About MSW

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Bombing Bulgaria

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Bombing Sofia – April, 1944
The modern aerial bomb, with its distinctive elongated shape, stabilizing fins, and nose-fitted detonator, is a Bulgarian invention. In the Balkan War of 1912, waged by Bulgaria, Greece, Serbia, and Montenegro (the Balkan League) against Turkey, a Bulgarian army captain, Simeon Petrov, adapted and enlarged a number of grenades for use from an airplane. They were dropped on a Turkish railway station on October 16, 1912, from an Albatros F.2 biplane piloted by Radul Milkov. Petrov afterward modified the design by adding a stabilizing tail and a fuse designed to detonate on impact, and the six-kilogram bomb became the standard Bulgarian issue until 1918. The plans of the so-called Chataldžha bomb were later passed on to Germany, Bulgaria's ally during the First World War. The design, or something like it, soon became standard issue in all the world's first air forces.

Petrov's invention came back to haunt Bulgaria during the Second World War. On November 14, 1943, a force of ninety-one American B-25 Mitchell bombers escorted by forty-nine P-38 Lightning fighters attacked the marshaling yards in the Bulgarian capital, Sofia. The bombing was spread over a wide area, including three villages. The raid destroyed some of the rail system, the Vrajedna airfield, and a further 187 buildings, resulting in around 150 casualties. A second attack ten days later by B-24 Liberator bombers was less successful. There was poor weather across southern Bulgaria, and only seventeen of the force reached what they hoped was Sofia and bombed through cloud, hitting another seven villages around the capital. The attacks were enough to spread panic through the city. In the absence of effective air defenses or civil defense measures, thousands fled to the surrounding area. The Royal Bulgarian Air Force, though equipped with sixteen Messerschmitt Me109G fighters supplied by Bulgaria's ally Germany, could do little against raids that, though not entirely unexpected, came as a complete surprise when they happened.

The raid in November 1943 was not the first attack on a Bulgarian target during the war, though it was the heaviest and most destructive so far. Bulgaria became a target only because of the decision taken in March 1941 by the Bulgarian government, after much hesitation, to tie the country to Germany by signing the Tripartite Pact, which had been made among the principal Axis powers, Germany, Italy, and Japan, the previous September. When in the spring of 1941 German forces were based in Bulgaria to attack Greece and Yugoslavia, the RAF sent a force of six Wellington bombers to bomb the Sofia rail links in order to hamper the concentration of German troops. A British night raid on April 13 made a lucky hit on an ammunition train, causing major fires and widespread destruction. Further small raids occurred on July 23 and August 11, 1941, which the Bulgarian government blamed on the Soviet air force. Although Bulgaria did not actively participate in the Axis invasion of the Soviet Union on June 22, 1941, it gave supplies to Germany and allowed German ships to use the major ports of Varna and Burgas. On September 13, 1942, a further small Soviet raid hit Burgas, where German ships laden with oil-drilling equipment were awaiting the signal to cross the Black Sea to supply German engineers with the materials they would need to restart production once the Caucasus oilfields had been captured. The Soviet Union was not at war with Bulgaria and denied the intrusions in 1941 and 1942, for which it was almost certainly responsible, but the attacks were of such small scale that the Bulgarian government did not insist on reparations.

The handful of pinprick attacks in 1941 and 1942 were enough to make Bulgaria anxious about what might happen if
the Allies ever did decide to bomb its cities heavily. Bulgaria’s position in the Second World War was an ambiguous one. The tsar, Boris III, did not want his country to be actively engaged in fighting a war after the heavy territorial and financial losses Bulgaria had sustained in the peace settlement of 1919 as punishment for joining with Germany and Austria-Hungary in the First World War. Only with great reluctance and under German pressure did the prime minister, Bogdan Filov, declare war on Britain and the United States on December 13, 1941. Aware of Bulgaria’s vulnerability, the government and the tsar wanted to avoid an actual state of belligerence with the Western powers, just as the country had refused to declare war on the Soviet Union. Bulgaria’s small armed forces therefore undertook no operations against the Allies; instead they were used by the Germans as occupation troops in Macedonia and Thrace, territories given to Bulgaria after the German defeat of Yugoslavia and Greece in 1941. By 1943 it was evident to the Bulgarian government and people that they had once again backed the wrong side. Much of the population was anti-German and some of it pro-Soviet. In 1942 a left-wing Fatherland Front had been formed, demanding an end to the war and the severing of links with Germany. Partisan movements in the occupied territories and in Bulgaria itself became more active during 1943, and in August of that year they launched a major recruitment drive. The partisans were chiefly communist and campaigned not only for an end to the war but for a new social order and closer ties with the Soviet Union. In May 1943 and again in October, Filov authorized contacts with the Western Allies to see whether there was a possibility of reaching an agreement. He was told that only unconditional surrender and the evacuation of the occupied territories could be accepted.

It is against this background that sense can be made of the Allied decision to launch a series of heavy air attacks on Bulgarian cities. Knowing that Bulgaria was facing a mounting crisis, caught between its German ally and the growing threat of a likely Soviet victory, Allied leaders were encouraged to use bombing as a political tool in the hope that it might produce a quick dividend by forcing Bulgaria out of the war. The idea that bombing was capable of a sudden decisive blow by demoralizing a population and causing a government crisis had been at the heart of much interwar thinking about the use of airpower. It was the logic of the most famous statement of this principle, made in 1921 by the Italian general Giulio Douhet in his classic study The Command of the Air (Il dominio dell’aria). The principle was also a central element in the view of airpower held by the British prime minister, Winston Churchill, who had previously applied it to both Germany and Italy. It was not by chance that in a meeting with the British chiefs of staff on October 19, 1943, it was Churchill who would suggest that in his view the Bulgarians were a “peccant people to whom a sharp lesson should be administered.” Their fault was to have sided once again with the Germans despite, Churchill claimed, his efforts to get them to see sense. Bombing was designed to undo the cord that bound Bulgaria to her German patron.

The sharp lesson was to be a heavy bombing attack on Sofia. Churchill justified the operation on political grounds: “Experience shows,” he told the meeting, “that the effect of bombing a country where there were antagonistic elements was not to unite those elements, but rather to increase the anger of the anti-war party.” Others present, including Air Chief Marshal Sir Charles Portal, chief of the air staff, and the chief of the imperial general staff, General Alan Brooke, were less keen and insisted that leaflets should be dropped along with the bombs explaining that the Allies wanted Bulgaria to withdraw its occupation troops and surrender (in the end leaflets were dropped with the curious headline “This is not about Allied terror, but about Bulgarian insanity”). But the idea of a “sharp lesson” quickly circulated. The American military chiefs thought that Sofia was so low a military priority that an attack was scarcely justified, but they were impressed by the possible “great psychological effect.” Both the British and American ambassadors in Ankara urged an attack so as to interrupt Turkish-German commercial rail traffic. On October 24 the Anglo-American Combined Chiefs of Staff directed General Dwight D. Eisenhower, supreme commander in the Mediterranean, to give such a lesson as soon as this was operationally practical. The Turkish government approved, hopeful perhaps despite neutrality to profit from Bulgaria’s discomfiture in any postwar settlement. Churchill wanted Stalin’s say-so as well, because Bulgaria was clearly in the Soviet sphere of interest, and on October 29 the British foreign minister, Anthony Eden, who was in Moscow for negotiations, was able to report back Stalin’s comment that Sofia should certainly be bombed, as it was nothing more than “a province of Germany.”

The Bulgarian government had expected bombing for some time. While the regime struggled to come to terms with internal dissent, the Soviet presence in the east, and Allied demands for unconditional surrender, it also sought ways to appease the Germans in case they decided to occupy Bulgaria. In the course of 1943 the deportation of Jews from the occupied areas of Thrace was completed, and despite the hostility of the tsar, the German authorities in Sofia persuaded the Bulgarian government to deport native Bulgarian Jews as well. It was agreed that they would first be transferred to twenty small towns in the hinterland around Sofia, and in May 1943 some 16,000 Jews were taken at short notice from the capital and parceled out among eight provinces. The Filov government linked the Jewish policy with bombing. When the Swiss ambassador asked Filov on humanitarian grounds to stop sending Thracian Jews to Auschwitz, Filov retorted that talk of humanity was misconceived when the Allies were busy obliterating the cities of Europe from the air. Moreover, when he failed to take up a British offer in February 1943 to transport 4,500 Jewish children from Bulgaria to Palestine, he feared that Sofia might be bombed in retaliation. Once the Jews of Sofia had been deported to the provinces, anxiety revived again in Bulgaria that the Allies would now no longer hesitate to bomb for fear of killing Jews. In the end the Jews of Bulgaria escaped not only deportation to Auschwitz but also the bombing, which left much of Sofia’s Jewish quarter in ruins.

It was not the Jewish question that invited Allied bombing in November 1943, though many Bulgarians assumed that it was. The first raids seemed to presage an onslaught of aerial punishment, and the population of the capital gave way to
incendiary attacks hastened the disintegration of Bulgarian politics and increased support for the Soviet Union, whose figure that would have been considerably higher had it not been for the voluntary evacuation of the capital. The further 750 buildings and heavily damaged the rail marshaling yard. During 1944 the death toll in Sofia was 1,165, a 139 of the population that had remained. The last major raid, on April 17 by 350 American bombers, destroyed a Bulgarian Orthodox Church, the National Theater, several ministries, and a further 3,575 buildings, but killing only B-24s, this time carrying 30,000 incendiaries, created a widespread conflagration, destroying the Holy Synod of the German targets. The raid of March 16 burned down the royal palace; the heavy raid of March 29–30 by 367 B-17s and Sofia and carried a proportion of incendiaries, 4,000 in all, in order to do to Sofia what had been done so effectively to German targets. The raid of March 16 burned down the royal palace; the heavy raid of March 29–30 by 367 B-17s and B-24s, this time carrying 80,000 incendiaries, created a widespread conflagration, destroying the Holy Synod of the Bulgarian Orthodox Church, the National Theater, several ministries, and a further 3,575 buildings, but killing only 139 of the population that had remained. The last major raid, on April 17 by 350 American bombers, destroyed a further 750 buildings and heavily damaged the rail marshaling yard. During 1944 the death toll in Sofia was 1,165, a figure that would have been considerably higher had it not been for the voluntary evacuation of the capital. The incendiary attacks hastened the disintegration of Bulgarian politics and increased support for the Soviet Union, whose

The second major raid, of January 10, did pay political dividends. While Filov tried unsuccessfully to persuade a visiting German general, Walter Warlimont, deputy for operations on Hitler’s staff, to mount a revenge attack on neutral Istanbul—the consequences of which might well have been even more disastrous for Bulgaria—most Bulgarian leaders had come to realize that the German connection had to be severed as soon as possible and a deal struck with the Allies. The bishop of Sofia used the occasion of the funeral for the victims of the bombing to launch an attack on the government for tying Bulgaria to Germany and failing to save the people from war. That month an effort was made to get the Soviet Union to intercede with the Western Allies to stop the bombing, but instead Moscow increased its pressure on Bulgaria to abandon its support for the Axis. In February the first informal contacts were made with the Allies through a Bulgarian intermediary in Istanbul to see whether terms could be agreed upon for an armistice. Although hope for negotiation had been the principal reason for starting the bombing, the Allied reaction to the first Bulgarian approach following the raids was mixed. Roosevelt wrote to Churchill on February 9 suggesting that the bombing should now be suspended if the Bulgarians wanted to talk, a view shared by British diplomats in the Middle Eastern headquarters in Cairo. Churchill scrawled “why?” in the margin of the letter. He was opposed to ending the bombing despite a recent report from the British Joint Intelligence Committee (JIC), which observed that the first bombing in November 1943 had achieved no “decisive political result.” He had already authorized the bombing of the Bulgarian ports of Burgas and Varna, which were added to the list of priority targets, subject to political considerations. In January 1944 the British War Cabinet, in the event of a German gas attack, considered the possibility of retaliatory gas bomb attacks against Germany and its allies, and included Bulgaria on the list. On February 12, Churchill replied to Roosevelt that in his view the bombing had had “exactly the effect we hoped for” and urged him to accept the argument that bombing should continue until the Bulgarians began full and formal negotiations: “If the medicine has done good, let them have more of it.” Roosevelt immediately wired back his full agreement: “Let the good work go on.”

