crotale NG ground-to-air systems. This support, coupled with excellent radar coverage of Emirati territory, likely contributed to the interception of more UAVs in the following days.[151]

Finally, the use of targeted strikes has increased massively since Hamas's attack on Israel in October 2023. While Hamas's barrage of rockets remains a manageable threat to Israeli missile defenses, Hezbollah's arsenal is more worrying, which explains the intensive air-ground campaign Israel is currently conducting in Southern Lebanon. Although its capacity to cause harm has been greatly reduced due to the continued targeting of its leaders and the destruction of its weapons caches, the group still has several tens of thousands of rockets and missiles, hundreds of which could hit anywhere in Israel, which is just 470 km long on the north-south axis.[152] The escalation risk of a massive strike with a significant number of deaths on a sensitive site in the north or center of the country is preventing displaced people from returning home, exacerbating pressure on the social system. Similarly, the IDF's air and artillery campaign in Southern Lebanon, which began in the fall of 2023 but has intensified considerably since the summer of 2024,

149. S. G. Jones et al., "The Iranian and Houthi War against Saudi Arabia", Center for Strategic and International Studies (CSIS), December 21, 2021, available at: www.csis.org.
150. S. Kaushal, "Lessons from the Houthi Missile Attacks on the UAE", Royal United Services Institute, February 3, 2022, available at: rusi.org.
151. A. Jubelin, "Interception de missiles houthis en rafale", *Dans le viseur*, No. 63, Podcast Le Collimateur, March 22, 2024, available at: lerubicon.org.
152. "Missiles and Rockets of Hezbollah", *CSIS Missile Threat*, August 10, 2021, available at: missilethreat.csis.org.

is causing heavy damage on a daily basis among the Lebanese civilian population, which has close links with Hezbollah.[153]

The Houthis have also demonstrated unprecedented strike capabilities, officially in support of the Palestinian cause. As well as UAVs and cruise missiles, at least four medium-range ballistic missiles have been fired from Yemen at Israel since November 2023, two of which were intercepted by the Israeli Arrow 3 ballistic missile defense system, marking the first exoatmospheric interception of a ballistic missile in real conditions. They also allegedly carried out a long-range UAV strike on an apartment complex in Tel Aviv in July 2024.[154] The Yemeni rebels have also fired more than 10 short-range (under 200 km) anti-ship ballistic missiles and tens of UAVs at merchant and military ships in the Red Sea. Although the majority caused no damage, either because they missed their target (inaccuracy) or because they were intercepted in flight, at least one damaged merchant ship was sunk.[155]

In contrast to the situation in the South China Sea, where Chinese anti-ship assets are directed primarily at military projection capabilities in the region, the Houthi strategy is focused more on disrupting global trade, increasing the group's visibility on the international scene even though its capacity to cause harm far exceeds its real power. Far from making Yemeni territory safer, these activities prompted the US and the UK to carry out targeted air strikes on missile launch sites and depots, although they have not managed to permanently neutralize the group's potential for harm. Attacks on maritime traffic in the Red Sea are continuing, with major economic consequences.[156] In parallel, the European Union is engaged in Operation Aspides, which aims to escort merchant ships and protect them against Houthi strikes.[157]

This proliferation of ballistic and cruise missiles and UAVs in the Middle East raises the question of the air and missile defense of Western interests in the region. The debate around equipping frigates and other destroyers with anti-missile and anti-UAV assets has been reignited. The French Navy justified using a one-million-euro Aster-30 missile to destroy a much less expensive Houthi UAV threatening a French frigate on the basis of the value of the crew and the vessel it was defending.[158] But missile stocks are finite, and production is slow. Recent adaptations to enable underway

153. A. Taher and A. El Kerdi, "Hezbollah to Hit New Areas in Israel If Civilians Targeted, Nasrallah Says", Reuters, July 17, 2024, available at: www.reuters.com.
154. A. Bentov and S. Metz, "Drone Strike by Yemen's Houthi Rebels Kills 1 Person and Wounds at Least 10 in Tel Aviv", *AP News*, July 19, 2024, available at: apnews.com.
155. M. Knights, "Assessing the Houthi War Effort Since October 2023", *CTC Sentinel*, Vol. 17, No. 4, April 2024.
156. A. Delivorias, "Recent Threats in the Red Sea: Economic Impact on the Region and on the EU", PE 760.390, European Parliamentary Research Service, March 2024.
157. "Opération Aspides: Péril en mer Rouge", Ministère des Armées, November 3, 2024, available at: www.defense.gouv.fr.
158. G. Poncet, "Faut-il encore tirer des missiles à 1 million d'euros contre des drones à 20 000 dollars?", *Le Point*, March 18, 2024, available at: www.lepoint.fr.

replenishment of frigates[159] and the *Charles de Gaulle* aircraft carrier[160] will partially make up for this deficit.

