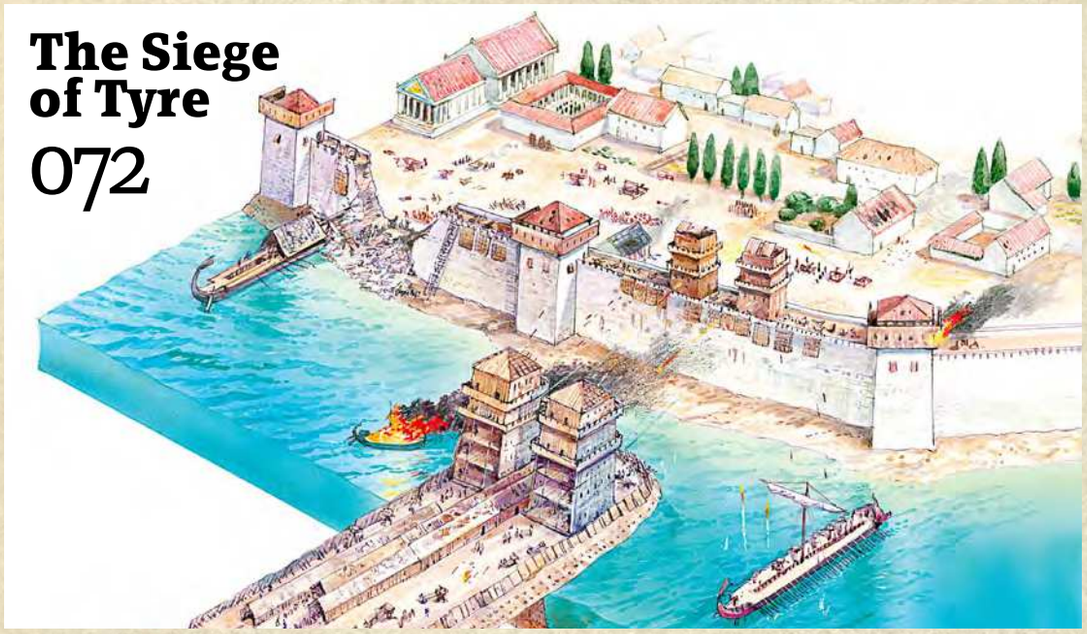
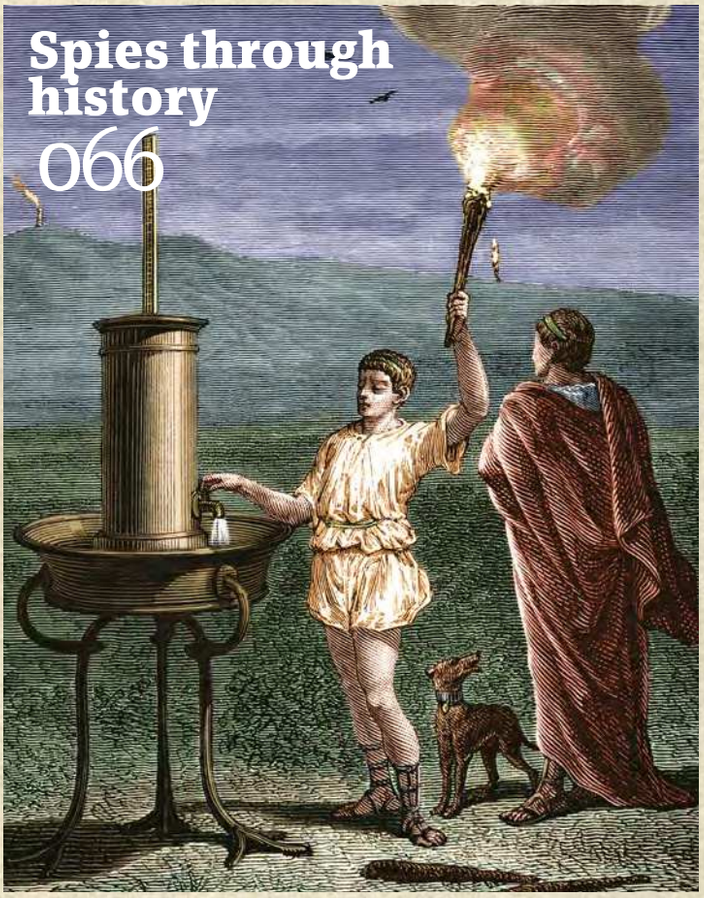
WEAPONS & WAR

074
Brutal battering rams

076
Meet the musketeers



The Siege of Tyre
072



Spies through history
066

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082
MH-60 Black Hawk

060
History's deadliest warriors

HISTORY'S DEADLIEST WARRIORS

Lethal fighters who could strike fear into the hearts of even the most battle-hardened enemy

Throughout history, many soldiers from across the world have been contenders for the title of the deadliest warrior, but who really was the most formidable? It takes more than just sheer strength or bloodlust to be considered a legendary fighter.

Most important of all is weaponry; even the toughest soldier can be defeated in a one-on-one dual by a rival with superior firepower. As the old adage goes, don't bring a knife to a gunfight, and the best fighters are always equipped for the job, whether it's a huge pitched battle or a covert operation. A popular theory as to why Custer's men were trounced at Little Bighorn was the fact that the Sioux warriors may have wielded superior rifles to the US Army.

Just as essential as having the right tools is using the right tactics. With a well-planned and efficiently executed strategy, soldiers can outmanoeuvre and outthink a numerically superior force or a physically stronger enemy. In a hypothetical battle between a samurai and ninja of Japan, for example, the use of underhand tactics could easily give the ninja an upper hand against a samurai bound to his moral code and obligated to fight with honour.

Finally, a deadly warrior must have the right attitude and appetite to emerge victorious. Whether it's to protect their homeland or simply earn a wage as a mercenary, a fighter with a purpose is much more dangerous. During the Crusades, Christians and Muslims fought to uphold their religious values and would take to the battlefield again and again in the name of their faith.

Ranging from ancient times to the modern era, read on to learn about some of the deadliest warriors in history. Any soldier would want these legendary fighters standing by their side on the eve of battle.

CIRCA 476-206 BCE

Qin soldier

The military that fought ruthlessly to unify China

The Qin Dynasty was a period of great progress for China. The new emperor Qin Shi Huang made a series of sweeping changes that unified the country and modernised its military. In came China's first professional conscripted army, staffed by formidable soldiers and led by skilled generals. Qin soldiers used some of the most advanced weapons during the era, from sharp iron swords to powerful crossbows.

Their role on the battlefield as shock infantry was supplemented by more heavily armed foot soldiers, as well as flanking cavalry and chariots. The warriors that battled on horseback were held in the saddle by a new invention, the stirrup, giving them greater balance than their adversaries. Some of their enemies were worthy foes, in particular, nomadic tribes from the north with mounted archers. But fuelled by a desire for conquest and loyalty to their emperor, the Qin often held their own in battle.

Notable battle... QIN'S WARS OF UNIFICATION 236-221 BCE

Hairstyle
A Qin soldier's hairstyle denoted rank as well as his unit. Braids in a leather cap were a popular choice that didn't obstruct the fighter in battle

Ribbons
The number of ribbons fastened to the chest plate was another way of indicating the soldier's rank

Bronze sword
Qin swords were originally made from bronze, but were later replaced with tough iron

Armour
Light robes, padded trousers and iron-riveted armour allowed the well-protected warriors to remain nimble

WEAPONS OF CHOICE
CROSSBOW, BRONZE SWORD

The Terracotta Army is made up of ceramic versions of Qin soldiers. The statues were buried with the emperor in his tomb to accompany him in the afterlife

CIRCA 400 BCE-476 CE

Roman legionary

One of the ancient world's finest armies comprised dedicated, hardened soldiers

The Roman legions were the finest fighting force on Earth for hundreds of years. Manned by well-drilled legionaries, they conquered most of Europe as well as parts of Africa and Asia Minor.

At the height of Roman power, the primary tactic was to throw a spear called a pilum into the enemy masses. It would either impale them or stick in their shields, rendering them unusable. After this, the legionaries drew a short sword, called a gladius, and charged at their foes. Legionaries first wore chain mail but later changed to lorica segmentata. These overlapping metal strips were just as protective but allowed the soldiers to be more agile in combat.

Despite being ferocious warriors in their own right, the prowess of the legionary was complemented by intelligent strategies. Formations like the testudo (tortoise) and siege weapons like the ballista could often be the difference on the battlefield and helped legions overwhelm opposing forces larger than their own. The Roman legions were also often better prepared than their enemy. Legionaries carried saws, rope, pickaxes, cooking pots and rations to set up camps deep into enemy territory.

In the later days of the empire, Roman tactics and armour changed as auxiliary soldiers sourced from around the empire began to fill the ranks. Being a legionary was a well-respected career in the empire, and victorious generals were treated to celebratory processions on their return to Rome.

Notable battle...
BATTLE OF PYDNA, 168 BCE

Pilum
A type of heavy javelin, the pilum had a strong tip and was weighted in such a way that it could pierce enemy armour

Helmet
Called a galea, the Roman helmet absorbed blows to the head and protected the side of the face

Gladius
Unsheathed after the pilum had been thrown, the gladius would be used in tight melees to thrust and stab the enemy

WEAPONS OF CHOICE
PILUM, GLADIUS, PUGIO

Chain mail
Even though Romans are often associated with lorica segmentata armour, legionaries also wore chain mail

Sandals
The Roman legionary marched in thick, heavy sandals that were stuffed with wool or fur in cold weather

Scutum
The iconic rectangular wooden shield protected the body and was glued carefully so it could interlink in the testudo formation

© WIKI Mary Evans

Roman training

Legionaries were trained to be superior to their enemies. To become part of the legion, the soldiers would be judged on their height, their eyesight and their physical fitness. Recruits were taken on from the age of 18 and would be expected to march up to 30 kilometres a day. A huge emphasis was placed on training, from battlefield formations to swordplay. In specialised training schools, legionaries fought with wooden swords and could lose rations if they did not perform well.

8TH-11TH CENTURY

Viking raider

These brutal warriors devastated coastal towns right across Europe

Anglo-Saxon Britain was assaulted by a series of raids by Norsemen from Scandinavia. Pitching their longboats up on the shore, Vikings pillaged the local area before returning to their ships with valuable plunder. As time wore on, the attacks became more and more frequent and an area known as the Danelaw was established, encompassing northern and eastern England. Wealthy Vikings used double-edged swords, but the majority of fighters carried axes or spears into battle.

The Vikings didn't have standardised tactics, giving them greater variety on the battlefield. Warriors called berserkers went into battle brandishing huge two-handed axes that they used to hew down anyone who got in their way.