Some of the evidence coming out of Bulgaria seemed to support Churchill’s stance. Intelligence reports arrived detailing the rapid expansion of both the communist partisan movement and the Fatherland Front. The partisans contacted the Allies through a British liaison officer stationed in Bulgaria, encouraging them to keep up the bombing in order to provoke the collapse of the pro-German regime and help expand support for the resistance. The partisans sent details about the central administrative area in Sofia, bordered by the recently renamed Adolf Hitler Boulevard, which they said was ripe for attack; at the same time, partisan leaders asked the Allies not to bomb the working-class districts of Sofia, from which most of their recruits were drawn. By March the partisans were finally organized by the Bulgarian communists into the National Liberation Revolutionary Army. As a result of the evidence on the ground, the Western Allies, with Stalin’s continued though secret support (the Soviet Union did not want Bulgarians to think they had actively abetted the bombing), accepted Eden’s argument that by “turning on the heat” on Bulgarian cities it might shortly be possible either to provoke a coup d’état or to batter the government into suing for peace. On March 10, Sir Charles Portal told Churchill that he had ordered heavy attacks on Sofia and other Bulgarian cities as soon as possible.

On March 16 and then on March 29–30 the Allies launched the most destructive attacks of all on Sofia, as well as subsidiary attacks on Burgas, Varna, and Plovdiv in the interior, designed to disrupt rail communications and sea traffic for the Turkish trade with Germany. The attacks were aimed predominantly at the administrative city center of Sofia and carried a proportion of incendiaries, 4,000 in all, in order to do to Sofia what had been done so effectively to German targets. The raid of March 16 burned down the royal palace; the heavy raid of March 29–30 by 367 B-17s and B-24s, this time carrying 80,000 incendiaries, created a widespread conflagration, destroying the Holy Synod of the Bulgarian Orthodox Church, the National Theater, several ministries, and a further 3,575 buildings, but killing only 139 of the population that had remained. The last major raid, on April 17 by 350 American bombers, destroyed a further 750 buildings and heavily damaged the rail marshaling yard. During 1944 the death toll in Sofia was 1,165, a figure that would have been considerably higher had it not been for the voluntary evacuation of the capital. The incendiary attacks hastened the disintegration of Bulgarian politics and increased support for the Soviet Union, whose
armies were now within striking distance. But only on June 20, 1944, several months after the bombing, did the new government of Ivan Bagryanov begin formal negotiations for an end to Bulgarian belligerency, still hoping to keep Bulgaria’s territorial spoils and avoid Allied occupation. By this time the Allies had lost interest in bombing Bulgaria, which slipped further down the list of priority targets as the bombers turned their attention to Budapest and Bucharest in the path of the oncoming Red Army.

By the summer of 1944 the Allies had other preoccupations, and it seemed evident that Bulgarian politics had been sufficiently destabilized by the bombing to make further attacks redundant. Nevertheless, the final assessment of the effects of the bombing was ambivalent. In July the U.S. Joint Chiefs of Staff prepared an evaluation of the Balkan bombings which suggested that the psychological effects desired had largely been achieved; the report nevertheless suggested that the enemy had sustained an effective propaganda campaign about the high level of civilian casualties, which had undermined the prestige of both the United States and Britain in the eyes of the Bulgarian people. The chiefs directed that in the future any attacks in the region had to be confined to “targets of definite military importance” and civilian casualties minimized. The British chiefs of staff rejected the American claim, and, in defiance of what they well knew to be the case, insisted that only military targets had been subject to attack, even if this had involved damage to housing and civilian deaths. Their report concluded that Allied bombers ought always to be able to act in this way and that operations “should not be prejudiced by undue regard for the probable scale of incidental casualties.” This was a view consistent with everything the RAF had argued and practiced since the switch to the deliberate bombing of German civilians in 1941.

For the historian the judgment is more complex. Bombing almost certainly contributed to the collapse of any pro-German consensus and strengthened the hand both of the moderate center-left in the Fatherland Front and of the more radical partisan movement. But in the end this did not result in a complete change of government until September 9, 1944, when the Soviet presence produced a Fatherland Front administration dominated by the Bulgarian Communist Party (a political outcome that neither Churchill nor Eden had wanted from the bombing). Moreover, other factors played an important role in Bulgarian calculations: the crisis provoked by Italian defeat and surrender in September 1943; the German retreat in the Soviet Union; and fear of a possible Allied Balkan invasion or of Turkish intervention. Where Churchill saw bombing as a primitive instrument for provoking political crisis and insisted throughout the period from October 1943 to March 1944 that this was the key to knocking Bulgaria out of the war, the American military chiefs continued to give preference to the bombing of Italy and Germany and were less persuaded that a political dividend was certain. For them the bombing fitted with the strategy of wearing down Germany’s capacity for waging war by interrupting the supply of vital war matériel and forcing the diversion of German military units from the imminent Normandy campaign. There was also a price to pay for the bombing. In September 1944, following the Bulgarian surrender, some 332 American air force prisoners of war were sent by air shuttle to Istanbul and then on to Cairo; some had been shot down while bombing Bulgaria, others on their way to or from attacks on Romanian targets. An American report suggested that the prisoners had been badly maltreated. Two air force prisoners were killed by the Bulgarian police, and an estimated 175 American war dead were presumed to be on Bulgarian territory, although only eighty-four bodies could be located.
The almost constant warfare among the Sumerian city-states for 2,000 years spurred the development of military technology and technique far beyond any similar development found elsewhere in the Near East at that time. The first Sumerian war for which there is detailed evidence occurred between the states of Lagash and Umma in 2525 b.c.e. In this conflict Eannatum of Lagash defeated the king of Umma. The importance of this war to the military historian lies in a commemorative stele that Eannatum erected to celebrate his victory. This stele is called the “Stele of Vultures” for its portrayal of birds of prey and lions tearing at the flesh of the corpses as they lay on the desert plain. The stele represents the first important pictorial portrayal of war in the Sumerian period and portrays the king of Lagash leading an infantry phalanx of armored, helmeted warriors, armed with spears as they trample their enemies.

The rise of the world’s first civilizations in southern Mesopotamia and Egypt in the late fourth millennium b.c.e also begins the history of organized warfare in western civilization. The creators of the first Mesopotamian civilization were the Sumerians, a people whose origins still remain unclear. By 3000 b.c.e they had established a number of independent walled city-states in southern Mesopotamia, including the cities of Eridu, Ur, Uruk and Lagash. As the number of Sumerian city-states grew and expanded in the third millennium b.c.e, new conflicts arose as city-states fought each other for control of local natural resources or united against the persistent threat of barbarian raiding and invasion.

With the rise of civilization and organized violence came the experimentation with metal alloys in a search for harder, more lethal materials to make weapons. As early as 6000 b.c.e in Anatolia, Neolithic man experimented with copper tools and weapons. But it was not until the fourth millennium b.c.e that tin was added to copper to produce a superior alloy, beginning the Bronze Age. Roughly contemporary to the rise of civilization in Mesopotamia, the Bronze Age made warfare a much more dangerous activity than it had been before in the neolithic period. From the back of their bronze-gilded war chariots, Mesopotamian kings and, later, Egyptian pharaohs made war and carved empires, bringing civilization to newly conquered regions.

The Sumerians are credited with inventing numerous military technologies, including the war chariot, bronze maces, sickle-swords, socket spears and axes, and the defensive technologies of copper and bronze helmets, armoured cloaks and bronze armour. Many of these weapons, such as the mace, spear and axe, were present in the pre-neolithic and neolithic periods as stone weapons, but the Sumerians improved their lethality by making them out of copper and,
The standard shock weapons in Sumerian armies were the long heavy spear, battleaxe and the dagger. The effectiveness of the heavy thrusting spear on the battlefields of Mesopotamia affected the tactical development of ancient armies more than any other weapon. If soldiers armed with the spear were to fight effectively in groups, they had to arrange themselves in close-order formation, giving rise to the first heavy-infantry battle-square in western civilization. Unfortunately, historians know very little about ancient Mesopotamian military formations and tactics because kings used writing to commemorate significant military victories, not the manner in which the battle was fought. Occasionally, the same events were recorded in pictorial form. The most impressive of these early illustrations of the Sumerian army at war is provided by the Stele of Vultures from the city-state of Lagash, dating from around 2500 bce.

The Stele of Vultures commemorates a victory of King Eannatum of Lagash over the king of Umma and takes its name from a section of the stele depicting a defeated enemy whose abandoned bodies are shown being picked at by vultures and lions. The battle scene shows the army at the moment of victory, marching over the bodies of their defeated and slain enemies. In the upper register the king leads a troop of heavy infantry, while in the lower register the king is shown riding in a four-wheeled battle chariot pulled by four onagers in the van of a troop of light infantry.

The Sumerian light infantryman is depicted without protective equipment and armed with a long spear in the left hand and a battleaxe in the right. It is not known whether these unarmoured light infantry used their spears for shock combat or as throwing weapons. The Sumerian heavy infantry are portrayed in formation, with the unnamed sculptor carving helmeted spearmen, organized six files deep with an eight-man front, with the front rank bearing large rectangular shields. What is interesting is the apparent standardized equipment and number of spears projecting between the shields. The common panoply and close order suggest that these soldiers were well trained, uniformed and equipped to fight as a corps, anticipating later Greek, Macedonian and Roman heavy infantry formations. Still, without corroborating textual evidence it is unknown whether this early battle square was a common battlefield formation, if it was capable of offensive articulation, or if it served primarily as a defensive formation.

Eventually, the Sumerian civilization would fall to the inventor of imperium, Sargon the Great, around 2340 bce (Map 1.1). During his fifty-year rule, the Akkadian king would fight no fewer than thirty-four military campaigns and carve out an empire that would include all of Mesopotamia, as well as lands westward to the Mediterranean, inspiring generations of Near Eastern rulers to emulate his accomplishment.

During the Sargonid period (c.2340–c.2100 bce) the Akkadians contributed another major innovation in weaponry: the composite bow. Although it is likely that the Sumerians utilized the simple bow in warfare, no textual or pictorial evidence exists to support this claim. The first evidence of the bow being used in collective warfare is found during the reign of Sargon’s grandson Naram Sin (2254–2218 bce), though it is possible that Sargon himself utilized the weapons in his own campaigns.

The impact of the composite bow on the battlefields of the Near East was significant. While the simple self-bow (a bow made of a single piece of wood) could kill at ranges from 50 to 100 yards, it could not penetrate even simple leather armour at these ranges. The composite bow, with a pull of at least twice that of a self-bow, could easily penetrate leather armour, and perhaps the bronze armour of the day. The reason for this increased performance was the unique construction of the bow. The composite bow was a recurve bow made of wood, horn and tendons from oxen, carefully laminated together to create a bow of superior strength, range and impact power.

Possibly invented on the Eurasian steppes and brought to the Akkadians by mercenary nomads, the composite bow quickly became an important asset on the battlefields of ancient Mesopotamia. Aiming against packed heavy-infantry formations, light infantry archers could fire withering barrages of arrows, causing gaps and tears and eroding the morale of the foot soldiers. Although we have no descriptions of Mesopotamian battles from the Bronze Age, it is safe to assume that the co-ordination of heavy infantry and light infantry archers working together on the battlefield represents a combined-arms tactical synthesis, perhaps the first in the history of western civilization.

Once created, the composite bow spread quickly to other armies over the next 500 years, appearing in Palestine around 1800 bce and introduced to Egypt and the Aegean region by 1600 bce. In New Kingdom Egypt (1567–1085 bce), the improved archer was placed in an improved war chariot, combining for the first time a powerful weapon with increased tactical mobility. Composite bow-wielding light infantry and cavalry would remain a persistent adversary to the heavy-infantry-based armies of western civilization for the next two-and-a-half millennia (c.1000 bce–c.1500 ce).