The same question applies to land bases. The Houthi attacks in January 2022 highlighted the UAE's vulnerability, forcing France to strengthen the protection of its holdings in the country. Less exposed to quasi-state threats, France's forward air base (BAP H5) in Jordan is also defended against short- and medium-range strikes (intermittent presence of a SAMP/T system). France's regional partners are showing increasing interest in defense systems, but also in long-range strike capabilities for deterrence purposes. Other than Iran, other countries are also deploying protection systems to create defense bubbles. The Russian A2/AD strategy around the Syrian regime's sensitive sites, such as the Khmeimim Air Base and the port of Tartus, is a perfect illustration of the attack/defense dialectic of deep strikes in the Middle East.

159. L. Lagneau, "Pour la première fois, le bâtiment ravitailleur 'Jacques Chevallier' a livré un missile Aster à une frégate", *Opex360-Zone militaire*, June 27, 2024, available at: www.opex360.com.
160. L. Lagneau, "Pour la première fois, le porte-avions *Charles de Gaulle* a reçu un missile Aster lors d'un ravitaillement en mer", *Opex360-Zone militaire*, May 14, 2024, available at: www.opex360.com.

The future of deep strike capabilities

The early 2020s have seen a proliferation of deep strike capabilities, which have become more accessible thanks to the development of sophisticated ISR capabilities on the civilian market and inexpensive weapons delivery systems with ranges of over 1,000 km. Although they do not have the penetration or destruction capability of a cruise or ballistic missile, these systems can be used to carry out strikes at great distances for a lower price, while also enabling a combination of strikes that can increase the penetration capability of more powerful systems. Simultaneously, the maturation of new technologies is fueling the development of increasingly high-performance delivery systems in terms of speed, maneuverability, range, or detectability. The associated costs are also increasing rapidly. In response to this trend of more numerous or effective offensive assets, defensive systems must also adapt to deal with different threats. With the military programming law (LPM) for 2024–2030 announcing a major reinvestment in France's defense apparatus, these trends must be taken into account to diversify strike capacities and invest in the means to protect against them.

Toward a new type of saturation strike?

The development of sophisticated weapons delivery systems that can hit protected and hardened targets is taking place alongside that of less sophisticated but cheaper delivery systems that can attack vulnerable gaps. Far from being incompatible or in competition, these two trends combine to enable a new approach to deep strike, with a small number of high-penetration systems used alongside large numbers of more rudimentary saturating systems.

Speed and maneuverability

Increasing speed and maneuverability seems to be the most effective response, although not the simplest, especially because it helps to optimize targeting efficiency, with a shorter flight time reducing the chances that the target will have moved between target acquisition and the arrival of the missile. The feedback from Ukraine shows a clear correlation between a system's speed and agility and its interception rate. The next generation of French naval cruise missiles[161] will have to reach higher speeds than their

161. S. J. Freedberg Jr., "Winning the Missile Wars: Army & Navy Tech in HASC NDAA", *Breaking Defense*, April 2016, available at: breakingdefense.com.

subsonic predecessors.[162] France is thus attempting to develop a faster missile to increase its penetration capability through the Future Cruise/Anti-Ship Weapon (FC/ASW) program, which will also have enhanced targeting, jamming resistance, and connection capabilities.[163] The UK, which is partnering with France on the program, is also trying to maximize the stealth of the future weapon by modifying its form and materials to reduce its radar surface, rather than simply increasing its speed. By delaying detection for as long as possible, a stealth missile can lower its risk of being intercepted in other ways. The ultimate goal for both partners is to have access to a wider array of options so that responses can be adapted to the different situations that call for this type of weapons delivery system.