The Vikings had a rich appetite for battle as well as an upbringing based on the necessity of war. The longboat helped initiate rapid attacks that would strike an enemy before its forces could retaliate. These tactics helped them conquer not just parts of the British Isles but also territories in Spain, France and Russia. The emperor of the Byzantine city of Constantinople even had his own Norse bodyguards, the Varangian guard, who were some of the toughest mercenaries of the era.

Notable battle...

ATTACK ON LINDISFARNE 793 CE

Ringed mail
Chain mail coats were worn by some chieftains into battle

Iron dome
Viking helmets did not have horns but they did have visors that helped protect the wearer's face

Weapon
The most popular Viking weapons were axes, swords and spears

Keeping warm
In cold temperatures on land and at sea, a thick under-tunic was worn below the armour

Round shield
Circular shields were made of wood and iron and attached to the side of a longboat when travelling

WEAPONS OF CHOICE
SWORD, AXE, SPEAR

"The Pope promised that anyone who fought would be forgiven their sins"

Bascinet
The iconic fully enclosed Crusader helmet protected the face and the neck

From mail to plate
Early Crusader knights wore chain mail, but this later changed to more durable and protective plate armour

Broadsword
The Crusaders' swords weren't always sharp – some were more effective as clubs rather than cutting instruments

Kite shield
The kite or tear shaped shield could be strapped on a Crusader's back to carry on long journeys

WEAPONS OF CHOICE
BROAD-SWORD

11TH-13TH CENTURY

Crusader knight

Clad in protective armour, these western knights fought in holy wars approved by the Pope

Between 1096 and 1272 there were a total of nine crusades to the Holy Land. The foot soldiers of these Christian armies fought to reclaim Muslim-controlled cities like Jerusalem, which they believed to be rightfully theirs. Pope Urban II initiated the First Crusade, promising that anyone who fought would be forgiven for their sins.

The Crusaders' iconic look was completed with a red cross emblazoned on a white surcoat. This was worn to identify each knight as a Christian as well as protecting the metal armour from the hot Sun.

The knights fought both on horseback and on foot as the ownership of the Holy Land changed hands between the Crusaders and the Saracens frequently. Many bloody battles were fought as huge losses mounted on both sides. Both forces still continued fighting undeterred though, fuelled by religious passion and an unwavering belief that they were dying in their god's name.

Notable battles...

SIEGES OF ANTIOCH (1097-1098), SIDON (1110) AND ACRE (1189-1191)

1325-1521

Aztec eagle warrior

The warriors of the Sun who formed an elite fighting force

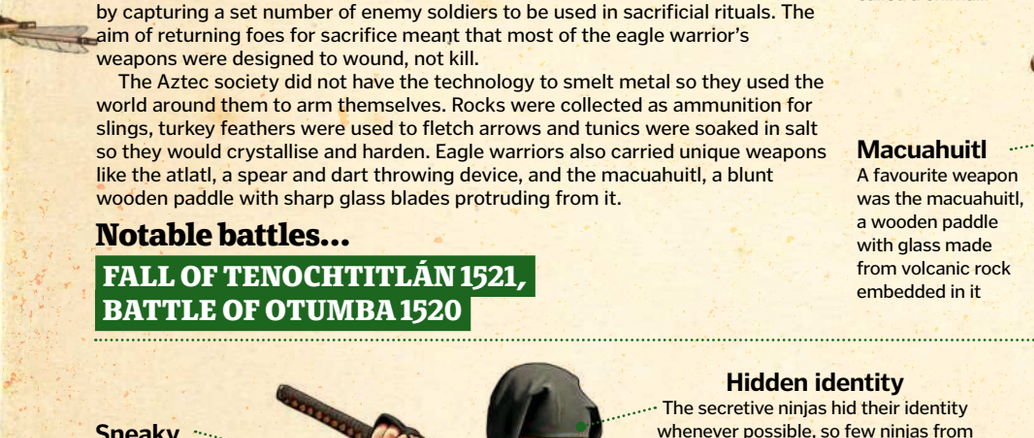
Prior to the arrival of the Spanish conquistadors, the Aztec Empire dominated vast areas of modern-day Mexico. One of the infantry types that helped maintain control were the eagle warriors. Along with jaguar warriors, they formed an elite unit of Aztec society that was renowned for its military prowess.

To be part of the society, an Aztec had to prove their worth on the battlefield by capturing a set number of enemy soldiers to be used in sacrificial rituals. The aim of returning foes for sacrifice meant that most of the eagle warrior's weapons were designed to wound, not kill.

The Aztec society did not have the technology to smelt metal so they used the world around them to arm themselves. Rocks were collected as ammunition for slings, turkey feathers were used to fletch arrows and tunics were soaked in salt so they would crystallise and harden. Eagle warriors also carried unique weapons like the atlatl, a spear and dart throwing device, and the macuahuitl, a blunt wooden paddle with sharp glass blades protruding from it.

Notable battles...

FALL OF TENOCHTITLÁN 1521, BATTLE OF OTUMBA 1520



Warriors of the Sun
Warriors wore a feathered headdress and wooden headgear that symbolised a bird's open beak

Protection
The warriors wore a quilted cotton tunic and carried a brightly coloured, feathered, round leather shield called a chimalli

Macuahuitl
A favourite weapon was the macuahuitl, a wooden paddle with glass made from volcanic rock embedded in it

WEAPONS OF CHOICE
MACUAHUITL, ATLATL

Other weapons
As well as spears, eagle warriors carried slings and bows tipped with either rock, bone or obsidian

Captive soldiers were often gruesomely sacrificed to the gods

10TH-17TH CENTURY

Ninja

With stealth as a priority, ninjas struck silently from the shadows

Among the most famous assassins in history, the ninja were dangerous adversaries in feudal Japan. Also known as shinobi, in folklore the ninja were first formed to fight back against oppression from the ruling class by a rogue samurai who went against the bushido code.

They practised ninjutsu, the art of stealth, which taught special ninja combat skills and how to remain hidden. Ninja were the opposite of the samurai, and rather than having codes based on honour like Bushido, they would happily covertly kill their enemies, an act considered immoral by the samurai. But this didn't mean that the two were enemies, instead, the ninja were often employed to aid the samurai.

Contrary to popular depictions, ninjas didn't just wear black; they dressed to blend in, so they would just as likely be clad in civilian clothing to avoid detection. In combat, ninjas would use standard Japanese weapons of the era, but also wielded their own special equipment. The shuko was a small device used for traction when scaling walls and a tessen was an inconspicuous metal fan that could be used as a weapon.

Ninja combat may not have been just reserved for men, either; tales of female ninjas, or kunoichi, described their dressing as servants or dancers to secretly infiltrate forts and compounds to get closer to a target.

Notable battles...

NANBOKUCHO WARS 1331-1392, ONIN WAR 1467-1477

Hidden identity
The secretive ninjas hid their identity whenever possible, so few ninjas from history are known by name

Sneaky operations
Ninjas were especially useful in sieges, infiltrating castles and distracting the surprised defenders

Weaponry
Ninjas were experts at using poison, and would add it to an enemy's food or infuse their blades with it

Dressed in black
The archetypal ninja is dressed head to toe in black, but they would only wear this attire for when it was needed, such as covert operations at night

A life in the shadows
Even though they carried swords and other weapons, ninjas only fought when absolutely necessary, preferring a silent kill or stealthily gathering secrets

Martial arts training
Ninjas were trained in martial arts like jujitsu, so they were a dangerous foe even when unarmed

WEAPONS OF CHOICE
SHURIKEN, MANRIKI-GUSARI, FUKIYA

Ninja tool kit

An array of weapons and accessories helped ensure ninjas always had a trick up their sleeves

Kakute
Similar to a knuckleduster, kakute were small, spiked iron rings worn around the fingers. They were an asset in hand-to-hand combat.

Shuriken
These throwing stars could quickly and secretly eliminate targets from distance. They were small enough to be hidden in clothing.

Fukiya
Blowpipes launched poison darts at enemies or sent secret messages to allies. They could also be used as breathing straws.

14TH-19TH CENTURY

Ottoman janissary

The elite infantry of the Ottoman Empire

WEAPONS OF CHOICE: BOW, ARQUEBUS, SWORD

For centuries the Ottoman Empire's mighty army was led by janissaries. The first force was formed around 1380 by Christian prisoners captured after successful Ottoman campaigns in Europe. Aged between six and 14, they were taken from their homeland and bred for battle. After being drafted into the army, they became the property of the sultan and acted as his personal bodyguards.

The janissaries were forced to observe strict rules and were trained to a high standard as disciplined and skilful warriors. As the sultan's most trusted guards, the companies resided in barracks and were constantly drilled for a life of war. The janissary commander was called the agha and ranked above other commanders in the Ottoman military.

Janissaries used swords and rifles as they moved quickly to overwhelm fortresses or to outflank cavalry. On the battlefield, janissaries were recognisable due to their distinctive headgear. They also fought at sea, using their rifles to fire at mariners on enemy ships. They gained a reputation as some of the best marksmen in the world, deploying devastating walls of fire.

In peacetime they also served in Ottoman cities as policemen. At their peak in the early 19th century, there were over 100,000 janissaries and the Ottoman Empire represented one of the finest fighting forces in the world.

Notable battles...

SIEGE OF CONSTANTINOPLE 1453

BATTLE OF MOHÁCS 1526

Headgear
A janissary's headgear was unique and designed to strike fear into enemies, who could recognise the formidable force from a distance

Robe
A felt robe was worn in place of armour. Lightweight and flexible, it allowed janissaries to move swiftly and engage in naval operations

Axe
When fighting at close quarters, a janissary would swing their axe, hacking away at anyone that crossed their path

Breeches
Long robes were stuffed into breeches so they were out of the way both during marching and in the midst of battle

Primary weapon
Starting off as archers, janissaries soon modernised and wielded arquebuses, becoming some of the most accurate marksmen in the world

Secondary weapon
With its curved blade the yatagan sword was useful on the battlefield as well as an enduring symbol of the janissary

Bow and arrow
The Sioux bow shot iron arrows over a short range, and some were backed with animal tendons to provide extra power

War paint
A Sioux warrior's face and body were covered in war paint, and bird feathers were worn in the warrior's hair

Tomahawk
Before rifles were introduced by settlers, axes were used as both melee and projectile weapons

Shield
The small shield was made of animal skin or leather and could deflect enemy arrows

PRE-EUROPEAN COLONISATION-1890

Sioux warrior

Native American warriors who preferred to count coups rather than draw blood

WEAPONS OF CHOICE: BOW, SPEAR, AXE, RIFLE, COUP STICK

Unlike many of the other warriors on this list, the Sioux seldom fought in large numbers. They preferred to attack in small raiding parties that focused on stealing horses or avenging a fallen comrade rather than occupying territory.