Perhaps no other single military invention is as closely associated with the ancient period as the war chariot. The military application of the wheel came quite early in the development of civilization, with the first chariot integrated into Sumerian battle tactics around 3000 bce. These early chariots were either of the two- or four-wheeled variety, were manned by a crew of two, and were pulled by a team of four onagers. The wheels were constructed of solid wood sections held together by pegs, while the placement of the axle either in front or in the middle of the chariot
itself made the Sumerian war chariot heavy and unstable at speed. The absence of a mouth bit made controlling the wild asses very difficult, and it is unlikely that these machines could have moved at more than 10 miles per hour.

Armed with javelins and axes, Sumerian charioteers used their weapons to deliver a shock attack, driving into opposing heavy infantry formations and scattering enemy footmen. The Sumerian machine, pulled by wild asses, was too heavy and cumbersome to offer effective pursuit. Still, the Sumerian chariot served as the prototype for wheeled shock combat for the next thousand years. In the early centuries of the second millennium BCE, two different innovations appeared in significant conjuncture to create a superior chariot: the widespread use of the domesticated horse and the new technology of lightweight, bentwood construction.

Although horses were raised as food in central Asia as early as the fourth millennium BCE, it was only in the second millennium BCE that domesticated equines spread throughout Europe and the Near East. At first too small to be ridden as a cavalry mount, the even-tempered horse was originally used as a replacement for the onager, harnessed to chariots, usually in teams of four. The development of bentwood techniques allowed for the construction of the spoked wheel with a rim of curved felloes and the manufacture of lightweight chariot bodies. At the same time, the appearance of the horse bit improved the control of the animal teams at higher speeds. This lightweight chariot with spoked wheels drawn by teams of horses provided for the first time a fast, manoeuvrable chariot, one that could be used as a firing platform for composite-bow-wielding archers.

By the fifteenth century BCE, the Egyptians had modified the chariot into the finest machine in the world. The Egyptian chariot was made entirely of wood and leather and was so light that two men could carry the body over rough terrain. The Egyptians improved the control, manoeuvrability and speed of the chariot by moving the axle to the very rear of the carrying platform. But manufacturing and maintaining a chariot corps was a very expensive endeavour, the prerogative of rich and powerful kingdoms. The chariots’ presence on the battlefield was supported by the complex logistics of horse breeding and training, a small army of wheelwrights and chariot builders, bowyers, metalsmiths and armourers, and the support teams on campaign who managed spare horses and repaired damaged vehicles. Moreover, the chariots’ position as the pre-eminent weapon system in ancient warfare required continued access to strategic materials, specifically the light and heavy woods required for bentwood construction. In the case of Egypt in the late Bronze Age and Assyria in the early Iron Age, this meant access to the famous cedars of Lebanon. It is no wonder why both of these empires expended so much effort maintaining their presence in Lebanon, the chief source of wood for the armies of the Near East.

How chariots were employed in battle in the late Bronze Age (c.1600–c.1100 BCE) is a matter of some debate. One view holds that the Bronze Age kingdoms used war chariots as a thin screen for massed infantry formations, with chariots moving laterally across the front of their own infantry and the chariot archers shooting – at a right angle – their arrows against the enemy infantry. A second view suggests that chariots were held in reserve until the infantry engagement reached a decisive point. At this moment, commanders would commit their chariots and win the day.

A more recent interpretation has opposing chariot forces lining up in long, shallow formations, then hurtling toward each other as archers fired over their teams and into enemy chariot formations. As enemy horses were killed and wounded, chariots veered, slowed and eventually stopped. At this time, friendly infantry ‘runners’ would finish off enemy chariot crews whose machines had been immobilized. Infantry may have also served as a cordon, a haven for damaged chariots to return to after battle. Because there is no evidence for a clash of close-order infantry formations
in late Bronze Age warfare, it is believed the infantry of the period was lightly armoured and unarticulated, and was most probably used in direct support of chariot charges, to fight in terrain unfavourable to chariot warfare and to garrison cities. During the Egyptian New Kingdom period these new chariots would help pharaohs carve an empire stretching from the Libyan Desert across the Sinai to the Orontes River in Syria.

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**WWII Anti-Vessel Ordinance**

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The Magnetic Mine

Napoleon once said that he preferred marshals with luck. Somebody else said, “Luck is a matter of planning.” The story of defeating the magnetic mine, which to the British was a bad surprise, shows how one side’s poor planning was the other side’s luck.

Toward the end of 1939, some ships entering and exiting British ports were damaged by underwater explosions that hit their lower hulls. The damage usually was not fatal, but in many cases bottom plates were torn, rivets popped out, and internal machinery and propeller shafts dislodged. Many of these ships had to be written off or at best put into dry dock for repair.

An investigation confirmed that these ships were not hit by conventional sea mines. (Such a mine is usually placed at low depth and anchored to the bottom by a cable so that it will be positioned a few feet below the surface.) The investigation of the ships that managed to stagger into port pointed to an explosion beneath the ship but at a distance from it. This led to the conclusion that the damage was caused by a so-called “influence mine,” which was laid on the bottom and was activated by the propeller noise, the pressure wave of the approaching ship, or the effect of the ship’s metal hull on the local magnetic field of the earth. The experts tended to assume that these were magnetic mines, because already in World War I such mines were developed although never used. The trouble was that no effective countermeasures could be devised and employed without knowing the exact characteristics of the detonation.
mechanism, and finding one became a priority undertaking. But how do you identify and recover a mine lying somewhere on the sea floor? Here Lady Luck smiled on the British—and not once but twice.

A German aircraft dropping such mines made a navigational error at night. At high tide, the area flown over by the airplane was covered with water, and the pilot (or navigator) probably thought he was in the right position, but when the tide receded the mine was observed lying in the mud next to a British military base. The mine was moved into a workshop, and the experts (who already suspected it to be a magnetic mine) manufactured a set of bronze (nonmagnetic) tools, disassembled it, and learned how it worked. Here luck played a role again. The mine contained an antimotion device to protect against tampering if dropped on land. This device was to be deactivated by water entering it, if dropped at sea. The short time the mine spent in the water rendered it safe for handling.

The British developed three ways to counter the mine. The one that finally became standard, because it was the cheapest and did not require sailing through “cleared” corridors, was the “degaussing” of the ships. By dragging charged electrical cables over the hulls, the ships became nonmagnetic. This took about half an hour, although the process had to be repeated every six months. The technology of the magnetic mine was not really new, and the Germans chose a well-suited weapon to use. Without better information, the British might have groped in the dark for a long time, spending time and effort trying to deduce the exact nature of the mechanism. Navigational carelessness negated all the work the Germans invested.

The Acoustic Torpedo

An acoustic torpedo, which homes in on the noise the target produces, was thought of during World War I but, because of technical limitations, was never developed. The Germans were later the first to produce one designed to home in on the propeller noise of surface ships. A first variant was introduced in July 1943 but quickly superseded by a faster variant (the Zaunkoenig), which was used with moderate success. It had a major problem that the Germans were apparently unaware of: it sometimes exploded just when entering the turbulent wake behind the target. The Allies for some time suspected such a German development, because the Americans were busy developing their own acoustic torpedo and concurrently thought of potential countermeasures. So within sixteen days of the appearance of the Zaunkoenig, they introduced the Foxer, a towed noisemaker that caused the torpedoes to detonate prematurely (Macksey 2000, 143).

The Germans distributed this torpedo sparingly, and submarine crews were instructed to use it only against escort vessels and not merchantmen (Gannon 1996, 99–100). Later, when several such torpedoes were captured by the Allies, it was found that they could home in only on ships moving at twelve to nineteen knots (Gannon 1996, 101). It is not
operations, believed such research would interfere with the production of standard torpedoes and assigned it the

in combat.

oxygen to grease and moving parts is an invitation for uncontrolled combustion, especially on surface ships engaged

combustion products were water-soluble, the bubbles would have been eliminated. However, the proximity of pure

Replacing the air in the tank with pure oxygen, or high-concentration peroxide (H2O2), which the Germans tried,

Toward the end of the nineteenth century, the torpedo was improved. Its original source of propulsive power,

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The modern torpedo, initially intended to be fired from surface ships, was developed by Robert Whitehead, a British

"Long Lance"[1] Type 93 Torpedo

The Americans advanced the homing technology much further. They had no need to attack merchantmen or escort

vessels in the Atlantic but were acutely aware of the need to attack submarines. (The German submarine force was
deemed of higher priority than the Japanese merchant fleet and its escorts.) From 1943, the ocean was regularly

scanned by aircraft that took off from Iceland or Greenland and from convoys’ escort carriers. When such an airplane
discovered a submarine, it would attack using bombs or depth charges and report the position to a Combat

Information Center, which then decided whether to send a surface vessel (if one was available) or aircraft, which would

force the submarine to stay submerged until the arrival of surface vessels.

But depth charges were of a limited efficacy. To explode near the submarine, the attacker had to follow the

underwater maneuvering of the submarine and stay more or less above it. This remained true even after the next
generations of forward-firing projectors—starting with the Hedgehog—were developed. More important, depth

charges were set before firing to explode at a given depth. While this did not totally depend on guesswork, it was

nearly so. Obviously, something better was needed.

In the fall of 1942, the U.S. Navy developed the sonobuoy. This device parachuted to the water, listened for anomalous

sounds, and broadcast them to an airplane. It succeeded in detecting submarine propellers up to three and a half miles

away. In order to fully exploit this capability, the United States then developed an acoustic torpedo that could home in

on the submarine’s propellers, and specifically on cavitation noises. This torpedo, the Mk-24 (referred to as the Mk-24

Mine to hide its true nature, and nicknamed FIDO), entered service in the beginning of 1943 and was meant to be kept

in production only until the end of the year. It was assumed that by that time the Germans would figure out its

characteristics and its usefulness would be over (Price 1980, 110). To delay this possibility, the Allies introduced some

strict rules. One of these said that this torpedo was not to be dropped against a submerged submarine when surfaced

submarines were in the vicinity. By that time, the Allies controlled the air to such an extent that they could force even

groups of submarines to submerge and then attack (Price 1980, 181). This torpedo also exploited the basic instinct of

any submarine’s commander: when detected, dive as fast as possible. But running the motors at highest power caused
cavitation, which was his undoing. In fact, if he had just shut down his motors, the torpedo would have lost its lock-on,

but as pointed out, this was against the basic instincts of submariners. The secret of the Mk-24 torpedo was not

compromised until the end of the war (Price 1980, 225n1).

Due to the combination of advanced technology and good secret keeping, this torpedo achieved a high success rate of

nearly 20 percent sinkings and 9 percent damaged submarines, compared with 9 percent for depth charges.

"Long Lance"[1] Type 93 Torpedo

The modern torpedo, initially intended to be fired from surface ships, was developed by Robert Whitehead, a British

engineer who lived in Italy (then under Austrian rule) and operated there a successful factory for marine engines. In

1848, Whitehead observed Austrian troops in Milan suppressing a popular uprising. He was horrified by what he saw

and became a pacifist. He then thought of developing naval weapon so dreadful it would prevent future wars. His

occupation with marine engines and his belief that naval warfare was the key to victory (in this, he anticipated Admiral

Alfred Mahan) no doubt lay behind this conclusion. In 1860, he saw a demonstration of a remotely controlled

explosive-carrying boat, but he thought that an underwater vehicle would be better and sat down to develop one. In

1870, he demonstrated his "torpedo," and the Austrian navy, which at the time controlled part of the Adriatic Sea coast,

was the first to buy it. The Royal Navy, the strongest naval power of the time, was the second, and in a few short years

all the world's navies were equipped with torpedoes. One of the torpedo's main advantages was that even small boats
could pack a punch comparable to big ships, which led to the development of a new class of ships—the "torpedo boat

destroyer"—which eventually became the "destroyer." The Royal Navy was the first to fire a torpedo in anger, in 1877,

against some Peruvian rebels. It missed, but it was enough to scare the rebels away.

Toward the end of the nineteenth century, the torpedo was improved. Its original source of propulsive power,

compressed air, was replaced by an internal combustion engine that received oxygen from a tank of compressed air.

This was a major improvement but had a major drawback: Beside oxygen, air consists of 80 percent nitrogen, which
does not contribute to the combustion and thus is exhausted as a visible wake of bubbles. This sometimes enabled a

ship to avoid the torpedo by a quick maneuver. Everybody was looking for something better.