At the top of the range are hypersonic weapons that combine a speed five times greater than the speed of sound with high maneuverability, including in the terminal approach phase. Together, these features considerably increase their penetration capability. The Russian Zircon missile seems to be operational, while the US is investing heavily in its ground-to-ground hypersonic cruise missile, the Long-Range Hypersonic Weapon (LRHW), and in hypersonic glide vehicles. In France, research is also progressing on these two types of weapon in the form of the ASN4G, a future hypersonic cruise missile being developed for deterrence purposes, and the demonstrator of the V-MAX hypersonic glide vehicle, officially for conventional strikes.[164] Due to the current high cost of these technologies, hypersonic glide vehicles, even conventional ones, are likely to remain rare and reserved for strategically valuable targets.[165]

Another promising area for improvement is AI-enabled collaboration between weapons delivery systems, whether equipped on-board the system itself or integrated into the targeting process. More intelligent systems could be used in collaborative swarms comprising multiple munitions[166] that can recalibrate themselves in flight in line with target priorities: If a missile destined for an important target is downed, another one will reroute to fill the gap, even if it means abandoning a secondary objective, all without human intervention. AI can also be used to optimize target selection, collateral damage estimation, and effector choice, as the IDF seems to be doing in its offensive in Gaza.[167] Finally, it can be useful in missile defense, where a shorter decision loop is needed when engaging target projectiles to be destroyed in order to counter the increasing speed and stealth of missiles.

162. Interviews with arms manufacturers and high-ranking officers in the French armed forces, fall 2023.
163. Ibid.
164. J. Henrotin, "Armes hypersoniques: Quels enjeux pour les armées?", *Briefings de l'Ifri*, Ifri, June 18, 2021, available at: www.ifri.org.
165. L. Lagneau, "Le ministère des Armées va financer un second démonstrateur de planeur hypersonique, le VMaX-2", *Opex360-Zone militaire*, May 4, 2023, available at: www.opex360.com.
166. T. Radtka, "Essaims et combat collaboratif: La saturation à l'ère de l'intelligence artificielle", *Briefings de l'Ifri*, Ifri, July 16, 2024.
167. C. Pietralunga, "Gaza: Des dizaines de milliers de cibles identifiées par l'IA pour l'armée israélienne", *Le Monde*, April 6, 2024, available at: www.lemonde.fr.

This increase in speed also necessitates additional investment in the range and computing power of detection radars.

The saturation/penetration trade-off

The war in Ukraine has demonstrated the importance of complementarity between sophisticated weapons delivery systems and large numbers of low-cost assets. With most of its arsenal consisting of sophisticated deep strike systems, Russia has been forced to diversify its strike systems in order to maintain a minimum efficiency level against increasingly effective air defenses. The Shahed-136 missiles procured from Iran in summer 2022 have filled a capability gap for Russia, which lacked a system of this type. On the Ukrainian side, the strike campaign against the Russian oil industry in spring 2024 was carried out by rudimentary drones with similar appearance and capabilities. The Ukrainian Navy is developing its own unmanned surface vehicles (USVs) that incorporate civilian technologies, like Starlink terminals, to strike enemy ships and infrastructure.[168] It is important to note, however, that these cheaper weapons delivery systems will have to adapt and become more complex as the enemy finds ways to counter them, which will gradually increase their unit cost and reduce, although not eliminate, the gap between them and higher-end systems. The rapid development of short-range defense systems and the interception of the majority of Shahed missiles have limited their use value against defended targets.

But the effector is only the last link in a kill chain that also involves intelligence and target acquisition assets. The efficacy of Ukraine's strikes is partly due to its almost unlimited access to intelligence provided by NATO powers. The latter receive a constant flow of ISR from intelligence planes near the theater and from observation satellites. Moreover, the development of specialized commercial services is opening up access to numerous tools that can contribute to targeting. An increasing number of companies, like Maxar or ImageSat International, are offering satellite imagery services with ever faster refresh rates to meet demand in a booming market. Given the limitations of military equivalents, this complementary civilian market actually seems more attractive for ensuring smooth information flows.[169]

Likewise, emerging commercial services offering internet access via dedicated satellites, such as Starlink, can be used in the military domain to guide weapons delivery systems to distant targets, as already seen in Ukraine. The various open-source research communities that have developed on websites over the last decade are another valuable source of information that can be used in a basic, inexpensive targeting process. A "techno-guerrilla" can acquire long-range UAVs with guidance provided by a Starlink terminal.

168. H. I. Sutton, "Overview of Maritime Drones (USVs) of the Russo-Ukrainian War, 2022-24", *Covert Shores*, May 2024, available at: www.hisutton.com.
169. N. Cooper, "Space Force Leads Adoption of Commercial Satellite Imagery for Military Use", *ExecutiveGov*, February 13, 2024, available at: executivegov.com.