The Sioux, like other Native American tribes, did not believe in the ownership of land, but they did compete with rivals like the Crow for hunting and living space in the summer months. Both Sitting Bull and Crazy Horse were Sioux warriors, and it was any young man's ambition to prove their status within a tribe. In Sioux warrior societies it wasn't considered heroic to die, and instead the ultimate show of courage was to touch an enemy with a coup stick.

Enemies that were killed were scalped. This, the Sioux believed, prevented enemies from revisiting warriors in the afterlife, and scalps would be hung as spoils of war outside tipis and on spears and shields.

Notable battle... BATTLE OF LITTLE BIGHORN 1876

PRE-EUROPEAN COLONISATION-19TH CENTURY

Zulu warrior

The men who defied the European imperialists

Zulus were divided up into regiments of hundreds or thousands of warriors called an ibutho. Younger unmarried men comprised the main fighting force, and to maximise their time in service, chiefs often didn't let their troops marry until their mid-30s. When a Zulu was married, they could choose to leave the ibutho and from then on were only required to fight in times of war.

Shields were only issued in wartime; Zulus were not allowed to own one in peacetime to help quell potential civil war. Younger regiments tended to have darker shields while more experienced contingents defended themselves with lighter coloured versions. The shields themselves were used to knock enemies off balance before stabbing them with short spears. As well as being traditional, it helped Zulu leaders identify different units on the battlefield. There wasn't a standing army and Zulu warriors returned to their homes between conflicts.

The army didn't have any sort of supply system and lived off the land. This made operations short but often decisive. The Zulus knew the lay of their land better than anyone, which made ambush attacks highly effective. Their prowess in battle enabled the Zulus to conquer rival tribes and made them more than a match for the invading Europeans.

Notable battles...

BATTLE OF ISANDLWANA 1879, BATTLE OF RORKE'S DRIFT 1879

Assegai
Equipped with a sharp, pointed blade, this spear was used to stab enemies from behind a large shield

Modern firearms
As well as spears, Zulu warriors also wielded rifles that had been imported into Africa by settlers or taken from defeated foes

Stamina
With no supply train or heavy armour, Zulu forces could cover over 30 kilometres in a day

Headdress
Zulu regiments wore distinguishing headdresses so their commanders could orchestrate battles from a distance

Isihlangu
A Zulu war shield was made from cowhide and when beaten with a spear, made a loud intimidating noise

Cowhide
The cowhide used to make the shields was made extra durable by drying it in the Sun, burying it under manure and then hitting it with rocks

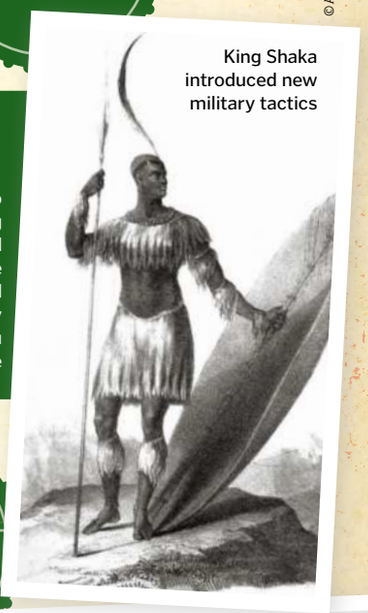
WEAPONS OF CHOICE
ASSEGAI, RIFLE

© Alamy; WIKI

Horns of the buffalo formation

When the Zulus delivered a crushing defeat to the British at the Battle of Isandlwana in 1879, they had their tactics to thank. The formation was pioneered by Zulu king Shaka and involved a strong central core of warriors flanked by horns – two units of light troops. As the enemy moved to engage the strongest Zulu units in the centre, they would be flanked and encircled. This strategy was devastatingly effective against local tribes but was less successful against the British, especially at Rorke's Drift, where concentrated rifle fire prevented the Zulus from getting in close. However, against the scattered British forces at Isandlwana, it led to an emphatic victory.

The two flanking horns would pressure the enemy toward the main body of the Zulu force



King Shaka introduced new military tactics

1815-PRESENT

Gurkha

Loyal and fearless, they were a vital asset to Britain in WWI

During World War I, Gurkhas were some of the finest soldiers on the side of the Allied powers. They travelled from their native Nepal to many theatres of the war, including the treacherous cliffs of Gallipoli and the blood-soaked fields of the Western Front. Time and again, the brave Gurkhas led assaults on key positions.

Gurkhas were first enlisted by the British in 1815 and around 3,500 still serve in the British Army. Almost 2,000 were awarded gallantry awards during the Great War and several have received the Victoria Cross. Their motto is 'better to die than be a coward'.

Notable battles...

BATTLE OF LOOS 1915, GALLIPOLI CAMPAIGN 1915-1916

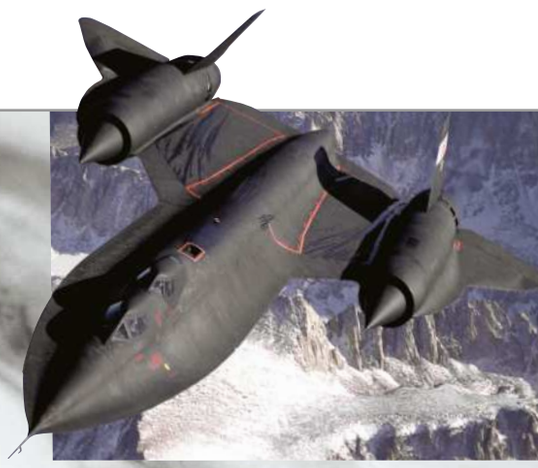
Battlefield courage
Gurkha regiments universally wore this headgear during WWI for traditional reasons

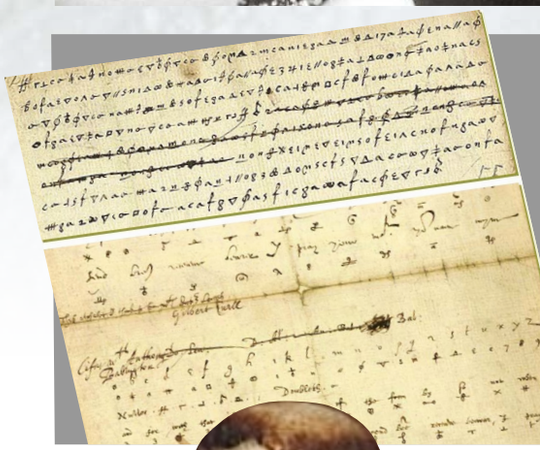
Kukri
A distinctive curved knife made of tempered steel, the kukri was a lethal weapon in practiced hands

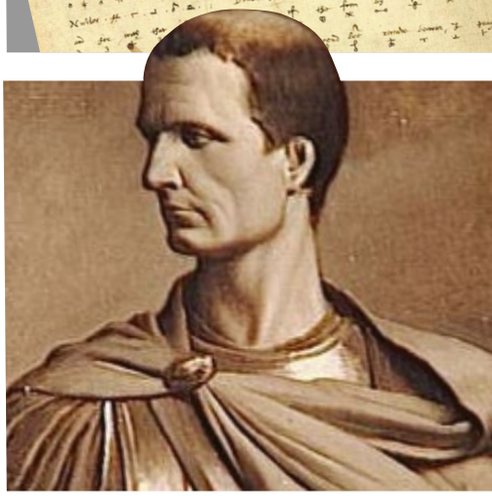
Weapon and tool
The kukri can also be used to chop food and wood. An old legend stated that it had to draw blood every time it was drawn

WEAPONS OF CHOICE
KUKRI

Over 200,000 Gurkhas served as allies of the British in the two World Wars







SPIES THROUGH HISTORY

The secrets of espionage through the ages

The principle of gathering confidential information, from secret documents to military tactics, has proved invaluable for rulers, empires and governments throughout history. Covertly collecting information about enemies, and even allies, provided nations with the opportunity for military, political or economic gain.

Espionage is the gathering of secret information, and the methods used changed dramatically as technology developed. In ancient Rome, letters could be intercepted en route to their intended recipient. In an attempt to prevent this, Julius Caesar invented one of the earliest-known ciphers – a code used to disguise messages – to stop enemy spies reading his secret military communications.

In the 20th century, espionage was particularly important during the two World Wars, as nations established huge intelligence networks in an effort to stay one step ahead of the enemy. Some estimate that deciphering the Nazi's 'uncrackable' Enigma machines (used to encode messages) helped shorten World War Two by several years, saving countless lives.

During the Cold War, with the threat of nuclear war between the US and Soviet Union looming, strategic intelligence was vital and influenced tactics on both sides. Spies disguised gadgets as everyday objects to help gather information, from coat button cameras to microphones hidden in shoe heels.

Counterintelligence operations continue to be incredibly important to this day. Security services across the world work to protect their citizens against threats to national interests, conducting counter-terrorism operations and tackling cyber crime.

Ancient espionage

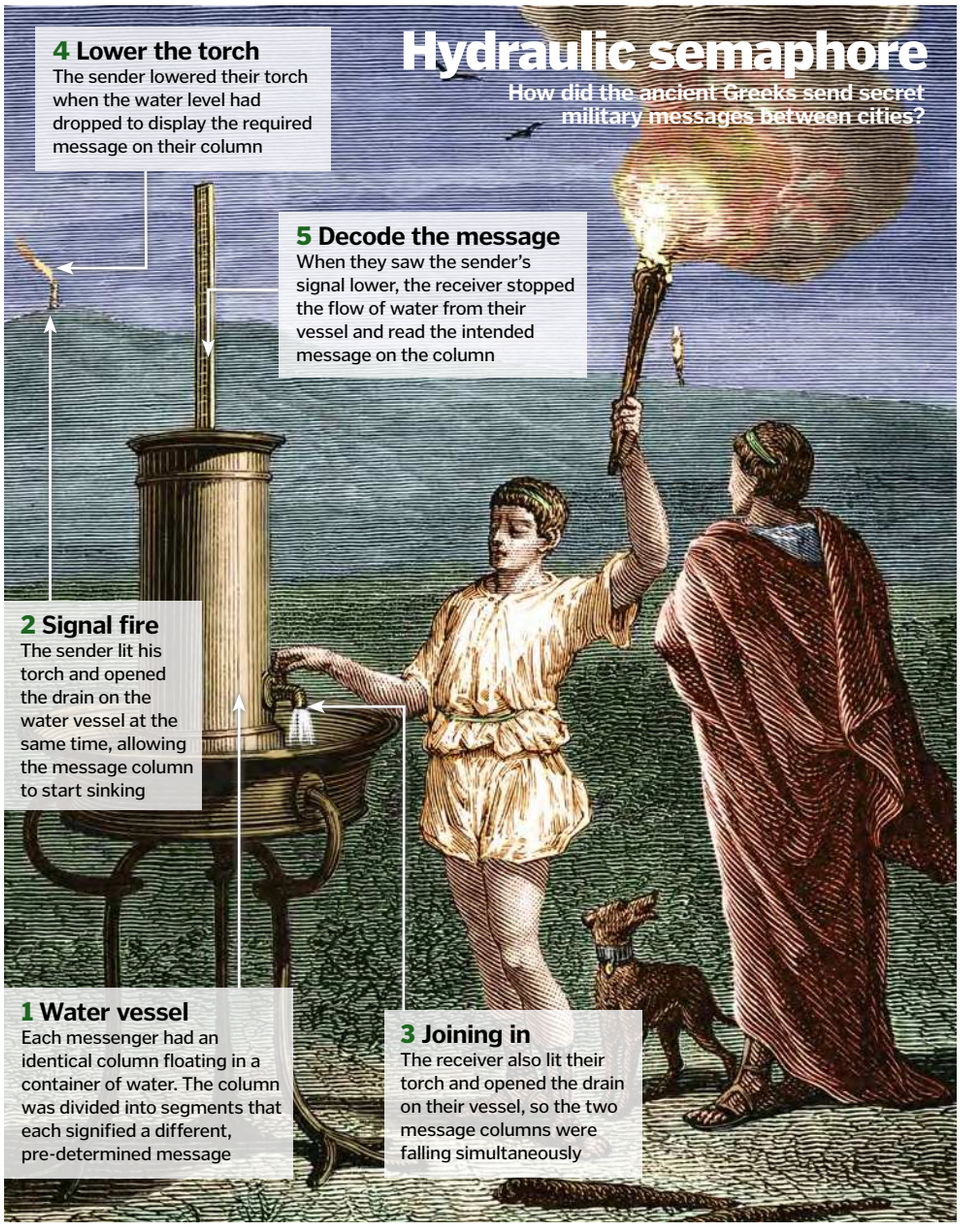
How intelligence was gathered by ancient civilisations