Replacing the air in the tank with pure oxygen, or high-concentration peroxide (H2O2), which the Germans tried,

would have solved two problems. It would have increased the amount of oxygen in a given air tank, and since all

combustion products were water-soluble, the bubbles would have been eliminated. However, the proximity of pure

oxygen to grease and moving parts is an invitation for uncontrolled combustion, especially on surface ships engaged

in combat.

Experimentation with oxygen was undertaken by several navies, and on the entrance of the United States into World

War II, such torpedoes were at various stages of testing. However, Admiral King, the U.S. Navy's chief of naval

operations, believed such research would interfere with the production of standard torpedoes and assigned it the
The Japanese, in their effort to achieve excellence, were aware of the dangers but decided that the advantages of oxygen technology surpassed its disadvantages. They developed several versions of this torpedo, to be launched from surface ships, submarines, and aircraft. Thanks to the use of oxygen, these torpedoes were faster, had more than double the range, and carried a heavier warhead than any comparable Western torpedo. After the war, the Japanese also reported that they had no shipboard accident with these torpedoes (Blair 1975, 279–80).

The Japanese were very careful to make sure that no such torpedo fell into the wrong hands. This policy sometimes caused large numbers of ships to search for lost practice torpedoes, which were supposed to surface after their run (Lowry and Wellham 2000, 38). Nevertheless, their security sometimes failed. Luckily for them, the Americans did not notice.

In 1934, the U.S. Office of Naval Intelligence (ONI) translated a Japanese article that stated "our latest torpedoes ran with practically no track." One of the officers who read that passage highlighted it, but there is no evidence that ONI pursued the matter further (Mahnken 2002, 70). A worse security leak occurred several years later.

At the end of 1939 or the beginning of 1940, the American naval attaché in Tokyo was approached in his tennis club by a local medical student who turned out to be Chinese. The man, angered by Japanese atrocities in China, told the American that the Japanese navy organized tours for students in order to encourage a national spirit and increase recruitment. The American asked some specific questions, and on their next meeting the man told him that the Japanese had developed an oxygen-propelled torpedo and cited its performance, which surpassed anything available in the West (Mahnken 2002, 70–71). The naval attaché forwarded a report to Washington, and although the range was understated by the Chinese student, it still caused a stir at ONI. A copy was forwarded to the Bureau of Ordnance, but they declared that such a weapon was impossible (Mahnken 2002, 71). They probably understood that to obtain such performance the torpedo had to utilize oxygen technology, as the Tokyo report clearly stated. But since the United States and Britain were struggling with this technology, they assumed the Japanese could not have perfected it on their own. The Bureau of Ordnance experts preferred to consider the report a mistake rather than face the spectre of Japanese technological superiority. Ironically, the Japanese developed this technology because of a mistaken belief that the British had already mastered it (Mahnken 2002, 71n101).

Armed with the judgment of the Bureau of Ordnance, ONI filed away all reports about oxygen-powered torpedoes and abandoned pursuing any further "rumors" about advanced Japanese torpedoes.

In response to the Guadalcanal landing and in an attempt to hit American supply ships in the area, the Japanese sent in a task force of cruisers and destroyers. In a night battle (the Savo Island Battle), it attacked and defeated a similarly sized American force in what was later described as the worst defeat in battle of the U.S. Navy, which lost four cruisers and a destroyer against no losses and only slight damage to the Japanese. It was the first in a series of night battles in which the Japanese fired long-range torpedoes at ranges far longer than the range of their or American guns.

In the beginning of 1943, such a torpedo, called the Long Lance, washed ashore at Cape Esperance on Guadalcanal, was taken apart, and its data was sent to Pacific Fleet intelligence, but nothing except rumors filtered back. In a meeting preparatory to one of these battles (Kula Gulf), the captain of one American cruiser who had heard the "rumors" warned the presiding admiral not to approach the Japanese to less than ten thousand yards. The admiral, who believed that a submarine sank one of his ships in a previous engagement, dismissed the story as "scuttlebutt" (Morison 1949, 196). In the ensuing battle, this captain’s ship, in addition to a destroyer, was sunk.

The U.S. Navy was aware of Japanese emphasis on night fighting, which reduced the advantages of American material superiority (Mahnken 1996, 435). This possibility was already exercised in 1933 in an American war game in which the American force was defeated by a torpedo attack, nine years before a Japanese admiral actually did this for real. (A night gun battle could not be efficient, let alone decisive, without radar.) Surprisingly, the Americans did not ask themselves whether the real-life Japanese (not those in the war game) would look for other means to circumvent their inferiority in radar technology.

And there was another failure, that of not realizing that the enemy thinks in a different way. In the United States, it was thought that radar developments would enable gun battles at night, and this might have led to the implicit assumption that when the Japanese would catch up in radar technology, naval battles would revert to gunnery, including at night. But apparently the Japanese understood early the advantage the Long Lance conferred on them. Their doctrine thus called for a night battle, initiated by torpedoes fired from cruisers and destroyers, and a daylight mopping up by guns. For this purpose, they equipped many destroyers and cruisers with large numbers of these torpedoes, and they even converted two cruisers to “torpedo cruisers,” which carried dozens of them (Mahnken 1996, 435).

[1] The Type 93, designated for Imperial Japanese calendar year 2593) was a 61 cm (24 in)-diameter torpedo of the Imperial Japanese Navy (IJN), launched from surface ships. It is commonly referred to as the Long Lance by most modern English-language naval historians, a nickname given it after the war by Samuel Eliot Morison, the chief
historian of the U.S. Navy, who spent much of the war in the Pacific Theater. In Japanese references, the term Sanso
 gyorai, lit. "oxygen torpedo") is also used, in reference to its propulsion system. It was the most advanced naval
torpedo in the world at the time.

French Naval Technology 1669-1716

Posted on February 9, 2019 by MSW
The French Navy in the seventeenth and eighteenth centuries differed in some significant ways from its contemporaries across the Channel or in the Netherlands, whose vessels and naval structures have been described in other volumes in this series. Perhaps the most crucial differences between French and other navies’ ships – certainly in the period before 1689 – were in the structural levels of the various ships of the line of battle (vaisseaux in French), and in the mixed calibres of cannon which armed these decks.

The Small Three-decked Ship of the Line

While there were certainly small ships with three continuous gun decks in the other major navies (in this article we use the term ‘gun deck’ to identify all the continuous cannon-bearing decks running from stem to stern, rather than simply the British practice of reserving the term for the lowest of these decks), mid-seventeenth century French practice was more widespread in building three-decked warships with as few as fifty guns. We exclude from our definition the fore and aft superstructures above the upper continuous deck – the forecastle (where such existed), quarterdeck and poop as usually described. Note the French did not employ the translations of the terms ‘lower deck’, ‘middle deck’ and ‘upper deck’; instead they referred to these deck levels as the ‘first deck,’ ‘second deck,’ and ‘third deck’ for three-deckers; as English-speaking readers would not be familiar with this practice, we have retained the more easily understood terms in this book. But we must caution the reader that the French definition of a three-decked ship differed markedly from that employed by the English.

On most three-deckers (prior to 1689), the upper gun deck was not armed with a continuous battery of cannon, but was divided in the waist of the ship. In some ships there was a physical continuous deck at this level (to cover and protect the men on the middle deck below), with continuous bulwarks along the sides (but no gunports), and supported below by transverse deck beams across the full width of the ship to provide structural strength; these ships carried no guns at this level when built, but in 1690 surviving ships of this grade received extra guns to give them a full UD battery.

In other ships, there was a physical gap at the waist, so that the central portion of the middle deck was open to the elements; on a number of ships, this gap was filled by a residual structure (a centreline gangway termed a ‘flying bridge’) linking the fore and aft sections of this deck. This structure could be (and frequently was) removed in operational practice, turning the type into what would by comprehended by the English as a two-decker. Nevertheless, the French Navy categorised all these ships officially as ‘three-deckers’, and described their non-continuous upper decks as the ‘third deck’. This led to some confusion between the navies, as in 1672 when, during a period of Anglo-French alliance and co-operation, a small French squadron visited Portsmouth, consisting of the 70-gun ships Superbe, Royal Thérese (exParis) and Magnanime.

The main exceptions (prior to 1689) among 1st Rank ships were the massive vaisseaux du premier rang extraordinaire – those few vessels of 100 guns of more, which carried three full tiers of guns, plus smaller guns on their forecastles, quarterdecks, and in some cases poops.

These small three-deckers were eliminated in stages. On 22 March 1671, a Regulation was laid down decreeing that ships with fewer than 70 guns should in future by built as two-deckers. In 1689 a fresh decree extended the Regulation to cover all new ships with fewer than 80 guns. Obviously, these regulations applied to new construction rather than to existing ships. In some cases, it was possible to convert an existing three-decker into a two-decker by the simple process of dismantling a ‘flying bridge’. On other vessels, a more comprehensive restructuring was required, and clearly on many vessels no changes were carried out and vessels remained three-deckers until the end of their lives. After 1689 all new three-deckers carried three full decks of guns, and none carried fewer than 80 guns.

Mixed Calibres on Gun Decks

The other significant difference, not always clear from certain writings, is that the lower – and on three-deckers the middle – decks on almost all pre-1689 French warships carried a mixture of calibres. The practice was clearly defined in the appropriate regulations, and there seem to have been few exceptions. Thus, a typical three-decker might have had a combination of 24pdr and 18pdr guns on its lower deck, and a combination of 12pdr and 8pdr guns on its middle deck, with 6pdrs on the upper deck (and sometimes 4pdrs on the poop, as a 4th tier). At some date before 1689, single calibres on each deck were adopted, and these became general after 1689 for new construction (and for refitting some older ships), although some older vessels were never re-armed.

Changes in Ship Rankings, 1669-1716

A major complication in determining which chapter should record details of individual ships is that the French Ranks were subject to frequent alteration, with ships being moved from one Rank to another and often back again. This was primarily true with the seventeenth century Ranks, but re-classing also took place during the eighteenth century. This was also a factor with the British Navy, but its more extensive employment by the French may make it difficult to
locate a particular ship. In general, it is preferable to describe a ship under the Rank it held when it first entered French naval service, but the position of a ship can be judged differently in Rank as it more helpful to record the development of a particular ship type. There can be no absolute rule adopted in this matter.

Appearance and Design

Further constructional factors contributed to differences between most French-built ships (we shall ignore here French-operated ships built abroad or captured from other countries) and those of other navies. French ships were generally larger, but more lightly built; among smaller ships, this is because they were not expected to remain at sea for such protracted periods as the ships of the maritime powers. It meant also that they tended on average to be faster.

The decoration of French ships, particularly the stern of major ships, was both more prolific and more formalised than in other navies. Under Louis XIV in particular, the carving and painting adorning their structures was designed to be more magnificent and more impressive than that of their likely opponents. The figureheads and sterns were distinct in their iconography and in the skills of their artwork. Many of the artists and sculptors who created the seventeenth century opulence of Versailles and Fontainebleau were equally employed in creating masterpieces afloat. Louis XIV and Colbert established sculpture academies in the three main dockyards, whose graduate craftsmen brought to life the designs of Pierre Puget and others.

The ostentatious decoration, particularly the most ornate sculpture which graced the bow and stern of each ship during much of the seventeenth century, was subject to radical pruning as the century neared its end. The decorators and sculptors, all gifted and often celebrated artists, outdid each other and indeed themselves to satisfy the vanity of their monarch; but the actual ship commanders, viewing the encumbrance and the fire danger of the ornamental work when at sea – particularly in action – strongly opposed the scale of the decoration, and often took steps to reduce it. The celebrated Pierre Puget, for example, would have been horrified to know that much of his careful artistic work was apt to be quietly jettisoned by a captain as soon as it was out of sight of the dockyard. Obviously this could not happen to the fleet flagship, which were likely to be visited by Louis and his senior ministers; but such carvings clearly suffered in action – witness the description of the ruined state of the magnificent stern sculptures of the Soleil Royal when she was grounded in Cherbourg after the Battle of Barfleur (where she would be burnt in a fireship attack a few days later).