These weapons delivery systems can be directed to targets identified by members of the "watcher" community—whether willing accomplices or not—who post on social media to announce the arrival in port of a specific ship or the landing of a particular type of aircraft at a given airport. This information can then be corroborated by space imagery services or confirmed by a human source on the ground before directing fire at the estimated coordinates. Although far from infallible, this procedure has the advantage of being hard to identify, offering considerable damage potential at a low cost.

Advanced actors can use deep strikes with saturating systems to optimize the effectiveness of their penetrating systems by escorting them with numerous cheaper decoy missiles. This kind of deep strike also enables the democratization of access to capabilities previously reserved for a specific type of actor, allowing less powerful nations, or even autonomous armed groups, to launch strikes against high-value targets that are poorly defended against such unexpected, improvised threats. Although they cannot completely destroy their target, these strikes can damage valuable equipment and put it out of action for significant periods. The threat of saturating systems absolutely must be taken into account when planning future capability efforts, because it will be a feature of any future conflict.

Deep strike in the French model

With most European militaries launching ambitious re-equipment programs, France's LPM 2024–2030 proposes the development of new capabilities in the deep strike sector as well as the continuation of new missile development programs. Beyond efforts already underway, the proliferation of threats and the evolution of the saturation/penetration relationship must now be taken into account when adapting France's capability and strategic approach, whether for offense or defense.

Creating a role for the ground forces

The French ground forces have limited deep strike capabilities. The 57 M270 multiple rocket launchers that entered service in the 1990s initially only had a range of between 30 and 45 km depending on munitions, which were designed for saturation fires. The 15 or so French M270 units upgraded to LRU (*lance-roquettes unitaire*) standard gained range and accuracy but lost raw firepower.[170] Its standard munition, the M31A1 rocket, has a range of over 70 km, and its warhead has been reduced to 90 kg to give it 1-meter accuracy. This change was intended to avoid or limit collateral damage from strikes in densely populated areas.[171] It also allows LRUs to be used among other targeting effectors in counterterrorism operations.

170. "Détachement de Liaison, Observation et Coordination (DLOC)", CICDE, June 2015, p. 15, available at: www.irsem.fr.
171. Interview with officers in the French Army, fall 2023.

Only nine LRUs were still officially in service in 2024. Long considered a low priority by a French Army facing budgetary constraints, their replacement is still some way off. Other than a brief deployment of three LRUs on Operation Barkhane in 2016, they have rarely been used for combat missions outside mainland France, and the fact that their deployment in Mali was not repeated suggests that they were only of limited use there.[172] Based on the hull of the M2 Bradley that entered service in 1981, the LRU and its European counterparts are showing their age. While Germany and the UK have been planning to modernize theirs since the early 2020s to allow them to remain in service,[173] the French LRUs did not receive the same attention. The LPM 2019–2025 contained no provision for them,[174] even though their maintenance is only guaranteed until 2027,[175] suggesting that the capability might simply be abandoned.

Since 2022, however, the remarkable effectiveness of the M270 units transferred to Ukraine and the importance of deep strikes have acted like a shock to the system. The LPM 2024–2030 announced a replacement program, with the goal of procuring 13 new systems of an unspecified type by 2030 and 13 additional ones by 2035.[176] A budgetary envelope of 600 million euros is planned as part of a new type of call for tenders known as an "innovation partnership".[177] The aim is to procure a rocket with a range of 150 km by 2030 and a missile with a range of 500 km by 2035. Two options are currently available:

- Off-the-shelf purchase of an existing system like the American M142 HIMARS, the Korean K239, or the Israeli EURO-PULS, all already procured by one or more of France's European partners;
- Development of a still unspecified French system.

Two proposals in particular stand out from the Frappe longue portée-Terre (FLP-T, Long-range strike-ground) innovation partnership launched by the Directorate General of Armament: a joint MBDA/Safran bid and a joint ArianeGroup/Thales bid. Both competitors estimate that they can develop their respective solutions by 2030, and both are offering proposals for a potential very long-range missile, which exceeds the demands of the current partnership.