In the first cities of ancient Mesopotamia and ancient Egypt, spying was an effective way for kings and pharaohs to monitor the population, as well as to discover enemy weaknesses. The ancient Egyptians used court spies to root out disloyal subjects, and they were also among the first to develop poisons for sabotage or assassinations.

With no spy gadgets at their disposal, eavesdropping on conversations, intercepting communications and scouting enemy movements were the key methods used to gather useful intelligence. Resourceful techniques were developed to ensure written messages remained secret, including codes and trick inks.

The ancient Greeks excelled at espionage and subterfuge. The legendary tale of the Trojan horse became a symbol of their cunning and deceptive military tactics. They developed efficient methods of communicating important messages between cities, including a fire signal system known as hydraulic semaphore.

Another tactic used by the Greeks to prevent communications being intercepted was carving important messages into wood and then covering it in wax. The wooden board would then be sent to an ally who would melt the wax to read the message. A more gruesome method was writing on the outside of an inflated animal bladder, before deflating it and packing it into a flask. The document could then be transported anywhere unnoticed until it was opened, inflated and read.



"Eavesdropping, intercepting messages and scouting enemy movements were the key methods used to gather intelligence"

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Julius Caesar's speculatores

The Roman Republic was a fragmented, unruly place and keeping hold of power was never easy. Many rulers hired bodyguards for protection, but Julius Caesar saw the value of secret surveillance and used spies called 'speculatores' to gather intelligence of potential revolts. This reconnaissance network helped Caesar keep abreast of goings on both domestically and internationally. Some sources suggest that Caesar was aware of the Roman Senate-led plot to assassinate him.

Not even Caesar's speculatores could prevent his assassination

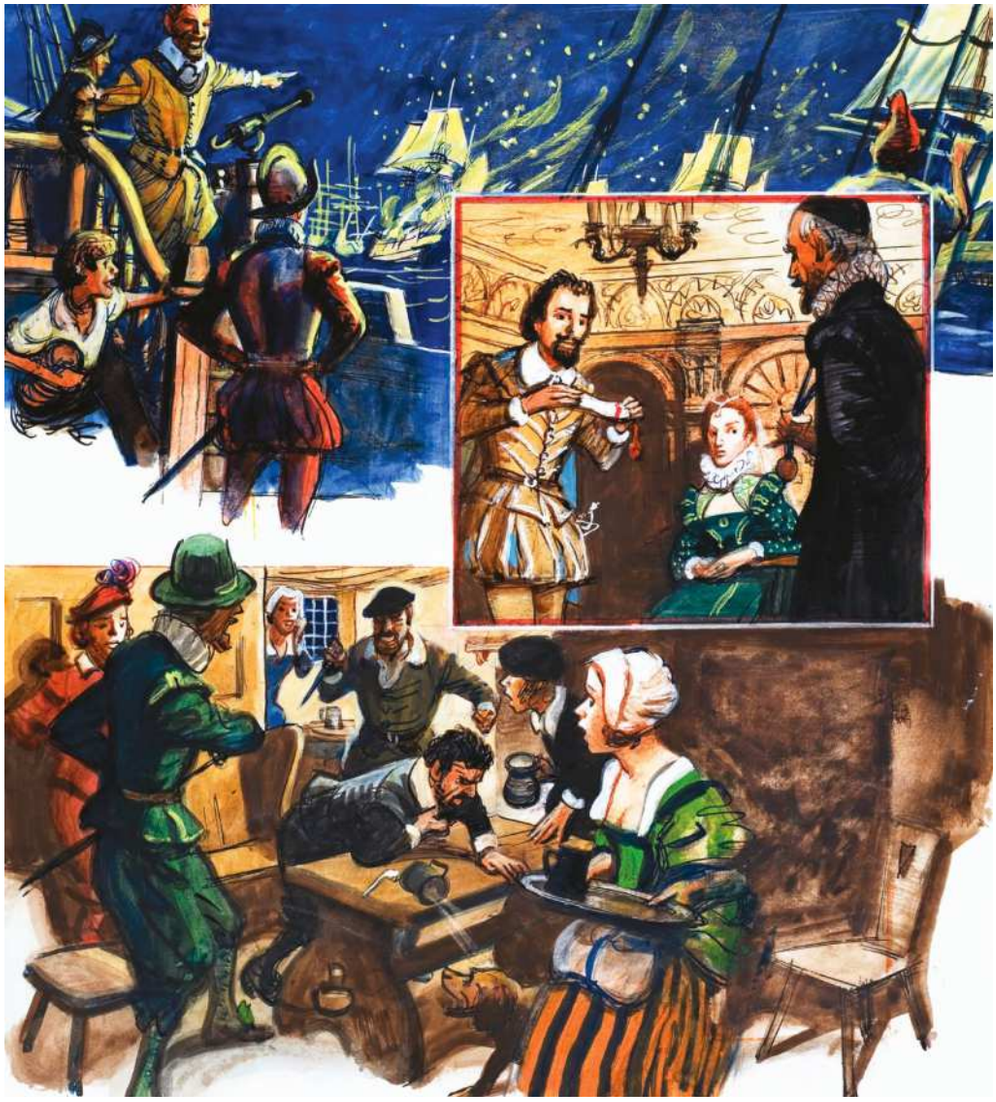
The Mongol spy network

United under leader Genghis Khan, the Mongols were one of the most feared military forces of the 12th and 13th centuries as they rampaged across Asia. However, this mighty army would not have been as successful had it not been for an extensive intelligence network. Genghis Khan gathered information from trade merchants, who had an in-depth knowledge of the areas he wished to conquer. This intelligence allowed the Mongols to pinpoint weaknesses in enemy territories.

Spies' information gave the Mongols an advantage when conquering new lands

Elizabethan espionage

The final Tudor monarch created a secret service network that helped keep her on the throne



Agents in Elizabeth's spy network gathered information about the Spanish Armada's preparations

As a Protestant queen with no heirs, Elizabeth I's reign was threatened by those who would have preferred the Catholic Mary Queen of Scots. With the threat of assassination, the Queen set up a network of spies to protect her against dissidents and uncover foreign plots. Head of Elizabeth's secret service was Sir Francis Walsingham, a Protestant lawyer. Those hired as spies were among the greatest minds in the land; scholars, scientists and linguists were all tasked with protecting the vulnerable monarchy.

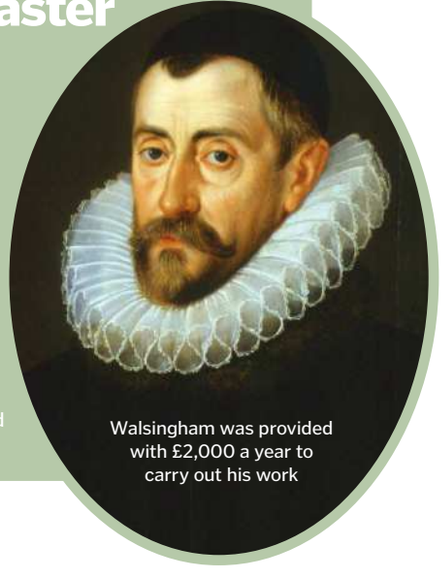
Technological advancements also aided the intelligence network. Invisible ink made from milk or lemon juice was first utilised in this period, allowing secret messages to be revealed by warming the paper over a candle. Cryptography became more advanced, and the spy network needed to be able to both write and decipher different codes.

A series of plots to overthrow or assassinate the Queen were uncovered during her reign. The intelligence gathered by Elizabeth's secret service most likely saved her life on more than one occasion. For example, after her imprisonment, Mary Queen of Scots maintained contact with the outside world by sending coded messages to her allies hidden in barrels of beer. Little did she know that the barrels were being smuggled by a double agent acting on behalf of Walsingham, who deciphered her messages and proved that Mary was involved in a plot to kill Elizabeth. Those involved, Mary included, were quickly caught, tried and executed for treason.

Elizabeth's spymaster

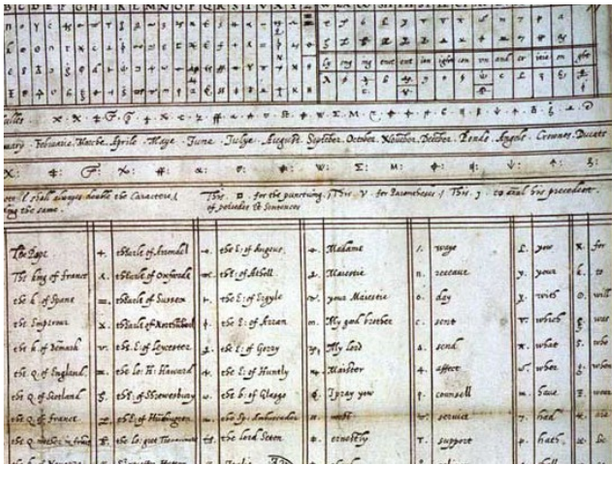
At the head of the Elizabethan spy network was the secretary of state, Sir Francis Walsingham. With threats coming from Catholic Spain, devout Protestant Walsingham built up a network of spies all over Europe – including prison informants and double agents – with the aim of gathering intelligence about the activities of Catholics, as well as political and economic information.