Ordnance

The principal weapon carried by all naval ships during this period was the smooth-bore cannon of varying sizes and weights mounted on a truck (wheeled) carriage. All French guns were classified according to the weight of the spherical solid shot that they could fire, but they could also be separated into those manufactured from bronze (fonte verte) and those cast from iron. During the seventeenth century, the limitations of foundry technology means that the heavier pieces could only be manufactured in bronze, although this situation changed significantly, when iron 24pdrs and 36pdrs (the abbreviation `pdr' signifying `- pounder' is used throughout this article) began to be introduced in 1688 and 1691 respectively. Nevertheless, bronze guns remained the preference, and by 1689 it was decreed that the guns in ships of the 1st Rank should all be of bronze.

Colbert’s Navy inherited in 1661 a variety of cannon of at least seventeen different calibres, a confusing situation and one which greatly hampered maintenance and supply of ammunition. A start was made in 1661 by restricting the number of calibres to seven, although the changeover took time, and the last ‘non-standard’ calibre weapons did not disappear until about 1676.

<table>
<thead>
<tr>
<th>Calibre</th>
<th>English units</th>
<th>Bronze</th>
<th>Iron</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>36pdr</td>
<td>38lbs 13.6oz</td>
<td>13</td>
<td>-</td>
<td>13</td>
</tr>
<tr>
<td>24pdr</td>
<td>25lbs 14.4oz</td>
<td>106</td>
<td>-</td>
<td>106</td>
</tr>
<tr>
<td>18pdr</td>
<td>19lbs 6.8oz</td>
<td>85</td>
<td>66</td>
<td>151</td>
</tr>
<tr>
<td>12pdr</td>
<td>12lbs 15.2oz</td>
<td>87</td>
<td>146</td>
<td>233</td>
</tr>
<tr>
<td>8pdr</td>
<td>8lbs 10.1oz</td>
<td>88</td>
<td>99</td>
<td>187</td>
</tr>
<tr>
<td>6pdr</td>
<td>6lbs 7.6oz</td>
<td>12</td>
<td>19</td>
<td>31</td>
</tr>
<tr>
<td>4pdr</td>
<td>4lbs 5.1oz</td>
<td>3</td>
<td>19</td>
<td>22</td>
</tr>
</tbody>
</table>

It can be seen that the supply of cannon at this time was barely enough to arm more than a few ships. Colbert’s ambition to create within a few years a Navy of some 120 vessels (an aim which he achieved by 1671) required an equal effort in gun manufacture. Including the non-standard calibres the Navy’s inventory rose to a total of 5,090 guns in 1671. During the next quarter-century the inventory almost doubled, reaching its peak of 9,514 guns (including 681 interrompus, probably unfit for service) in 1696. The other main development during this period was the
development of the ability to manufacture large calibre guns of iron (24pdr in 1688 and 36pdr in 1691), with the subsequent decline in the production of bronze guns and the near-disappearance in the inventory by 1696 of bronze guns smaller than 18pdr. The following quantities of guns of the standard calibres were available in 1671 and 1696:

<table>
<thead>
<tr>
<th>Calibre</th>
<th>1671 Bronze</th>
<th>1671 Iron</th>
<th>1671 Total</th>
<th>1696 Bronze</th>
<th>1696 Iron</th>
<th>1696 Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>36pdr</td>
<td>64</td>
<td>–</td>
<td>64</td>
<td>405</td>
<td>214</td>
<td>619</td>
</tr>
<tr>
<td>24pdr</td>
<td>252</td>
<td>30</td>
<td>282</td>
<td>432</td>
<td>554</td>
<td>986</td>
</tr>
<tr>
<td>18pdr</td>
<td>391</td>
<td>446</td>
<td>837</td>
<td>315</td>
<td>1,256</td>
<td>1,571</td>
</tr>
<tr>
<td>12pdr</td>
<td>372</td>
<td>1,049</td>
<td>1,421</td>
<td>12</td>
<td>1,743</td>
<td>1,755</td>
</tr>
<tr>
<td>8pdr</td>
<td>315</td>
<td>828</td>
<td>1,143</td>
<td>3</td>
<td>1,571</td>
<td>1,574</td>
</tr>
<tr>
<td>6pdr</td>
<td>105</td>
<td>487</td>
<td>592</td>
<td>3</td>
<td>1,508</td>
<td>1,511</td>
</tr>
<tr>
<td>4pdr</td>
<td>39</td>
<td>195</td>
<td>234</td>
<td>8</td>
<td>795</td>
<td>803</td>
</tr>
</tbody>
</table>

By the early 1690s the 36pdr had become the standard heavy weapon of the battlefleet. The Ordinance of 15 April 1689 specified a uniform armament of bronze 36pdr on the LD of first rank ships of 1690, and increased production of these weapons was soon followed by the introduction of iron 36pdr which gradually supplanted them.

Besides conventional cannon, two other items of ordnance deserve mention (other than small arms). The pierrier (anglicised to ‘perrier’ in British usage, although this was also called a ‘swivel’ by them; but the Ordnance Office generally called them ‘bases’ or ‘murderers’; the Spanish called them ‘pedreros’, while the Dutch called them ‘kamerstukken’, or chamber guns) was – as its name implies – originally evolved to fire stone projectiles rather than metal ones. The term in English originally referred to weapons (of up to 24pdr calibre) firing stone shot. By the mid-seventeenth century the larger calibres had become obsolete, but the pierrier survived as a lightweight short-barrelled anti-personnel weapon, usually fitted into a metal stock (between the arms of which it could be elevated or depressed), in turn mounted on a swivelling base on an upright wooden post which was integral with a ship’s structure. By the 1660s they used shrapnel ammunition in removable chambers (usually 8 per gun), which were loaded in advance and could be removed and replaced in a few seconds, making quick-firing guns. The name pierrier was latterly employed by the French as a term by which to describe all their light swivel-mounted guns.

The other item of heavy ordnance was the sea mortar. This was adopted in the early 1680s as a shore bombardment weapon in vessels specially designed for the purpose. Clearly not applicable for ship-to-ship combat, the mortar-bearing vessel (usually constructed as a galiote) was the seventeenth/eighteenth century version of the twentieth century monitor. Whereas mortar vessels in the English Navy were built with mortars fitted along the centreline of the vessel, usually one ahead of and one aft of the mainmast, in French service the mortars were carried in pairs, mounted side by side before the vessel’s mainmast to fire forward over the bows. The weapons were fixed in place, and could not be trained to either side. Furthermore, there were initially cast with an integral base-plate from which they could not be moved, and fixed into the mortar vessel’s structure with a fixed elevation of 45 degrees. Consequently, they could not alter their elevation, and the sole means of changing their range was by varying the size of the powder charge used. Later in the eighteenth century mortars were fitted on mountings that could be trained and elevated.
The action at La Hogue in May 1692 formed a crucial scene in the wider context of the Battle of Barfleur. This was a naval battle of the War of the League of Augsburg [Nine Years’ War], 1689-97, fought between an Anglo-Dutch and a French fleet. It was not finally brought to a conclusion until 24 May in the Bay of La Hogue, in the course of which the French flagship ‘Soleil Royal’ as well as the ‘Triomphant’ and the ‘Admirable’ were burned by the English. The centre of this dramatic scene is occupied by a group of six French ships burning. A seventh is shown burning on the shore. They have been attacked by the boats of the Anglo-Dutch fleet which are also attacking another group of ships further round the Bay of La Hogue, one to the left which is also burning. On the extreme left in the distance the Allied fleet can be seen at anchor. In the right background a third lot of shipping is burning near a town. An odd feature of the picture is that two of the ships in the nearest group wear white flags with a blue cross, a flag associated with 17th century French merchant ships. The painting is signed ‘Diest fe.’ Diest, Adriaen van Credit National Maritime Museum, Greenwich, London, Caird Collection

Until the Glorious Revolution of 1688 in England installed William of Orange as King of England, the French Navy had few issues to plan for as the Dutch were only aggressive when France chose to start a war (mainly on land), while the English were allied with France for much of the time. The events of 1688 changed this, uniting the two maritime powers, and for the first time in decades threatening a challenge to the dominant French superpower. Forthwith the role of the French Navy altered from supporting the army in campaigns against the Dutch to safeguarding French commerce against the likely aggression of the combined Anglo-Dutch forces. A building race ensued, while at sea the Navy began its campaign by a successful operation to land and supply the army of King James in Ireland. This culminated in the inconclusive Battle of Bantry Bay in May 1689, an action which led to a formal declaration of war.

France rapidly consolidated its battlefleets, bring the Toulon-based Flotte du Levant around to the Atlantic coast and joining the existing Flotte du Ponant at Brest. By 1690 France was clearly on its way to equalling, if not overtaking, the combined strengths of the allied English and Dutch Navies in the Channel. William of Orange’s priority had been to land his ground forces at Carrickfergus in June 1690, leading to his success in defeating James at the Battle of the Boyne on 11 July. Meanwhile Louis ordered his Vice-Amiral du Ponant, Comte de Tourville, to enter the Channel with his 84 ships (and the 13 galleys under the Chevalier de Noailles).

His initial remit had been to attack the English at Plymouth, Torbay and Portland, and then to attack the enemy’s main base at Portsmouth before proceeding to the Straits of Dover. However, these instructions were later amended by Louis, instructing Tourville to seek out the enemy fleet and do battle wherever the opponents met. A major battle in the Channel (off Beachy Head – known to the French as Béveziers) on 10 July pitted 70 French vaisseaux (plus 5 frégates légeres and 18 fireships) against 34 English and 22 Dutch ships. The English lost only one ship (the 70-gun Anne) while the Dutch lost a total of 7 ships and 3 fireships. While most English ships were undamaged, the majority of the remaining 15 Dutch ships were severely damaged and required dockyard repairs before they could face the French again. The battle demonstrated the capabilities of the French fleet; its victory in that battle gave the French control of the waterway for almost two years.

Seignelay, Colbert’s son and successor, died in November 1690. His replacement, the Comte de Pontchartrain (Louis Phélypeaux), who was also the Controleur général des finances, began by continuing Colbert’s strategy, but lacked Seignelay’s prime interest in the Navy and long awareness of naval affairs. The French naval campaign of 1691 was
dominated by the ‘Campagne du Large’; Pontchartrain’s instructions to Tourville, issued on 26 May 1691, instructed the latter to cruise for three months in the Western Approaches (the entrance to the Channel) and to try to capture the homebound merchant fleet en route from Smyrna (Izmir). The French fleet, comprising 73 ships (plus 21 fireships) sailed from Brest in June and returned in August from this ‘distant cruise’ without fighting a fleet action, but since 1690 the Allied strength had improved both in quantity (92 ships) and in quality. The French advantage was lost by 1691. In 1692, without waiting for the completion of the major battlefleet units under construction, Louis ordered the fleet’s commander, Comte de Tourville, to put to sea and challenge the Allies, even though the French at that time were numerically inferior to their opponents.

A realisation by Louis soon after of the tactical error came too late, as Tourville had followed his orders, and the countermanding message from Louis failed to arrive in time. The resulting contest off Barfleur resulted in a bruising defeat for the French, even if no ships were lost in the actual battle. The retreating French fleet was split up, with twenty ships making for the safety of Brest, while three heavily damaged ships, including Tourville’s flagship Soleil Royal, were stranded at Cherbourg, while another twelve sailed east and took refuge in the port of La Hougue. All fifteen were boarded and set on fire a few days later by the Allies.

The losses sustained to the battlefleet at Cherbourg and at La Hougue, while not in themselves catastrophic (French construction was able to fill the gaps with even more powerful 1st and 2nd Rank ships) had significant tactical and strategic consequences. The fact that the destruction at La Hougue had been carried out by ships’ boats rather than by fireships convinced the French that building new fireships was a waste of resources; those on order or projected were cancelled, and on the limited occasions France employed fireships thereafter, they were always converted purchases or prizes.