Purchasing a system that has already been developed off the shelf from abroad brings a guarantee of interoperability. An existing system would also theoretically be available more quickly—an important factor given that the

172. Interview with officers in the French Army, fall 2023.
173. "British Army Acquires M270A2 GMLRS Rocket Launchers: Displayed at DSEI 2023 Defense Exhibition", *Army Recognition*, September 23, 2023, available at: www.armyrecognition.com.
174. Report annexed to the LPM 2019–2025, available at: www.senat.fr.
175. Interview with actors in the defense industry, fall 2023.
176. Report annexed to the LPM 2024–2030, available at: www.legifrance.gouv.fr.
177. N. Gain, "Les industriels en ordre de bataille pour offrir un successeur au LRU", *Forces Operations Blog*, May 4, 2023, available at: www.forcesoperations.com.

nine remaining LRUs will no longer be usable after 2027. However, the downside of this approach is the lack of control over the production of these systems and their munitions, given that the target of 26 units is not high enough to warrant significant industrial offsets. Purchasing from abroad also means being fitted into a production schedule that is sometimes already fairly packed. Given Lockheed Martin's order backlog, any HIMARS procured would not be delivered before the end of the decade, with further delays possible if the US armed forces exercise their priority right over domestic production. There is also a risk that the exporting country could impose limitations on the use of the imported systems so as not to conflict with its own diplomatic agenda, like the SCALP and Storm Shadow missiles given to Ukraine on condition that they not be used to strike Russian territory. Nevertheless, it is worth noting that these risks are not new, and the LRU was subject to similar restrictions in its time.

Developing a domestic solution resolves the problem of control over the production and use of the LRU's future replacement, but it does raise other issues. Long neglected, the process to replace the LRU was started belatedly, increasing the risk of a capability gap by the time a domestic successor has been developed and delivered. This problem could partly be solved by developing a joint training program with other European armed forces that still have M270 systems. Moreover, the competing manufacturers both emphasize their ability to integrate existing technologies, both in terms of targeting and munitions and launchers, which would reduce the development time to the certification process.

The important issue of unit cost remains. The purchase of 26 systems is likely to mean a very high price per system, which is all the more difficult to offset through exports because most potentially interested European states have already confirmed the purchase of foreign systems. Generally speaking, long-range ground-to-ground missiles are expensive. The American ATACMS only costs under 2 million dollars because it was produced with a run of 3,500 units,[178] reducing the unit cost. A future LRU with a range of over 500 km and acquired exclusively by France would likely be expensive and only acquired in small numbers, limiting its use to strictly strategic contexts. Although the Chief of Staff of the French Army has expressed a desire for a sovereign solution so as not to face restrictions on its use, such a solution could, in reality, be limited by the number of munitions procured.[179]

Through the FLP-T project, the French Army is seeking to develop a capability previously reduced to a remnant, at the same time as crossing thresholds that have never been reached before by French conventional land weapons. The stated goal is to guarantee the ground forces their own

178. J. Ismay, "The Missile Ukraine Wants Is One the U.S. Says It Doesn't Need", *The New York Times*, June 10, 2022, available at: www.nytimes.com.
179. L. Lagneau, "La DGA n'exclut pas une solution 'souveraine' pour la future capacité de feux dans la profondeur de l'armée de Terre", *Opex360-Zone militaire*, May 3, 2023, available at: www.opex360.com.

capability to strike an enemy located in the depth while also providing counterbattery capabilities that can handle enemy long-range weapons delivery systems. The arrival in the theater of the HIMARS, which doubled the range of Ukraine's systems in a matter of weeks, forced the Russian forces to move a whole range of logistical, medical, and command elements back a considerable distance. Having access to these capabilities would also support France's ambition to command an army corps with an area of effect covering almost 300 km (see Diagram 1). This was also one of the Polish objectives motivating the procurement of the PrSM.

Deploying a deep strike capability with enough ammunition to handle tactical-operational objectives would also make it possible to maintain strong pressure on enemy forces, which cannot spread out indefinitely without losing coherence and efficacy. A division's logistics support point must be within 100 km of the front to ensure forward service support is not impaired. Moreover, the Ukrainian conflict has highlighted the proliferation of targets of intermediate value,[180] requiring longer-range strike capabilities that can also sustain a certain mass of fires. Ground-based operational deep strike capabilities would thus offer a welcome complement to those of the air force, which remain indispensable.[181]

Faced with the inherent costs of an ambitious program, pooled development with several partners is an alternative that has been envisioned since at least the beginning of 2024 in the form of a series of joint initiatives. Announced in July 2024, the European Long-Range Strike Approach (ELSA) project involves France, Germany, Italy, and Poland, with the UK and Sweden joining in October 2024. The details of the project remain vague, with the various partners still negotiating on common specifications, particularly in terms of range.[182] The stated minimum goal is to be able to fill a critical capability gap revealed by the war in Ukraine. It should concentrate on systems with a range of over 500 km, which are almost totally absent from current European military inventories.[183] Again, France has solutions like a ground-based version of MBDA's MdCN, known as the Land Cruise Missile (LCM), or ArianeGroup's Missile Balistique Terrestre (MBT, land ballistic missile) project.