To ensure his agents were as effective as possible, Walsingham established a spy school to train new recruits. His network proved invaluable to national security after foiling several plots against the Queen, as well as providing intelligence about the Spanish Armada leading up to the attempted invasion in 1588.



Walsingham was provided with £2,000 a year to carry out his work

Mary sent secret messages to her allies using these cipher symbols, but Walsingam's spies decoded them



World War spies

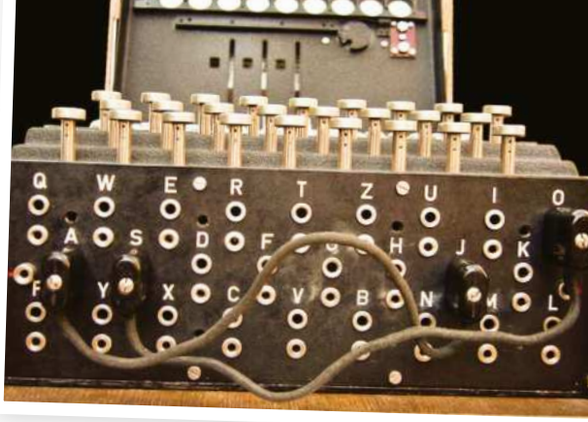
How inventive spying strategies were used to try and win both global conflicts

World War One may be remembered primarily for trench warfare, but behind the lines, spies were performing a vital role. One of the most successful spy networks during the war was codenamed 'La Dame Blanche'. With over 1,000 members, the organisation worked for the British, conducting valuable reconnaissance missions in German-occupied Belgium, spying on trains, roads and airfields.

The development of aircraft in the early 20th century meant that aerial reconnaissance was also a large part of the war. Both German and French planes took photos from above to examine troop movements. German intelligence greatly helped its divisions push forward on the Eastern Front. By acquiring secret documents and intercepting radio messages, they knew what moves the Russians would make.

When World War Two began, espionage was still an instrumental part of warfare. Germany's military intelligence organisation, the Abwehr, was particularly effective during the occupation of the Netherlands. The group captured 52 Allied agents and 350 resistance fighters, some as soon as they parachuted in. Still under the illusion that they were supplying their Dutch allies, the British unwittingly provided the Germans with 570 boxes of weapons and ammunition.

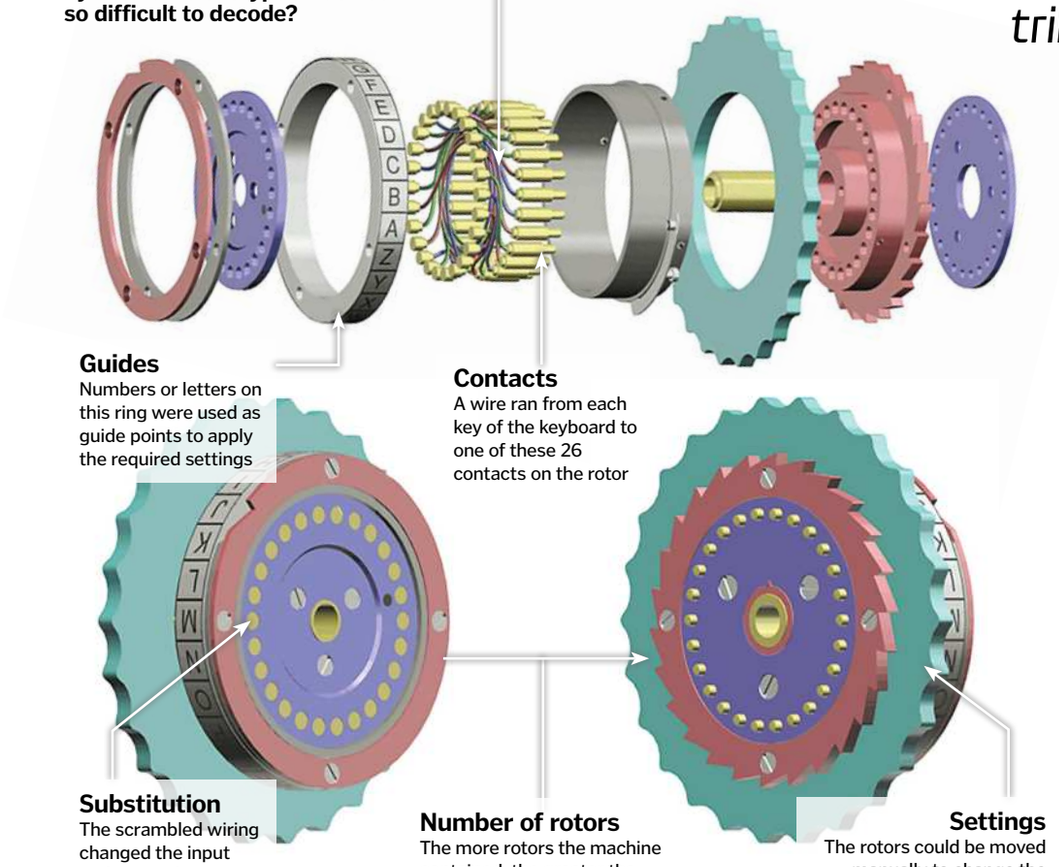
Most famously, the Nazi's Enigma machines were used to ensure their army's messages remained secure. To send a signal, an operator typed in their message and then scrambled it using a series of rotors, which would reproduce the message as a jumble of different letters. The receiver would need to know the exact settings used by the sender in order to decode the original message on their own machine. The settings were frequently changed, and a typical army-issue Enigma machine could have over 150 million trillion different settings, so cracking the code was considered impossible. The British eventually managed to decipher Enigma after teams of mathematicians and code-breakers at Bletchley Park developed computers known as bombes that could work out the machine's settings based on an intercepted coded message. Some historians estimate that the intelligence the Allies gathered by breaking the Enigma code helped shorten the war by two years.



On the front face of the Enigma machine was an electronic plugboard that could be used to swap pairs of letters, for an extra level of encryption

The Enigma machine

What made the messages sent by the Nazi's encryption device so difficult to decode?



"A typical army-issue Enigma machine could have over 150 million trillion different settings"

World War spies

The shady double agents that provided intelligence to the opposition

Howard Burnham
Burnham was an intelligence officer for the French government in World War One and often hid his spying equipment in his wooden leg.

Mata Hari
A Dutch dancer, Hari spied for the Germans before being caught by the French and sent to the firing squad in 1917.

Virginia Hall
Hall was a US spy during World War Two who provided support, information and training for resistance fighters and the Allies in occupied France.

Takeo Yoshikawa
Living in Hawaii during World War Two, Japanese spy Yoshikawa provided intelligence to his country ahead of the surprise attack on Pearl Harbor.

Cold War espionage

After the Second World War, a new era of spying emerged during a bitter rivalry

A decades-long power struggle between the US and the USSR began after the collapse of the Third Reich. The nations held opposing ideologies – capitalism versus communism – and had a mutual distrust of one another's intentions. Tensions rose as both powers entered into an arms race and the threat of a devastating nuclear war grew. Espionage was one of the primary methods used to try and break the deadlock. Each of the two superpowers was determined to gain the upper hand, so spies were sent all over the world to gather intelligence about the enemy.

One of the most infamous spy networks behind the Iron Curtain was the Ministry for State Security, commonly known as the Stasi. Operating in East Berlin, the organisation used brutal methods to monitor the activities of the East German capital's citizens. Stasi soldiers would shoot citizens who strayed out of line or tried to make a break for the West.

"The Blackbird could travel at more than three times the speed of sound"

After World War Two, the US set up Project Shamrock and Project Minaret, espionage exercises to monitor all telegraph information entering and leaving the country. Despite this, there were a number of spies operating in the US for the Soviets, gathering information on nuclear weapons, military movements and new technologies.

Aerial reconnaissance continued to play a huge part in intelligence operations. The CIA located Soviet ballistic missiles using spy satellites under the Corona Program. After a CIA pilot was shot down while flying over the USSR in a U-2 spy plane in 1960, the US realised that continuing to use these aircraft was too risky. In response, the record-breaking SR-71 Blackbird was constructed. The Blackbird could travel at more than three times the speed of sound, and reach altitudes high enough to avoid radar detection. The reconnaissance jet even had special radar-absorbing black paint.

1 CIA training
Only the most successful recruits are selected to be agents. An intensive course including both physical and mental tasks will show who's capable of being a spy.

2 The life of a spy
To avoid arousing suspicion, you must create a believable persona and backstory. The finest agents appear to live completely ordinary lives.

3 Data collection
Your main objective is to determine the Soviets' intentions towards the US. The intelligence you gather could give your country a huge advantage.

4 Decryption skills
The best spies have a talent for code-breaking. Soviet intelligence agents encrypt their messages so you will have to decipher them to reveal any secret plans.

5 Break morale
With your spy persona, you have the ability to spread rumours behind enemy lines. Create fake news stories to cause unrest among citizens or the leadership.

6 Avoid capture at all costs
If you're caught, it's all over. Espionage is a serious offence during the Cold War, carrying the penalty of a long prison sentence or execution.

The 'Illegals Program'

In 2010, ten Russian agents were arrested in the US. Upon interrogation by the FBI, it was revealed that they had been active in the US for years as sleeper agents, spies who weren't always active but resided in the US if ever needed for duty. Known as 'Illegals', some of the spies posed as American citizens with fake names and backgrounds, and had normal jobs. They had been instructed to make contact with academics to obtain secret intelligence that they could report back to Russia. All ten of the spies were charged with conspiracy to act as an agent of a foreign government, and were released into Russian custody as part of a prisoner exchange.

Anna Chapman was arrested after an FBI operation exposed her as a sleeper agent

Spies wanted

How intelligence agencies operate in the internet age

Most of us share our lives with friends and family on social media, but this data creates problems if you want to be a spy. Intelligence agencies are struggling to operate effectively in a time where false identities and backstories are hard to create. Most people will leave traces of their real lives online, and facial recognition software can potentially use these traces to link an undercover agent to their true identity.

To try and combat this, the UK's Secret Intelligence Service (SIS, or MI6) were planning to hire nearly 1,000 new staff by 2020. In a statement, SIS chief Alex Younger explained: "The information revolution fundamentally changes our operating environment. In five years' time there will be two sorts of intelligence services – those that understand this fact and have prospered, and those that don't and haven't."