Notwithstanding the major efforts to achieve battlefleet superiority until 1692 (which ironically would have achieved success by 1694 if continued), Louis XIV was always more concerned with continental strategy than maritime dominance, and Pontchartrain’s views were closer to the King’s than Colbert’s and Seignelay’s commercial and naval strategy. During the financial crisis of 1693–94, Pontchartrain ceased ordering large battlefleet units, and in October 1693 wrote to the intendants at each major dockyard to tell them that no new battlefleet vessels were to be begun, although those already building could continue. The procurement strategy turned instead to vessels which – together with French privateers – could disrupt English and Dutch commerce. Indeed, as part of this strategy, a considerable number of battlefleet units were loaned out to partnerships put together for privateering on a strictly commercial basis. While causing concern in the allies’ mercantile interests, this was never enough to affect the outcome of the war.

Moreover, it was now realised that France’s strength in naval construction could be undone if their Ponant and Levant Fleets were kept separate. Initially, the allies maintained a posture of concentrating warships in the Channel, to ward off invasion attempts and control commerce, a strategy held since Elizabethan times; this left France, even with its (temporarily) reduced naval strength, in control of the Mediterranean. William III adopted a policy, against the urging of his Council and naval commanders, that would challenge France in Mediterranean waters and – more importantly – would deter any attempt to deploy the Levant Fleet northwards. He dispatched an Anglo-Dutch fleet (under Adm John Berkeley and Lt-Adm Philips van Almonde) into the Mediterranean in 1694, and ensured that it wintered there – in Cadiz Bay, where an English base was established to shelter and repair the fleet. As a consequence, the Levant Fleet was confined to port at Toulon, or at best able to operate in the Western Mediterranean only. And as a result, maintaining control of the Straits of Gibraltar became a permanent aim of the English.

Pontchartrain’s son, Jérome Phélypeaux, the new Comte de Pontchartrain, was awarded the survivance of his father’s office three years later. When Louis de Ponchartrain received the top-ranking position of chancelier de France (Minister of Justice), Jérome in September 1699 became Secretary of State for the Navy, but with only the mere addition of the portfolios of the Colonies, the Sea Fishing, the Maritime Trade and the Consulates: therefore, he was to become the politically weakest Secretary of State for the Navy of the reign.

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Using the “Eighty-Eight”

Posted on February 8, 2019 by MSW
In the shimmering morning heat on 15 June 1941, the slow-moving British Matilda “infantry” tanks were waved forward towards the Halfaya Pass, which guarded the Libyan border from British attack. Soldiers of the 11th Indian Brigade were walking behind the Matildas, confident the heavily armoured tanks would provide protection from anything the Germans could throw at them. The British Operation Battleaxe appeared to be going to plan.

Waiting for the 11th Indian Brigade and Matildas were 13 88mm flak guns dug into undulating desert terrain and camouflaged with netting. When the first Matildas hit a hidden minefield and started to have their tracks blown off, the time was ripe for the German gunners to open fire. One squadron of the 5th Royal Tank Regiment was destroyed in the first salvo and the rest of the regiment was soon in retreat. Further attacks by the British 4th Armoured Brigade fared little better. The Matilda’s 2-pounder cannons did not have the range to reach the German guns, which were easily picking targets off at more than 1500m (1640yd) range. Even if they could have closed on the German position, the British tanks lacked high-explosive shells because their primary task was to deal with enemy anti-tank gunners by using their machine guns.

In the space of four days the British lost 123 out of 238 of their tanks and failed to budge the Germans from Halfaya Pass. The battle forever destroyed the Matilda’s reputation for invulnerability, and soon Allied tank crews came to fear the weapon they called the “Eighty-Eight”. To their German crews, they were nicknamed the “Acht-Acht” and their presence on the battlefield was a great morale booster. Not only did they keep Allied aircraft at bay, but it was very reassuring for German soldiers to know that they were protected by a weapon that could also defeat any Allied tank. For a gun that was supposed to be an anti-aircraft weapon, the fact that the “Eighty-Eight” should achieve fame as an anti-tank gun was no surprise to its designers.

Under the terms of the 1919 Versailles Treaty that ended World War I, Germany was denied the right to possess anti-aircraft artillery. The army of the new Weimar Republic, the Reichswehr, was not going to let such legal niceties get in the way of its plans to develop new weapons. It started to fund the famous armaments firm, Krupp, to set up a secret research base in Sweden in cooperation with the Bofors company. In return, Bofors was invited to set up a branch office in Berlin that was manned solely by Germans. Throughout the 1920s the German designers worked away, preparing for the day when they could openly return to business as usual. Krupp and Rheinmetall were asked towards the end of the decade to design a new anti-aircraft gun, but it was not until 1931 that a satisfactory product was ready. This experimental 88mm gun featured many of the characteristics of the weapon that would be famous in World War II: it had a cruciform wheeled carriage and an 85-degree elevation to fire at aircraft. To fire, the cruciform carriage was lowered to the ground and two elevating side legs dropped to form a firm base. The gun also had a 360-degree rapid traverse. After the rise of Hitler in 1933, Germany reneged on the Versailles armaments restrictions and Krupp was ordered to begin production of its weapon, designated the 88mm Flak 18.

The Flak 18

The Flak 18 was a hardy design. It was transported on the Sonderanhänger 201 limbers (two two-wheeled sets), and when deployed for firing stood on a cruciform platform comprised of four legs horizontal legs meeting at the central gun pedestal. This design gave the gun a 720-degree traverse; elevation was from minus 3 degrees up to 85 degrees. The gun itself had a single barrel held within a jacket, and also a novel “semi-automatic” breech system that automatically ejected spent shell cases. This latter features, along with the unitary cartridge design of the 88mm’s shells, meant that over 15 rounds a minute could be fired by an experienced crew in action – heavy firepower indeed.

The Flak 18 fired armour-piercing or high-explosive shells at a muzzle velocity of 820mps (2690fps) to a maximum ceiling of 9900m (32482ft). However, it didn’t take long for artillery officers to realise that the gun could also perform well in an anti-tank role, with a maximum ground range of 14.8km (9.25 miles). Operational experience in the Spanish Civil War (1936–39) bore this out, and the Flak 18 began its career as an anti-tank weapon.
Improvements were soon made to the Flak 18 and its carriage, resulting in the Sonderanhänger 202. This received identical front and rear limber sections, each axle having four tyres set in double-wheel arrangements. A barrel support was added to each end of the limber (the Sonderanhänger 201 had only one barrel support) so the gun could be towed facing either direction. Performance was unchanged, but a new three-section barrel was designed. This allowed worn out parts of the barrel to be replaced, rather than the entire barrel itself, hence saving time and materials (rear rifled sections tended to wear out more quickly than muzzles, for example). This design modification also made it possible for units to replace barrels in the field; Flak 18s had to be shipped back to workshops behind the lines to have their heavy one-piece barrels replaced. There were various other changes affecting the sighting systems and other parts of the gun. The new gun and its mount was called the Flak 36. However, it should be noted that Flak 18 barrels often ended up on Flak 36 guns and vice-versa.

It was not long before further refinements were introduced to produce the Flak 37. The changes were mainly concentrated on the fire-control system, and allowed the gunlayer to more easily follow instructions supplied to him from a battery fire direction post. The barrel liner was also replaced with a two-piece unit, rather than the Flak 36’s three-piece barrel.

The Flak 18, 36 and 37 were the bulk of the 88mm gun variants deployed by the Wehrmacht in World War II, though there were a number of attempts to improve on this tried and tested design. Rheinmetall, the designers of the original Flak 18, developed the Flak 41; a version with a longer, five-part barrel. A few hundred were built, but technical problems and production delays meant they never replaced the older models in widespread use. It is thought that few, if any, Flak 41s were ever deployed outside of Germany. The Krupp design bureau also attempted to improve on Rheinmetall’s original design in the late 1930s and early 1940s. Krupp’s engineers drifted from their original brief and ended up effectively redesigning the entire weapon from scratch, though their final product – called the 8.8cm Gérat – was by most practical criteria identical to the Flak 37.

The success of the 88mm in the anti-tank role in North Africa and Russia, and the appearance of heavily armoured Soviet T-34s and KV-1s, made the Weapons Office look to producing a specialist anti-tank version. This was a pressing requirement because the existing 50mm and 75mm anti-tank guns were unable to deal with the new Soviet tanks. An important requirement was to reduce the silhouette of the weapon to make it easier for their crews to camouflage and conceal them. Krupp modified their design for the 8.8cm Gérat, adapting it for a purely anti-armour role and reducing the size of its recoil mechanism. The result was the PaK-43, which retained the cruciform carriage of the old 88mm, though this was soon superseded by the PaK-43/41 which was mounted on a single axis carriage, like a traditional artillery piece. While crews liked the killing power of the new anti-tank gun, they were less impressed by its size and weight – more than 6 tonnes (5.9 tons) – and soon nicknamed it the “barn door”.

The basic 88mm Flak 18 weapon weighed 7.1 tonnes (7 tons), which meant it was not easily manhandled once the crew had lowered it from its wheels. Just as famous as the weapon itself was its Kraus-Maffei SdKfz 7 halftrack prime mover, which could carry the gun’s crew and a basic load of ammunition.

Operating the weapon was a very labour-intensive process. A single gun was served by a crew of nine, which included a commander, layer to elevate the gun, layer to traverse the gun, a loader, four ammunition handlers, two fuse setters and a tractor driver.

Some of the first guns were sent to Spain with the German Condor Legion to protect the airfields used by General Franco’s fascist forces. When they ended up being used against ground targets, the Luftwaffe High Command realized that it needed to order armour-piercing rounds for the weapon and armoured shields to protect their crews from shell fire. These improvements were in hand when war broke out in 1939.

The weapon’s high velocity – 820m (2690ft) per second – was the key to its success in both the anti-aircraft and anti-tank roles when supplied with the correct ammunition. For anti-aircraft work, it was provided with time- and pressure-fused high-explosive shells to allow the crew to set the altitude at which the shells exploded. In the ground role, three main types of round were available. The Pzgr 39 armour-piercing, capped, ballistic cap (APCBC) round was the first round used and was later supplemented by the Gr 38H high-explosive anti-tank (HEAT) round, and Pzgr 40 armoured-piercing, composite rigid round, which had a tungsten core. With this ammunition an “Acht-Acht” could punch through 99mm (3.8in) of armour at 2011m (2200yd), which meant no type of Allied tank was safe until the arrival of the Soviet Josef Stalin tank in early 1944. Poorly armoured tanks, such as the Sherman and T-34, which had only 31mm (2in) and 47mm (1.8in) frontal armour respectively, were easy prey for the 88mm at ranges in excess of 3000m (3282yd).

Although a large number of “Flieger-Abwehr-Kanone” or flak units had been formed in World War I, Germany was banned from possessing air defence artillery by the Versailles Treaty. In secret the Reichswehr reformed its flak units in 1928, and disguised them as transport detachments and elements of the German Air Sports Union. Hitler’s rise to power in 1933 was quickly followed by the establishment of the German Air Ministry, which was a cover for the secret formation of the Luftwaffe. Responsibility for flak units was soon passed from the army to the Luftwaffe, because of the need to integrate anti-aircraft artillery with fighter defences. In only four years the flak branch was expanded to some 115 units, which had the job of defending airfields, key strategic locations and the field army. Two years into the
The pre-positioning of anti-tank ammunition near to the gun line was very important to ensure that a rapid rate of fire could be swept by fire, creating killing zones. The high silhouette of the 88mm flak gun meant weapons had either to be dug into pits, or hidden in woods and buildings to prevent them being spotted. Good concealment was essential to stop the attackers spotting the flak guns until they were well inside the kill zone and unable to escape. If the enemy were dug into pits, or hidden in woods and buildings to prevent them being spotted. Good concealment was essential to stop the attackers spotting the flak guns until they were well inside the kill zone and unable to escape. If the enemy broke through. Guns were to be sited to make maximum use of their long range, so clear fields of fire were a must. Overlapping fields of fire were also allocated to individual guns and batteries, so the whole of the front could be swept by fire, creating killing zones. The high silhouette of the 88mm flak gun meant weapons had either to be dug into pits, or hidden in woods and buildings to prevent them being spotted. Good concealment was essential to stop the attackers spotting the flak guns until they were well inside the kill zone and unable to escape. If the enemy spotted the flak guns too soon, then their artillery would fire on the flak batteries with deadly effect.