The future of air and naval strikes

With the prospect of a possible high-intensity conflict in Europe, and with the steady reduction of the number of LRUs, France's deep strike capabilities

180. Interview with Ukrainian experts and officers, summer 2024.
181. Interview with officers in the French Army, fall 2023.
182. L. Lagneau, "Paris, Rome, Berlin et Varsovie envisagent une capacité commune de frappe à longue portée", *Opex360-Zone militaire*, July 12, 2024, available at: www.opex360.com.
183. N. Gain, "Un quintette de pays s'accorde sur le futur de la frappe longue portée de précision", *Forces Operations Blog*, July 12, 2024, available at: www.forcesoperations.com.

have gradually been limited to those of the French Air and Space Force and the French Navy.

For operational deep strike missions, the French Air and Space Force has had the SCALP missile since the beginning of the 2000s. Used for the first time by the Royal Air Force in Iraq in 2003, the SCALP has been continually improved and should remain operational until 2032.[184] By then, it should have been supplemented by the Franco-British FC/ASW program. The carrier should also evolve in line with the future *Rafale* standards and the FCAS program, which will provide new suppression of enemy air defenses (SEAD) and electronic warfare assets to improve the penetration of weapons delivery systems.

The MdCN has been in service in the French Navy since 2017 and is equipped with *Suffren*-class nuclear-powered attack submarines (SNA). With a declared range of 1,000 km, it has allowed the French Navy to diversify its deep strike capabilities beyond the *Rafale* of the carrier battle group, with a first use in 2018 in Syria as part of Operation Hamilton.[185] Although its subsonic speed theoretically makes it, like all systems of its type, vulnerable to interception by a robust air defense, the MdCN can adopt extremely discreet flight profiles that increase its survivability. Saturation fires, or eventually mixed salvos, remain the key for effective use, multiplying flight profiles and approach angles, as the French Navy sought to demonstrate in April 2024 with a synchronized double launch by a FREMM and an SNA.[186]

The SCALP and the MdCN are rare in French inventories: Between 200 and 300 SCALP missiles were modernized at the beginning of the 2010s, while around 200 MdCN were procured.[187] SCALP stocks have been further reduced by deliveries to Ukraine. Powerful but scarce, they are seen as "strategic" weapons, with the decision to use them usually reserved for the political authorities. The initial goal of developing the SCALP was not, however, to produce a weapon with such limited uses, but rather to equip the French air forces with a long-range strike asset that could be used much more widely. It is likely that a weapons delivery system procured in greater numbers would avoid being classed as a strategic weapon and would give the armed forces a broader range of options to respond to growing threats. It is worth noting that a hypersonic cruise missile would have a much higher unit cost than current systems, which would doom it to the status of a strategic weapon with an even more limited set of uses.[188] A report by the US

184. "MOD Signs £146 Million Contract to Upgrade RAF's Long-Range Missile", British Government website, February 22, 2017, available at: www.gov.uk.
185. L. Lagneau, "Syrie : la Marine nationale a tiré les enseignements des 'ratés' de l'opération Hamilton", *Opex360-Zone militaire*, November 3, 2018, available at: www.opex360.com.
186. "La DGA a soutenu la Marine nationale pour son 1er double-tir simultané de missile de croisière naval", Ministère des Armées, April 18, 2024, available at: www.defense.gouv.fr.
187. Interview with officers in the French Air and Space Force, spring 2024.
188. Interview with officers in the French Army, fall 2023.

Congressional Research Service in September 2024 estimated the unit cost of a missile similar to the LRHW at 41 million dollars.[189]

Delivered to Ukraine in small numbers, the French and British SCALP missiles have been very useful there, although several have apparently been intercepted by Russia's air defenses, forcing the Ukrainian forces to launch larger or ever more carefully planned salvos to ensure a satisfactory success rate.[190] These salvos consisted of SCALP and other missiles, such as the Ukrainian Neptune or other cheaper weapons delivery systems, to increase penetration by distracting the enemy air defenses and maximizing penetration chances. Deep strike in the 2030s will therefore have to be based on a mixed strike model, taking advantage of the saturation and penetration capabilities of each weapons delivery system. Future cruise missiles, more powerful but also more expensive and so less numerous, will have to be accompanied by a certain number of less powerful systems as well as decoys with similar radar signatures that can saturate the enemy's monitoring and interception capabilities to allow more powerful systems to reach their target. The whole mixed salvo will have to be able to function with a minimum level of synergy, particularly in target prioritization, while also making sure not to increase the price of secondary systems or decoys. Without changes to current budget trajectories, the number of new-generation missiles procured is likely to drop. This scarcity must be addressed by the distribution of deep strike missions across all branches of the armed forces, including the capabilities of the ground and naval components.