Vauxhall Cross in London has been the SIS's headquarters since 1994

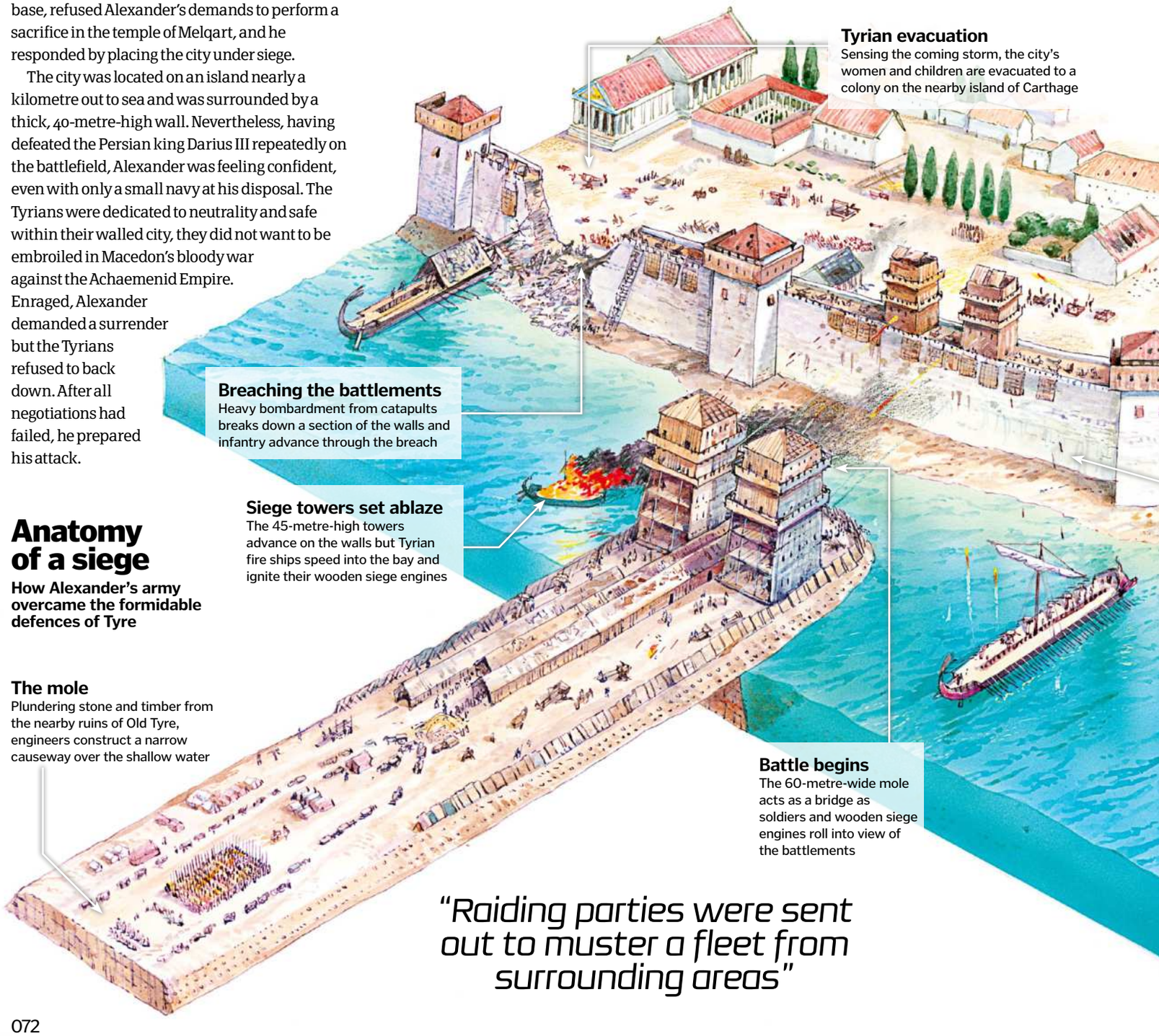
The Siege of Tyre

Find out how Alexander the Great's relentless advance was halted by the determined defence of one city-state

Two years into their conquest of the Persian Empire in 332 BCE, the Macedonian Army faced one of its hardest challenges yet. As Alexander the Great had marched through Phoenicia, many towns, including Byblos, Beirut and Sidon had immediately surrendered. But the walled city of Tyre, an important Persian naval base, refused Alexander's demands to perform a sacrifice in the temple of Melqart, and he responded by placing the city under siege.

The city was located on an island nearly a kilometre out to sea and was surrounded by a thick, 40-metre-high wall. Nevertheless, having defeated the Persian king Darius III repeatedly on the battlefield, Alexander was feeling confident, even with only a small navy at his disposal. The Tyrians were dedicated to neutrality and safe within their walled city, they did not want to be embroiled in Macedon's bloody war against the Achaemenid Empire. Enraged, Alexander demanded a surrender but the Tyrians refused to back down. After all negotiations had failed, he prepared his attack.

The city was clearly impregnable by normal methods of assault, so Alexander looked to alternative strategies for a breakthrough. It was decided that a fleet was required after all and raiding parties were sent out to muster one from surrounding areas. The addition of naval assaults, as well as the construction of a stone causeway, or 'mole', proved to be too much for the city and the walls were finally breached. In the brutal battle that followed, 10,000 residents were executed, while 30,000 more were forcibly sold into slavery. The victory was six months in the making, and proved to be one more example of Alexander's ruthless yet effective military tactics.



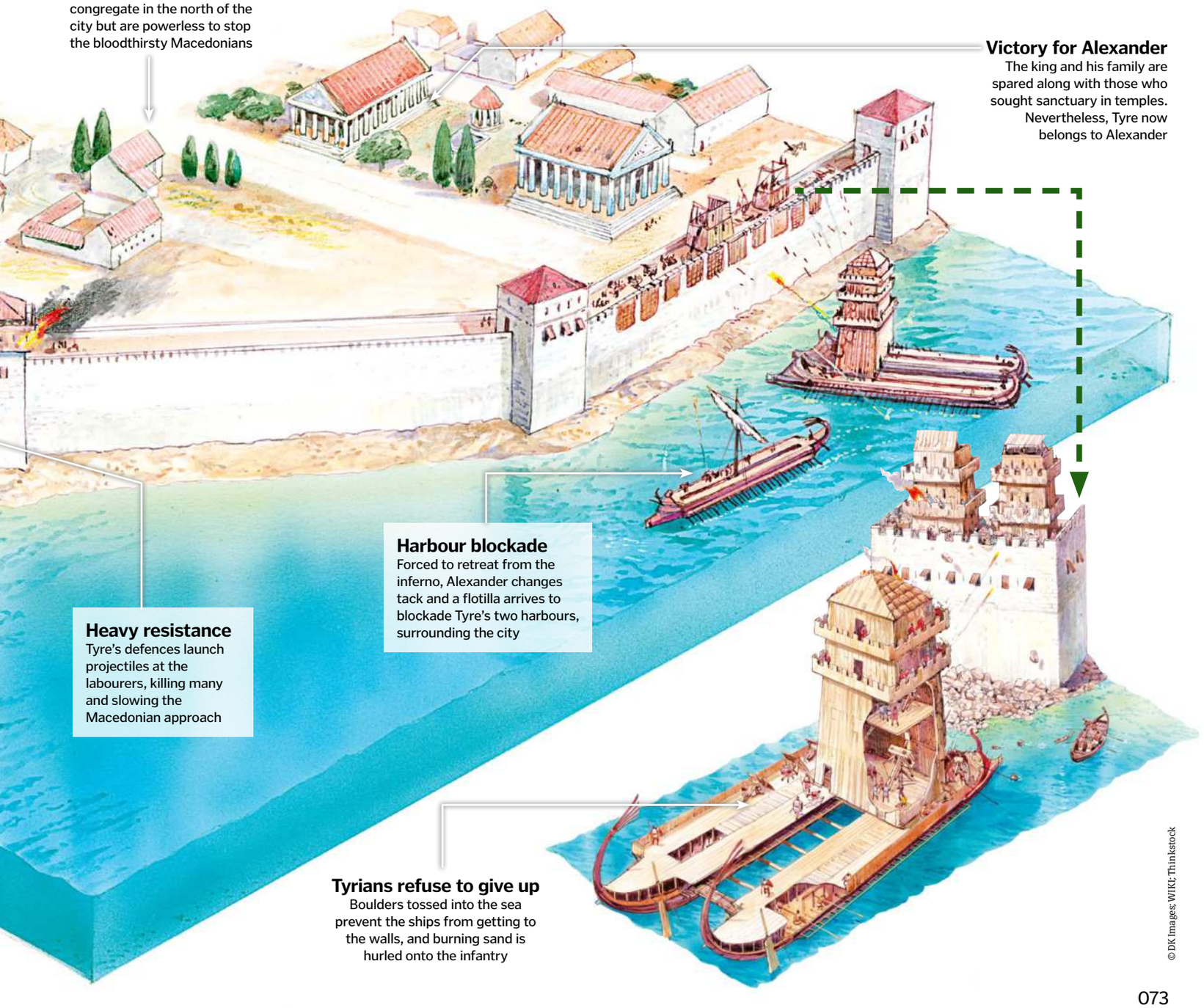
"Raiding parties were sent out to muster a fleet from surrounding areas"

Alexander the pharaoh

Tyre was the last Persian stronghold in Phoenicia to fall, and the road to Egypt then lay open to Alexander the Great. The young Macedonian had been brought up with tales of the splendour of Ancient Egypt and after witnessing the Great Pyramid with his own eyes, he sailed down the Nile to Memphis.

The Egyptians saw Alexander as their saviour, having liberated them from Persian rule after centuries of repression. Upon his arrival, Alexander was declared Pharaoh and began worshipping Egyptian gods as forms of Zeus. It was during this conquest that he began to seriously see himself as a demi-god as his ego took hold. After founding the city of Alexandria and naming it after himself, he left Egypt in 331 BCE and decisively triumphed over Darius and the Persians at the Battle of Gaugamela. Having been declared 'King of the Four Quarters of the World', Alexander continued his conquests, heading east to take eastern Iran and northern India. He died of malaria in 323 BCE, aged just 32.