Flak regiments were not committed to the emergency anti-tank role without prior planning and reconnaissance. As a standard procedure, flak commanders would survey their sector of the front for possible firing positions in case enemy tanks broke through. Guns were to be sited to make maximum use of their long range, so clear fields of fire were a must. Overlapping fields of fire were also allocated to individual guns and batteries, so the whole of the front could be swept by fire, creating killing zones. The high silhouette of the 88mm flak gun meant weapons had either to be dug into pits, or hidden in woods and buildings to prevent them being spotted. Good concealment was essential to stop the attackers spotting the flak guns until they were well inside the kill zone and unable to escape. If the enemy spotted the flak guns too soon, then their artillery would fire on the flak batteries with deadly effect.

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On the Russian Front, German flak units increasingly took on more anti-tank duties as the weight of Soviet offensives established its reputation as a "bogey weapon" in the eyes of British tank crews. British tanks started "brewing up", forcing the rest to pull back. Rommel's aggressive use of the 88mm in North Africa protected the Afrika Korps' supply trucks. As the Grants got to within 1500m (1640yd), the 88s roared into life. The 135th Flak Regiment to steady the German line. Four 88mm guns were quickly formed into an improvised gun line to stop the British 7th Armoured Brigade in its tracks, after its commander had rashly ordered his tanks to charge headlong across the desert directly at the Germans. Only four 88mm guns were dug-in on the first day of the battle. This impressive display of firepower was just the morale boost the assault troops needed as they dropped their boats in the Meuse on 13 May. By the end of the afternoon Guderian had his bridgehead, and during the night the engineers had built the first of several pontoon bridges. The flak gunners moved two 88mms across the river just behind the first panzers and they were soon in action, knocking out French tanks sent to counterattack during the night.

The Battle of the Meuse

The first decisive intervention by "Acht-Acht" guns occurred in May 1940. Heinz Guderian's panzer corps raced to the River Meuse at Sedan to build the bridgehead needed to open a breach in French lines, allowing the panzers to race to the English Channel. Guderian, the father of the German panzers, had the Luftwaffe's Flak Regiment 102 attached for this operation, and gave it a key mission. Colonel von Hippel's regiment had been specially reinforced and trained for its part in an operation that was to turn the battle for France in Germany's favour.

Once the panzers had reached the river, infantry were ordered across in rubber assault boats to seize a bridgehead. French troops and guns emplaced in concrete bunkers high on the far bank were turning the German assembly areas into killing zones. Guderian had already thought about dealing with the French defences, and he had sent his flak gunners to Poland to practice putting shells directly through the firing ports of abandoned Polish bunkers. Covered by panzers, the 88mm crews rolled their guns up to firing positions on the river bank opposite the bridgehead, and started to pick off the French bunkers. In some places the flak gunners were less than 100m (109yd) from their targets, and the 88mm proved to be superbly accurate.

In emergency situations, a flak commander was usually the first officer on the scene with battle-winning equipment, so they assumed command of the action against the rampaging enemy tanks. Any infantry or troops on the scene subordinated themselves to the flak commander as part of ad hoc battlegroups. No matter how much forward planning had occurred, this was when the flak commander got to show his mettle. They often had to bring order to a chaotic situation, ensuring their guns were in position and fire discipline was maintained until the vital moment. This was a time for iron nerves.

Flak commanders identified key points to be defended and concentrated their guns there, to ensure that the defence line held whatever happened. They had to juggle their mission to provide air defence, with the need to counter breakthroughs of enemy armour. Often the requirements of both missions overlapped: for example, defending strategic bridges, railway lines or high ground. Movement to other key sectors on the battlefield was regularly rehearsed so flak units could rapidly move on receiving an accepted codeword.

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increased. The summer of 1943 saw a rejuvenated Soviet armoured force take the offensive after the German Kursk Offensive had been checked. Pre-positioned Soviet tank reserves were unleashed just as the German panzer spearheads had been worn down by anti-tank defences and minefields. With great skill, the Soviet High Command struck at the weak flanks of the German front and, within days, it had been shattered in several places north of Orel. Four Soviet tanks corps smashed through the German Second Panzer Army’s front and raced towards the key rail junction at Khotynets. Luftwaffe tank-busting planes and 88mm guns of the 12th Flak Division were the only things that could stop the hundreds of tanks surging southwards. Unless the rail junction was held, panzer reserves would be unable to reach the crisis zone.

Flak Against T-34s

Although the German fighter-bombers were able to shoot up an entire Soviet tank brigade, more T-34s continued the offensive. A battalion of 88mm guns, already on the move under the cover of darkness, was able to set up a gun line outside Khotynets. When the Soviets tried to stage a coup de main raid on the town they drove into a firestorm of 88mm shells and fell back. More attacks continued over a three-day period, but more “Acht-Acht” batteries arrived to bolster the German defence. Casualties were heavy among the flak gunners, who had to fight off the Soviets virtually unsupported by artillery or armour.

During this desperate battle the division claimed 229 tanks knocked out and ensured the safe arrival of panzer reinforcements, allowing the breaches in the front to be restored. The success of the 12th Flak Division validated the mass employment of the “Acht-Acht” as emergency anti-tank forces.

The next major test of the 88mm came in the summer 1944 on the Normandy Front. In late July the British massed almost 800 tanks around the city of Caen to punch a hole through I SS Panzer Corps’ front. A mix of Army, Waffen-SS and Luftwaffe 88mm flak and anti-tank battalions, with some 78 guns, were concentrated in this key sector. In spite of being on the receiving end of saturation bombing by 1000 Allied heavy bombers, the German defences were ready when the first wave of British tanks kicked off Operation Goodwood early on 18 July. The British 11th Armoured Division was sent forward through a 4.8km (3-mile) wide bridgehead. Backed by Tiger and Panther tanks of the Waffen-SS Leibstandarte Panzer Division, the surviving “Acht-Acht” gunners emerged from the ruins and started firing into the huge column of British Shermans. By the end of the day more than 300 British tanks were burning in front of the German lines, many of which fell to 88mm flak and PaK-43/41 guns. A renewed attack the following day only resulted in 100 more British tanks being destroyed.
In 1939, however, colder economic winds began to blow. Greek Dictator Ioannis Metaxas poured every available drachma into building up Greece’s industry and military establishment, and as a result, the country’s borrowing bill soared. Between 1936 and 1940 some fifteen billion drachmas had gone into rearmament. Greece was sinking into a sea of red ink. Whereas in 1933 Greece’s public deficit stood at 373 million drachmas, by 1937 it had yawned to 1.7 billion drachmas, dipping to 341 million in 1938 and climbing back up to 1.5 billion in 1939. In April 1939 the Greek government was paying out up to forty per cent on Greek state bonds, with jittery London lenders demanding sixty-five per cent. Britain’s credit institutions were fretting over Greek orders for warplanes and other military materiel, fearing that a European war might erupt before they could get their money back. Greece already had a shaky record of defaults going back to the 1840s. Greece’s neighbours to the north, meanwhile, were changing their stance in the face of the growing German menace. Bulgaria let its arms-limitation agreement with Greece lapse, while Italy delivered a nasty surprise by occupying Albania on Easter Monday 1939. In the circumstances Metaxas felt he had no choice but to accept an informal guarantee of Greece’s territorial integrity by Britain and France. Somehow, the London City lenders were fobbed off, but grumbling continued.

To aid national rearmament Metaxas promoted a domestic steel industry, though against the opposition of Britain and Germany which feared the loss of a market for their own steel. Some industries had to be bullied into building up national power.

The War Ministry made itself unpopular, for example, when it ordered the textiles industry to come up with nearly three million metres of khaki fabric for military uniforms at a price set by fiat. The dissident voices were silenced when the chairman of the League of Greek Industry (SEBB), Andreas Hadjikyriakos, was co-opted into Metaxas’ administration as national economy minister. Hadjikyriakos’ ministerial career was short-lived. In May 1937 the SEBB
Infantry and Colonel Roberto Gianani’s 32 Infantry crossed the frontier. On their left the Ferrara also advanced, with sheets of rain into Greek territory, while to the east the first two regiments of the Siena Division, Colonel Carloni’s 31 regiment, made choppy Ionian Sea, a regiment of the Raggruppamento del Litorale under Colonel Enrico Andreini pushed through Rossí’s Twenty-fifth Corps, dubbed the ‘Chamuria,’ advanced in the centre, while in the west, hugging the grey and sunlit mountains. But for two days the rain had come down in torrents, turning the dusty mountain tracks into brown quagmires sucking down boot and hoof. Ordinarily gentle mountain gullies became raging cataracts. Men and horses and mules struggled through the mire. But Visconti Prasca was unperturbed; bad weather, he figured, would be bad for the enemy as well. What he apparently failed to realize was that though mud and rain indeed affected all alike, they were immeasurably harder on an advancing army than on one in a defensive position.

When Visconti Prasca ordered his legions to cross the Greek border at 5.30 am, 28 October 1940, he found his first minesweepers and the ancient hulk of an armoured cruiser as a reserve) and the flimsy Royal Hellenic Air Force (underequipped Royal Hellenic Navy (all of ten destroyers, thirteen torpedo boats and six submarines, a handful of anti-aircraft units. The bulk of Greece’s rearmament, in fact, had overwhelmingly benefited the Army, with the divisions and one cavalry division, fifteen regiments of mountain artillery and five of field artillery, plus scattered anti-aircraft units. The bulk of Greece’s rearment, in fact, had overwhelmingly benefited the Army, with the underequipped Royal Hellenic Navy (all of ten destroyers, thirteen torpedo boats and six submarines, a handful of minesweepers and the ancient hulk of an armoured cruiser as a reserve) and the flimsy Royal Hellenic Air Force (barely 130 front-line aircraft) left to manage as best as they could.

When Visconti Prašca ordered his legions to cross the Greek border at 5.30 am, 28 October 1940, he found his first unexpected foe in the weather. Autumn in the Balkans can be a riot of gold and ochre-coloured forests wreathing the sunlit mountains. But for two days the rain had come down in torrents, turning the dusty mountain tracks into brown quagmires sucking down boot and hoof. Ordinarily gentle mountain gullies became raging cataracts. Men and horses and mules struggled through the mire. But Visconti Prašca was unperturbed; bad weather, he figured, would be bad for the enemy as well. What he apparently failed to realize was that though mud and rain indeed affected all alike, they were immeasurably harder on an advancing army than on one in a defensive position.

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Mitralexis, too, survived, having nursed his robust fighter to the ground with surprisingly minimal damage. Once minus the pilot who was apparently killed by Mitralexis’ initial burst – baled out. CantZ’s tail section. The impact sheared off part of one of the twin rudders, throwing the plane into a spin. The crew – found he was out of ammunition. His next act, witnessed by an amazed wingman, was to aim his PZL straight into the and sent a stream of 8mm bullets into it. Not seeing any immediate effect, he pressed the firing button again, but caught a three-engined CantZ1007 – a sinister-looking machine painted in lizard-like camouflage – in his gun-sight monoplane fighters sporting the blue and white Greek roundel climbed to meet them. Pilot Officer Marinos Mitralexis northwest, the Regia Aeronautica regularly bombed Greek strategic and civilian targets, making little distinction for the army in Epiros. The former was the task of the air force’s four pursuit mirai based (thanks to Metaxas’ artillery for the army in Epiros. The former was the task of the air force’s four pursuit mirai based (thanks to Metaxas’ foresight) mostly in central and northern Greece. While the army was trying to absorb the Italian incursions in the west, the Regia Aeronautica regularly bombed Greek strategic and civilian targets, making little distinction between them. On 2 November the pilots of 22 Pursuit Mira based at Thessaloniki were scrambled to meet a formation of Italian bombers of 50 Gruppo converging on the city at 20,000 feet. Eight Polish-built PZL24 monoplane fighters spotting the blue and white Greek roundel climbed to meet them. Pilot Officer Marinos Mitralexis caught a three-engined Canti1007 – a sinister-looking machine painted in lizard-like camouflage – in his gun-sight and sent a stream of 8mm bullets into it. Not seeing any immediate effect, he pressed the firing button again, but found he was out of ammunition. His next act, witnessed by an amazed wingman, was to aim his PZL straight into the Cant’s tail section. The impact sheared off part of one of the twin rudders, throwing the plane into a spin. The crew – minus the pilot who was apparently killed by Mitralexis’ initial burst – baled out.