Of strategic considerations

Alongside capability and financing issues, which have direct implications for the French deep strike model and on the effects sought using current and future assets,[191] there are also strategic considerations related to France's nuclear status. Nuclear deterrence remains at the heart of France's defense strategy for covering and protecting the country's vital interests, which have a European dimension now acknowledged by the French president.[192] In this model, and in contrast to the NATO or US posture, deterrence remains strictly nuclear, although the conventional forces perform an "*épaulement*" or "back-up" role.[193]

Faced with the proliferation of threats under the nuclear threshold and the prospect of Russian conventional deep strikes on European territory or Chinese strikes on Western interests in the Pacific, this "*épaulement*" must

189. A. Feickert, "The U.S. Army's Long-Range Hypersonic Weapon", op. cit.
190. Interview with French and Ukrainian civilian and military actors, spring 2024.
191. F. Hoffmann, "The Strategic-Level Effects of Long-Range Strike Weapons: A Framework for Analysis", *Journal of Strategic Studies*, Vol. 47, No. 6–7, May 2024, pp. 964–1000.
192. H. Fayet, "Pourquoi la France ne proposera pas de 'parapluie nucléaire' à l'Europe", *Le Rubicon*, March 6, 2024.
193. O. Baudet and D. Marty, "L'épaulement des forces nucléaires et conventionnelles", *Revue Défense Nationale*, special issue, No. 13, 2023, pp. 111–131.

be rehauled, giving greater prominence to deep strikes so that they can contribute to deterrence. Although these observations do not apply to strikes in a dynamic battlefield context, which retain a tactical-operational dimension as long as there are enough systems available to avoid reclassification as a strategic capability, they are very relevant for projects with a range above 1,000 km. Such systems could be used in a coalition context, deployed along Europe's Eastern flank to reassure NATO members. Nevertheless, their real deterrent effect should not be overestimated, given that their destructive capacity remains below that of a nuclear weapon.

If this kind of approach were adopted, nuclear weapons delivery systems would have to be distributed according to a clear policy, which would have to remain so to reduce the risks of ambiguity and unintentional escalation. This would rule out a conventional hypersonic cruise missile being launched from a plane, or conventional ballistic missiles from an SNLE nuclear ballistic missile submarine. Future weapons delivery systems presented as conventional, such as the Missile balistique terrestre project or the demonstrator for the V-MAX glide vehicle, would also have to comply strictly with this warhead allocation.[194] Likewise, targeting would have to be particularly cautious when striking another nuclear-equipped state. Countries like Russia clearly include their nuclear command and control infrastructure on the list of sites covered by their deterrence posture, as well as other centers of gravity and strategic nodes that could be targeted by deep strikes. Ukrainian strikes on Russian detection radars provoked heated debate among Western analysts around the escalation potential of such an attack, which was ultimately lower than expected.[195] Although it is essential to update weapons delivery systems and carriers to ensure France has a strike capability, it is also crucial to invest at the same time in radar (detection), satellite, and intelligence capabilities.

Nevertheless, given the proliferation of this type of capability and the increasing prominence of the debate within NATO, President Macron has let go of the slight distrust shown toward it previously and seems keen to open up new possibilities for France to procure assets for very deep strikes on operational-strategic targets. In April 2024, he announced to the press that it would be necessary to "put everything on the table" to assess offensive and defensive capabilities, including nuclear deterrence as well as long-range strikes and missile defense.[196] This commitment was reiterated by the minister of the armed forces at a Weimar Triangle meeting in spring 2024, and then confirmed by the signing of a letter of intent on the ELSA project. This openness must be maintained in order for France to move toward a

194. S. Spet, "Frappe dans la profondeur terrestre: Quel rôle dans les opérations futures françaises?", *Revue Défense Nationale*, special issue, No. 13, 2023, p. 264.
195. M. Varenikova, "Ukrainian Drone Strikes Target Russian Nuclear Radar Stations", *The New York Times*, April 30, 2024, available at: www.nytimes.com.
196. F. Brochet, N. Mauret, and J. Mitoyen, "Emmanuel Macron face aux jeunes Européens: 'Il y a une hypocrisie démocratique du RN'", *Dernières nouvelles d'Alsace*, April 27, 2024, available at: www.dna.fr.

more integrated defense and enable the "*épaulement*" Macron wants to see between the conventional and nuclear forces, as well as to give military and political decision-makers additional offensive options and to increase the compatibility of French doctrine with those of its US and NATO allies.