Alexandria flourished as a port town, taking Tyre's place as the centre of trade and commerce in the region



Tyre's last stand
The last Tyrian defences congregate in the north of the city but are powerless to stop the bloodthirsty Macedonians

Victory for Alexander
The king and his family are spared along with those who sought sanctuary in temples. Nevertheless, Tyre now belongs to Alexander

Harbour blockade
Forced to retreat from the inferno, Alexander changes tack and a flotilla arrives to blockade Tyre's two harbours, surrounding the city

Heavy resistance
Tyre's defences launch projectiles at the labourers, killing many and slowing the Macedonian approach

Tyrians refuse to give up
Boulders tossed into the sea prevent the ships from getting to the walls, and burning sand is hurled onto the infantry

Brutal battering rams

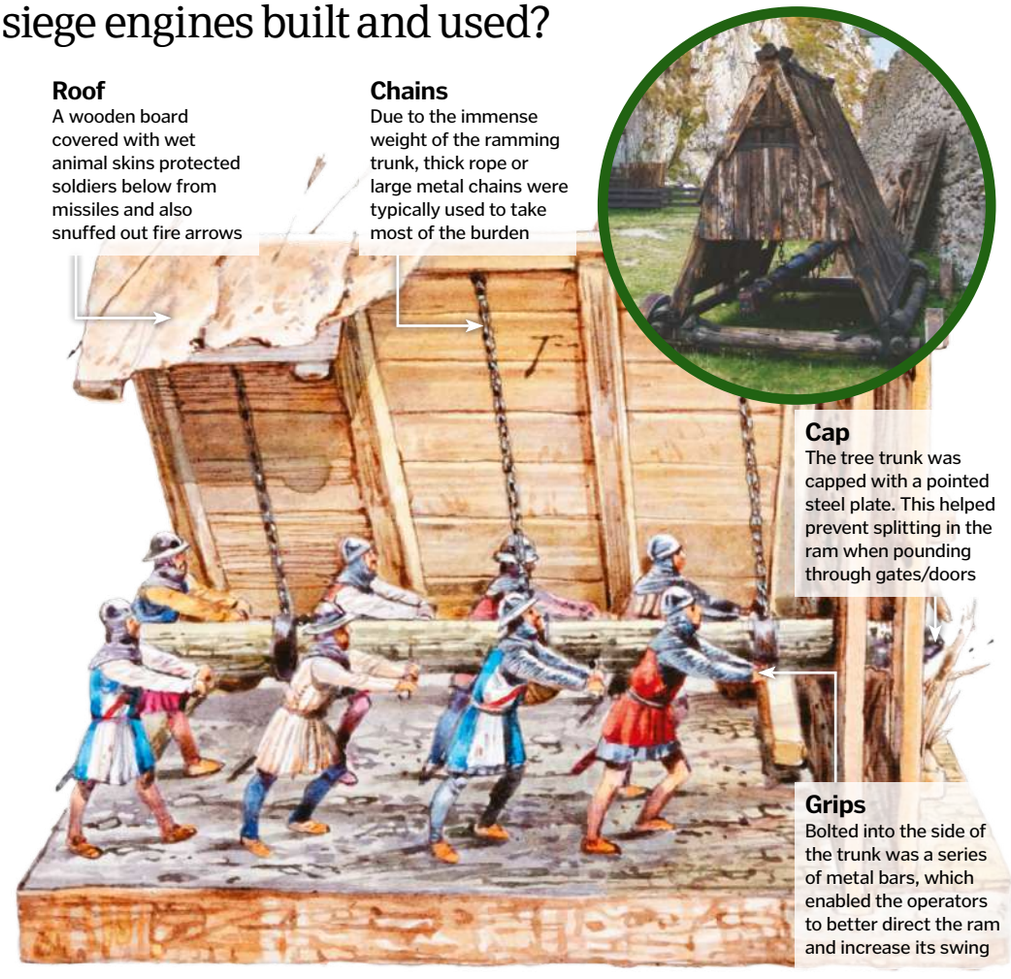
How were these powerful siege engines built and used?

Battering rams were one of the most common pieces of siege equipment from antiquity right through to the Middle Ages, often granting offensive forces access to an enemy's fortified stronghold or city.

A typical battering ram consisted of a rectangular wheeled frame from which a large tree trunk was slung via ropes or chains. The suspended trunk would then be rocked backwards and forwards within the frame until it swung with great force. By placing an obstacle – such as a wooden gate – in the ram's path, it could transfer a vast amount of energy into the target, often shattering the defence.

However, for a ram to get up to speed, a team of soldiers was required to first place it in position and also control its swinging – both of which are difficult when under attack by ranged weapons. To counter this, battering rams often featured triangular wooden coverings stretched with wet animal hides. This shielding protected the soldiers from direct missile strikes and the risk of fire, with the hides extinguishing any flaming arrows.

The age of the battering ram came to a close largely due to the proliferation of gunpowder and explosives in the late-Middle Ages, with army sappers using these incendiary devices to bring down gates and walls much faster.



Roof
A wooden board covered with wet animal skins protected soldiers below from missiles and also snuffed out fire arrows

Chains
Due to the immense weight of the ramming trunk, thick rope or large metal chains were typically used to take most of the burden

Cap
The tree trunk was capped with a pointed steel plate. This helped prevent splitting in the ram when pounding through gates/doors

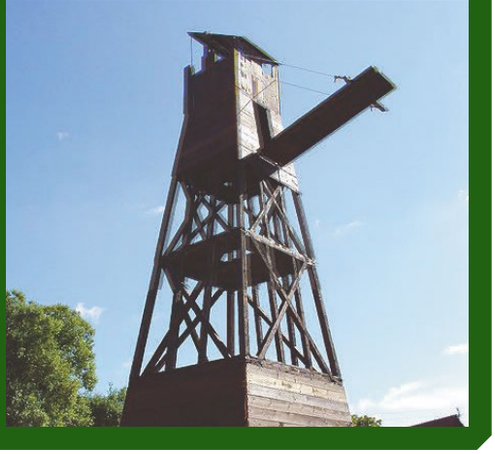
Grips
Bolted into the side of the trunk was a series of metal bars, which enabled the operators to better direct the ram and increase its swing

What other weapons were used in siege warfare?

Trebuchet
One of the most useful siege weapons ever to be created, the catapult-style trebuchet allowed an army to bombard a city's walls and interior buildings with huge stones, flaming balls of earth and even dead animals (the latter spreading disease and panic throughout the inhabitants). On the downside, trebuchets required a large team to operate effectively.

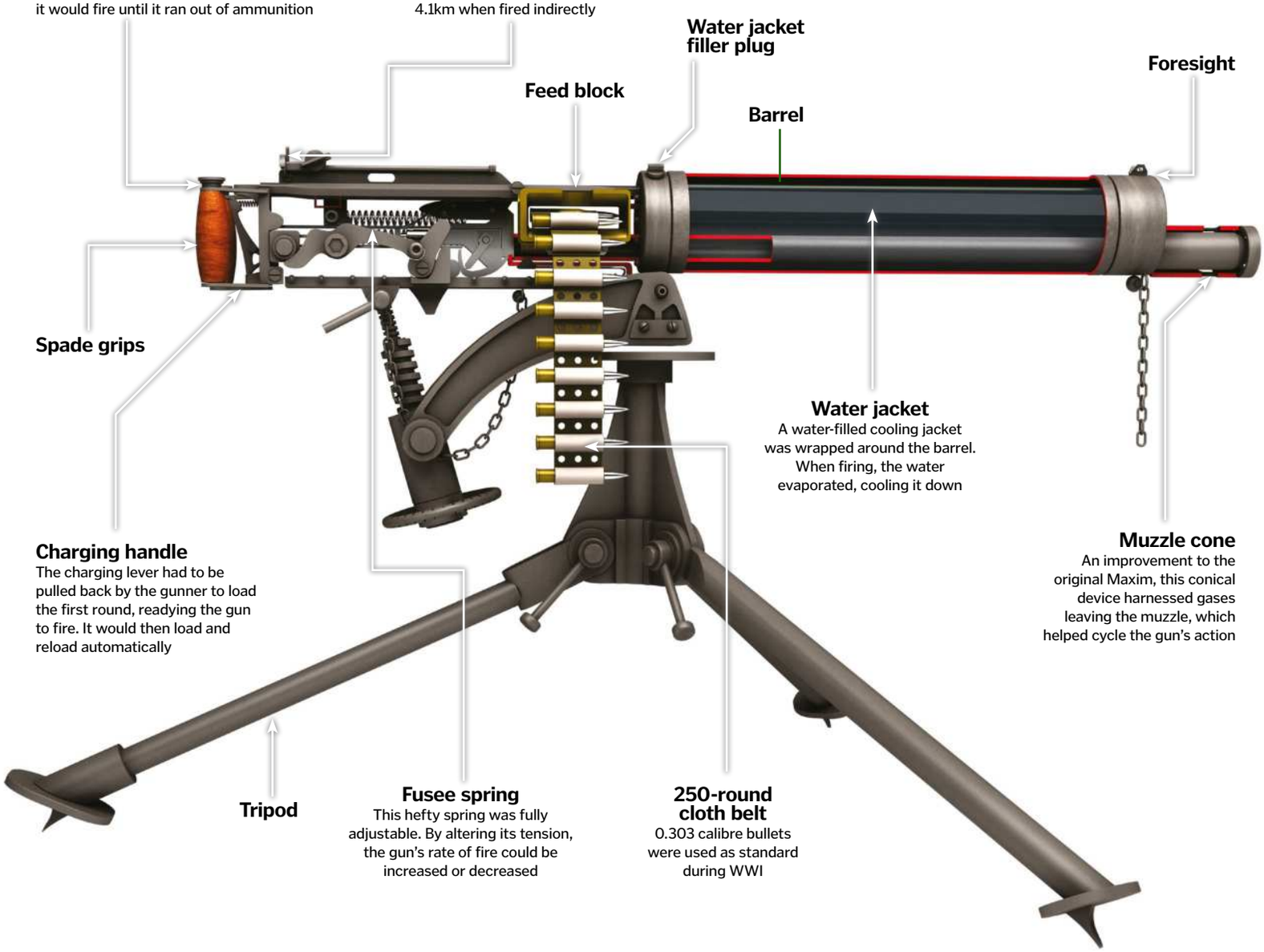
Ballista
A large missile-throwing weapon, the ballista was an excellent choice when you wanted to disrupt infantry columns. Developed first by the Ancient Greeks, the ballista worked via torsion springs, with huge wooden spikes propelled at great speed when released over large distances. The ballista would be scaled down over the centuries until eventually it could be handheld.

Tower
A simple yet devastatingly effective siege weapon if used correctly, the tower was literally a mobile wooden turret on wheels that enabled troops to scale enemy walls in relative safety. After climbing up through the shielded internal cavity, soldiers would then be released with the dropping of a small drawbridge, enabling them to charge over enemy battlements.



Ready, aim, fire!

Clever engineering prevented malfunction in the heat of battle



WWI's Vickers-Maxim gun

Stare down the barrel of this deadly British weapon

The Vickers-Maxim machine gun obliterated battlefields, rattling off over 450 rounds a minute. It entered service in time to see action during World War I and served the British Army for more than 50 years.