Peasants in the Greek frontier villages rushed from their fields as the air shook with artillery fire and ran to huddle around their fireplaces. Only the lucky few with radios had any idea what was happening. Villagers gazed impassively at the Italians in their grey-green uniforms tramping southwards through the damp and narrow streets. The Italians were just the latest invaders of Epiros over the ages, after the Ottoman Turks, Slavs, Goths, Gauls and Romans. These, too, would come and go. Thanks to this history, each mountain village had its secret caves where the population could flee to if things got really rough.

Papagos, ready or not, had to deploy what he had, and fast. His defence plan included a transfer of the 13th and 17th Infantry Divisions from the Bulgarian border to beef up the 8th Division, plus 16 Infantry Brigade, though the units would need time to complete their transfer. These divisions would be under the ultimate command of I Corps in Athens, while the 2nd, 3rd and 4th Divisions would muster east of the Pindos mountain range to be sent to the front via Arta. Rather than split his forces to meet the two separate waves of invaders, Papagos risked temporarily giving up some Greek territory in order to maintain contact between his forces and forge a defensive wall of men. Even so, Papagos’ front was more than 240km across, the 8th Division alone responsible for some 100km. Time was impossibly short. National mobilization was still far from complete. Men would have to be called up, given basic training and sent into battle within days. Some of the delays in preparation had been understandable. Metaxas, for cogent reasons, hadn’t wanted to make the mobilization too obvious. Moreover, the Greek military had not fought a war since the demoralizing Asia Minor debacle of 1922, and as a result strategic and tactical thinking had not progressed much since then. For Metaxas, however, the period of agonizing uncertainty had come to an end, and he could throw himself into his task with a clear mind.

Bad weather over Albania and Northern Greece had grounded all the Regia Aeronautica units based in Albania. But those bombers based in southern Italy had no such impediment. Barely had Grazzi got back into his car after delivering the Duce’s ultimatum when a squadron of Savoia-Marchetti SM81s took off, appearing at 20,000 feet over the Royal Hellenic Air Force College at Tatoi north of Athens around lunchtime. The sirens sounded in Athens again around 9.30 am but no-one bothered to run to a shelter. The war was just too exciting. The college commandant, Group Captain George Falkonakis, thought the planes were Greek. Either the fine art of aircraft recognition had yet to be taught in Greece or it took time for the RHAF officer corps to realize that Greece was actually at war. Only when the first bombs came whistling down did he order the sirens to be sounded and his flying cadets to don their helmets and man the anti-aircraft guns. One of them was Constantine Hatzilakos, a keen student flier barely into his first year at the air force college, finally glad, as he put it much later, ‘to get into the fight’ even if not yet airborne. Pilot Officer Doros Kleiamakis, a young flight instructor, was in the air testing a French-made Bloch MB151 fighter when he puzzled over the black puffs dotting the sky around him. Realizing what was happening, he managed to land without getting hit by his own side’s anti-aircraft fire. Falkonakis’ delay in mobilizing the defences got him court-martialled.

On 1 November 1940 Metaxas personally ordered a night bombing attack on the Italian position at Doliaina, a few kilometres northwest of Kalpaki. It was the first time the RHAF had flown operationally at night. Three crews of Larissa-based 31 Bombing Mira (squadron) were selected. They were frankly scared as they climbed into the cockpits of their French-built twin-engine Potez 63s; none of them had ever flown a night mission, but Metaxas was adamant that it be done, even if it were to prove fatal. After a half hour’s anxious flight on instruments alone the mission leader, Group Captain George Falkonakis, thought the planes were Greek. Either the fine art of aircraft recognition had yet to be taught in Greece or it took time for the RHAF officer corps to realize that Greece was actually at war. Only when the first bombs came whistling down did he order the sirens to be sounded and his flying cadets to don their helmets and man the anti-aircraft guns. One of them was Constantine Hatzilakos, a keen student flier barely into his first year at the air force college, finally glad, as he put it much later, ‘to get into the fight’ even if not yet airborne. Pilot Officer Doros Kleiamakis, a young flight instructor, was in the air testing a French-made Bloch MB151 fighter when he puzzled over the black puffs dotting the sky around him. Realizing what was happening, he managed to land without getting hit by his own side’s anti-aircraft fire. Falkonakis’ delay in mobilizing the defences got him court-martialled.

The RHAF, in fact, had a dual mission on its hands: to defend Greek cities against bombing while acting as long-range artillery for the army in Epiros. The former was the task of the air force’s four pursuit mirai based (thanks to Metaxas’ foresight) mostly in central and northern Greece. While the army was trying to absorb the Italian incursions in the northwest, the Regia Aeronautica regularly bombed Greek strategic and civilian targets, making little distinction between them. On 2 November the pilots of 22 Pursuit Mira based at Thessaloniki were scrambled to meet a formation of Italian bombers of 50 Gruppo converging on the city at 20,000 feet. Eight Polish-built PZL24 monoplane fighters spotting the blue and white Greek roundel climbed to meet them. Pilot Officer Marinos Mitralexis caught a three-engined CanZl007 – a sinister-looking machine painted in lizard-like camouflage – in his gun-sight and sent a stream of 8mm bullets into it. Not seeing any immediate effect, he pressed the firing button again, but found he was out of ammunition. His next act, witnessed by an amazed wingman, was to aim his PZL straight into the Cant’s tail section. The impact sheared off part of one of the twin rudders, throwing the plane into a spin. The crew – minus the pilot who was apparently killed by Mitralexis’ initial burst – baled out.

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That same day Captain Luigi Mariotti was leading a dozen Fiat CR42s of 363 Squadriglia on a bomber escort to Thessaloniki when they were jumped by four fighters of 22 Mira. Sergeant Constantine Lambropoulos in his fighter engaged the Fiats but soon had the worst of the encounter. As bullets smashed into his plane from every side he tried to bale out but caught his flying boot lace in the cockpit. With the plane plunging down vertically, his chances of survival were rapidly dwindling to zero when a shell burst in the cockpit, snapping the lace and allowing him to fall free. Seconds later the plane disintegrated, and as Lambropoulos drifted down the Italians kept firing at him – a contemptible practice which sullies the otherwise impressive record of the Italian air force in the Greek campaign. He remained unpunctured, but his parachute had more than fifty holes in it.

Savoia-Marchetti SM79 bombers of 107 Gruppo based at Grottaglie raided Thessaloniki and Larissa, killing scores of noncombatants. CantZs of 47 Stormo, including bombers skippered by Mussolini’s two sons, Bruno and Vittorio, were met by defenders of 21 Mira but suffered no losses. In retaliation, British-made Bristol Blenheim IV bombers of the RHAF 31 Bombing Mira hammered the Italian air base at Korce inside Albania, killing nineteen Italian airmen in the base operations room.

The Regia Aeronautica’s bombers might fly blithely over Greek skies to bomb the towns and factories, but they seemed to be in short supply over the front itself. Though Greek sources mention waves of Italian bombers over the front, General Rossi, the Twenty-fifth Corps commander, fumed at the perceived lack of air support on 4 November after the failure of the first Italian attempt to break the line at Kalpaki. The Greeks, however, reported shooting down two Italian aircraft on 5 November, as Italian artillery renewed its bombardment of the Greek position. At about 10.00 pm the Siena and Ferrara divisions launched a fresh assault, backed by about sixty tanks of the Centauro. The attack was beaten back, with fifteen Fiats immobilized in the bogs of the Kalamos River.

That evening Rossi felt he had to give his battered units a breather. The staff of the 8th Division intercepted an Italian despatch that graphically described what the invaders were up against:

*The Greeks, known for their stubbornness and persistence, have since peacetime organized the naturally rough and uneven territory of Epirus with such method and diligence that every rock is an artillery nest and every cave a defensive bulwark. [The Greeks] are so fierce in battle that more and stronger means are required to drive them off.*

The RAF Arrives

The RAF put in a much-needed appearance to beef up the slender resources of the RHAF. On 3 November 1940 whatever Air Chief Marshal Sir Arthur Longmore, the RAF commander in the Middle East, could spare from his forces began landing at Eleusis and Tatoi fields near Athens. These were, initially, eight Bristol Blenheim I light bombers of 70 Squadron plus a few battle-worn and already obsolete Gloster Gladiators of 30 Squadron. They were later joined by four more Blenheim and Vickers Wellington bombers from 70 Squadron, which were at once sent into action to hit Italian supply ships in the Albanian port of Sarande, across the strait from Corfu. The question of accommodation became acute. Seven Greek generals had to give up their offices in the Grande Bretagne to RAF officers. The RAF commander in Greece, Air Commodore John D’Albiac, DSO, promised up to forty more bombers and thirty-five fighters, not to mention much-needed batteries of 37mm Bofors anti-aircraft guns for the RHAF airfields. Metaxas feared that not even that might be enough.

As the RAF began to bomb Italian shipping at Vlore and Sarande, the Greeks were cheered by news of the Fleet Air Arm victory off Taranto on 12 November, where the redoubtable British ‘stringbags’ – Fairey Swordfish torpedo-bombing biplanes – decimated the bulk of the Regia Marina’s heavy ships. But the RAF’s initial daylight raids on Vlore were proving costly. On one of the first such attacks on the air base at Vlore, three Blenheim Is of 30 Squadron were met by the Fiats of 364 Squadriglia. Captain Nicola Magaldi, the flight commander, drew a bead on the Blenheim skippered by Sergeant G. W. Ratlidge and raked it with fire, killing the upper gunner, Sergeant John Merifield. All three bombers, despite their extensive damage, managed to make it back to Eleusis. Merifield was given a hero’s state funeral in Athens, attended by the king and filmed by newsreel crews.

The appearance of the RAF meant that the Regia Aeronautica’s air superiority was now about to be seriously challenged. But 364 Squadriglia was in action again the following day, against a flight of 70 Squadron’s Wellingtons over Vlore. Lieutenant Alberto Spigaglia and Warrant Officer (Maresciallo) Guglielmo Bacci claimed credit for destroying two Wellingtons, those of Sergeant G. N. Brooks, which blew up in mid-air, killing all on board, and Flight Lieutenant A. E. Brian, two of whose crew parachuted into captivity. Greek anti-aircraft fire on 9 November downed and killed Second Lieutenant Pietro Janniello of 363 Squadriglia. Blenheim of the RAF’s 84 Squadron bombed the squadriglia’s base at Gjirokaster and were away before the base fighters could be scrambled properly.
The crash of the bombs falling on Athens' industrial districts and port of Piraeus, and the banging of anti-aircraft fire, became a daily backdrop to the lives of young Sotiris Kollias and the other villagers of Kalyvia. Sometimes the blasts would be loud enough to rattle windows. The village and its neighbouring communities, in fact, provided a refuge for the homeless of Piraeus and the bombed districts. 'There wasn’t a house that didn’t provide shelter to some family from Piraeus,' Kollias recalled. Not that Kalyvia itself was out of danger. Sotiris and his pals were playing in a field when an Italian aircraft roared overhead spraying the kids with machine-gun fire. By sheer chance no-one was hit.

Such hazards, however, were not much when compared with the growing jubilation among all Greeks as the Duce’s armies were being pushed back much sooner than anyone imagined. Greek state radio resounded to the sultry voice of singer Sophia Vembo, who had since 28 October turned her talents from romantic pop tunes to patriotic ditties. Even Italian songs were transformed into Greek musical weapons. For example, 'Regina Campanella' was re-worded in Greek to pour utter scorn on Mussolini, Ciano and anyone unfortunate enough to be wearing a grey-green uniform. It became an immediate hit on the radio and in packed theatres.
War has a way of masking the stage with scenery crudely daubed with fearsome apparitions.

Carl von Clausewitz, On War
weapons and warfare, siege — Modern scholars are unsure when the first sieges of fortified towns in Mesopotamia and surrounding regions took place. Most experts agree that the existence of fortified walls, especially brick and stone ones, around many early towns indicates ... Ancient Mesopotamia dictionary.