More specifically, the French Army's procurement of deep strike assets requires improvement of joint-forces targeting capabilities and greater coordination between the ground and air forces, not just in terms of target distribution, but also sharing airspace if France acquires ballistic missiles, although their rapid ascension through and out of the atmosphere helps to reduce congestion. It could be useful to improve interconnections with specialized NATO software programs, particularly on the basis of certain feedback from the Orion exercise in 2023. From the perspective of weapons delivery systems, the balance between penetrating and saturating systems must be permanently shifted to cope with the development of specialized defenses, which will only continue to accelerate, fueled by the lessons of the conflict in Ukraine. The existence of hardened targets that are unreachable or too difficult to damage by kinetic means creates a demand for non-kinetic means, which are useful for weakening a target prior to a strike.

For cruise missiles, the question of quantity cannot be avoided; the limited number of modernized SCALP systems should be seen as a low point that must not be repeated with systems currently in development. A key factor when considering this question is the use of saturating systems that can distract enemy defenses to ensure penetrating systems can hit their target. Both types of system must be procured in sufficient quantities to ensure deep strike is not limited to strategic targets. The increased range of conventional artillery means that forces are now spread out over greater depths, creating numerous tactical-operational targets that can only be hit with longer-range weapons delivery systems that are available in large numbers. Saturating systems must accompany penetrating systems to ensure an appropriate force model is maintained.

Finally, the proliferation of deep strike assets, such as programmable munitions, means more assets must be allocated to protection in order to avoid unsustainable losses, including against much less powerful enemies. This protection can take various forms depending on the nature of the threat. Against a smaller number of penetrating systems accompanied by decoys, air defense systems must be enhanced with a target discrimination capability, at the same time as increasing their number to improve the A2/AD bubble against saturating waves. They can also be equipped with passive defenses, such as electronic warfare assets. Hardening or dispersal should be able to limit vulnerability but also means adapting functionality, particularly in the case of command posts, which are priority targets for operational deep strikes.

Conclusion

The prospect of a major conflict with Russia, combined with the uncertainty around US involvement, is pushing European militaries to develop their deep strike capabilities, particularly ground-to-ground. Washington's shift of focus to the Asian theater is prompting European armed forces to equip themselves with sufficient conventional assets to conduct deep strike missions without US help. Following the example of the US and its allies, who are rearming against the Chinese threat, Europe's ground and naval forces are seeking to increase their ability to carry out deep strikes despite increasingly dense and effective enemy defense systems. Militaries that have never had deep strike capabilities now want to obtain them, while those that already have them are trying to increase their power and reach longer ranges, posing strategic dilemmas in terms of targeting and escalation control.

The war in Ukraine has also led to the evolution of deep strike capabilities themselves. Having started the war with an impressive arsenal of conventional missiles, Russia now has a growing number of long-range one-way drones to supplement its salvos and ensure they hit their target. Ukraine, less well-equipped in this sector, has also developed its own arsenal of very long-range unmanned systems that can hit high-value targets deep in Russian territory. Long seen as a differentiating capability, deep strikes are becoming increasingly widespread, including in the hands of non-state actors.

Whatever form the conflicts of the next few decades take, French and Western militaries will have to confront these threats to their forces and infrastructure. Western air defenses must adapt, both in terms of equipment and organization and industrial model, in order to be ready for potential proliferation. These changes call for an adaptation of doctrines and better coherence at the European level to avoid being overtaken in the coming decades.

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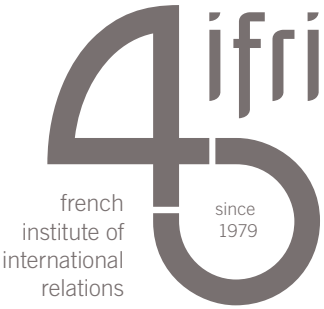

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