The key to the design was that it used the power of the cartridge explosion to reload and re-cock the gun after each shot. This became known as a recoil system, as the forward force of the bullet produced an opposing force – the recoil. The force generated pushed the bolt and barrel backwards, while they were locked together. A small metal catch then unlocked the two parts as they moved backwards, before the spring pushed the barrel forward again. The backward motion also ejected the used shell, and a new cartridge was automatically loaded into place from the ammunition belt. If the trigger was still depressed, the whole cycle started again and another shot would fire almost immediately.

Although the Vickers was rather heavy and required a team of six to operate, it was extremely reliable. During a British attack in 1916, it's estimated that ten Vickers fired more than one million rounds in just 12 hours.

Men from 5th (Scots) Parachute Battalion, 2nd Parachute Brigade, fire a Vickers machine gun from a rooftop in Athens in 1944

Meet the musketeers

One of the most popular military units for centuries, musketeers fought in battles and protected esteemed rulers all the way from France to India

Musketeers were an early form of soldier who were armed with muskets. They acted as a bridge unit between traditional infantry – which fought on foot and typically hand-to-hand with swords and other melee weapons – and dragoons, a type of light cavalry armed with long-ranged weapons. This granted them a level of versatility and flexibility most prized on the battlefield, with musketeer units typically reserved for the protection of nobility or, in many Western nations, royalty.

While musketeers as a unit are older (see 'Musketeer origins' boxout for details), they didn't emerge in Europe until the 16th century, with the concept only really taking off on a large scale in the early-17th century.

While this particular era was dominated by the French musketeers of the Maison du Roi (the Royal Household) – upon which the fictional musketeers of Alexandre Dumas' *The Three Musketeers* are based – countries like Spain, Britain, Russia, Sweden, Poland and even India each developed their own musketeer units in this period and used them on the battlefield frequently.

Musketeers as a common military unit were largely phased out by the middle of the 19th century, with a number of new developments in firearms rendering the musket obsolete. With the introduction of the rifle – which could shoot both farther and much faster than the musket – the rifleman unit would emerge, negating the need for the greater speed afforded by the mounted musketeer.

This, combined with the decline of many dynasties throughout Europe – notably the Ancien Régime of France during the French Revolution – saw all musketeer units permanently disbanded.

A Prussian engraving of a French musketeer (right) from the reign of Louis XIV (1643-1715)

How to fire a musket step-by-step

1 Carry
While marching to position the musket should be carried over the shoulder, with the firing rest secured in your off-hand.

2 Firing prep
When firing is ordered, the musket is filled with priming powder, charge and ball, with the weapon held in a diagonal orientation.

3 Insert fuse
The match fuse should then be cocked in the matchlock and blown on, ensuring at all times that the match doesn't extinguish.

4 Shoot
Draw up the musket while simultaneously securing the firing rest. Slot the musket in the rest's support brace, aim and fire.

5 Withdraw
Bring the musket off its rest, draw it down to your side, then take the fuse off the musket and await further instructions from superiors.

Uniform of a musketeer

Check out the essential kit worn by famed musketeer captain, Comte d'Artagnan

Hat
Musketeers started off in the West wearing simply ornate hats, but by the early-19th century these evolved into metal helmets. They did remain decorative though, often with large feathered plumes attached

Bandolier
Bandoliers (a pocketed belt) and ammunition pouches/bags were a common accessory for musketeers, so they were always well supplied on the battlefield. These belts were strapped around the waist or chest

Tunic
Considerably more elaborate than standard infantry, musketeer tunics and – in later periods – cuirasses, favoured manoeuvrability over armoured protection

Musket
The musketeer's primary weapon, the musket was deadly, albeit cumbersome to use. Its slow reload rate restricted use to four shots per minute at best

Holdall
As musketeers were on the road during much of their military service, each carried their own holdall to store food and personal belongings

Cape
A feature associated more with earlier iterations of musketeers, the cape offered some protection from the elements while travelling

Sword
As musketeers were trained to fight both on horseback like dragoons and on foot like infantry, they were also equipped with a sword for hand-to-hand engagements

Boots
Boots were an important part of the musketeer's uniform, both communicating their prestigious position and providing good support on the ground and on horseback (some had spurs attached)

Musketeer origins

Unlike the musketeers of the Maison du Roi – the Royal Household of France – who were founded in 1622 during the reign of Louis XIII, musketeers had already been operating across the other side of the world in China since the 14th century. Indeed, through the Ming Dynasty (1368-1644) no national army was complete without multiple musketeer divisions, with soldiers armed with matchlock muskets. Surviving texts indicate that these musketeers fired in lines and typically from a kneeling position. This development of the concept of musketeers in China stemmed from their invention and mastery of gunpowder, with the musket revolutionising traditional forms of combat.

"The musket was deadly, albeit cumbersome to use"

Inside the Manhattan Project

In 1945, America unleashed the most powerful weapon the world had ever seen

The word atom means 'uncuttable', but in 1938 German scientists achieved the unthinkable. They split an atom into pieces, triggering an intensive period of research that would change the world forever.

Splitting the atom, or nuclear fission, was achieved by shooting neutrons at uranium. As the particles slammed into the atoms, their nuclei broke apart, creating lighter elements and releasing more neutrons in the process. If these neutrons could be harnessed, they could be used to split even more uranium atoms, triggering a chain reaction that could become powerful enough to be used as a weapon. And, as World War II dawned, physicists were afraid that the Nazis would do just that.

Several scientists had fled fascism in Europe and arrived on American shores, and among them were Leo Szilard, Albert Einstein and Enrico Fermi. Szilard wanted to warn the president about the new discovery, but he was a junior researcher and needed a more senior scientist to back him up, so he asked colleague Edward Teller to take him to see Einstein, who then alerted President Theodore Roosevelt.

Roosevelt formed an advisory committee on uranium, but he was distracted by the war and it wasn't until 1941 that he really sat up and took notice. That was the year that Japan attacked Pearl Harbour, killing over 2,000 American soldiers in a brutal aerial ambush.

Headquartered in New York City and under the name of the Manhattan Project, Lieutenant General Leslie R Groves assumed control of atomic research. His team was given just $6,000 to investigate atomic warfare, and eminent physicist Enrico Fermi began work on the first phase. No one thought they would succeed.

Fermi had escaped Italy when he went to Sweden to collect his Nobel Prize; rather than return home, he fled to the US with his wife. As the Manhattan Project began, he focused his efforts on getting a nuclear chain reaction working, and with Szilard's help he built the world's first nuclear reactor in a squash court under the stadium at the University of Chicago.

To sustain a nuclear chain reaction, they needed to slow the neutrons down so that they could collide with more uranium nuclei and split them open. They did this by embedding uranium spheres in layer upon layer of graphite. Finally, in 1942, they succeeded in getting a chain reaction going, and the government started to pour money into research.

The army bought land in the desert at Los Alamos in New Mexico under the pretence that they needed a new demolition range. The new

facility was put under the command of physics professor Robert Oppenheimer, and the team started working out how much fuel they would need to build their bomb.

Uranium ore contains different isotopes of the radioactive element; the atoms of these variants have different numbers of neutrons. Most uranium is in the form of uranium-238, but to build a bomb the scientists needed uranium-235, so they needed a way to separate them. The calculations for how much fuel they would need were little more than estimates, but when Oppenheimer and his team asked for 200 kilograms of uranium (ten times more than they ended up using), President Roosevelt approved $500 million of extra funding.

The first separation devices for creating uranium fuel were designed by Ernest Lawrence at Berkeley, California. Known as calutrons, the machines were scaled-up mass spectrometers, which send atoms whizzing past a magnet. Uranium-235 is ever so slightly lighter than uranium-238, and the lighter an atom is, the more the magnet will bend its path, allowing the two to be neatly separated.

The process was painstakingly slow; each calutron structure could only produce ten grams of uranium-235 a day. So they built a dedicated facility called the Y-12 Uranium Enrichment Plant at Oak Ridge in Tennessee, which contained over 1,150 of them. There was no time to test the tech on a small scale, and when they first switched Y-12 on, its magnets reportedly pulled the nails out of the walls. However, once it was up and running, the plant attracted 75,000 workers, and by the end of the war Oak Ridge was the fifth largest town in Tennessee.

Calutrons alone weren't going to be able to produce enough uranium to build a bomb, so the Manhattan Project scientists employed a second enrichment method to generate even more fuel. Gaseous diffusion – developed in the UK in the 1940s – worked by combining uranium with fluorine to make uranium hexafluoride gas. This gas was then passed through a barrier studded with microscopic holes, barely large enough to allow the molecules through. The molecules containing the smaller uranium-235 isotope squeezed past slightly faster on average, allowing them to be collected. 300,000 square metres of the barrier were constructed at the K25 plant in Tennessee in 1943.

At its peak, the production of nuclear fuel for the programme was consuming a tenth of the energy produced in the US. And within the space of two years the Manhattan Project had expanded to become one of the largest scientific

"There was no time to test the tech on a small scale"

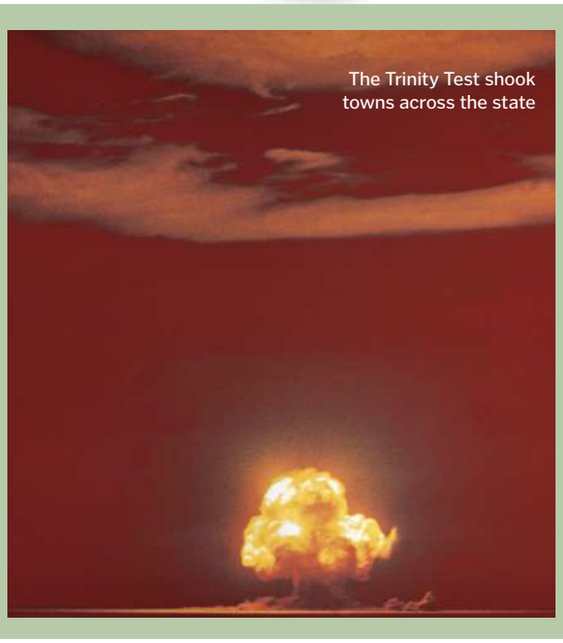
Uranium ore must be heavily processed to extract the right isotope needed to make a bomb

The first atom bomb

On 16 July 1945, the world changed forever. In the Trinity test, a 20-kiloton bomb known as 'The Gadget' was detonated in the Jornada del Muerto Desert in New Mexico, throwing a vast mushroom cloud into the air and turning the ground beneath to glass.

The Gadget was based on the same design as the Fat Man, the bomb that would later be detonated over the city of Nagasaki. It contained plutonium encased in explosives, designed to compress when it was triggered, kick-starting a nuclear chain reaction.

No one knew what would happen when an atom bomb went off, so soldiers were placed in the surrounding towns to help with an evacuation if it all went wrong. But the trial was a success, and less than a month later the bombs were dropped for real.



The Trinity Test shook towns across the state

The brains behind the bomb

Leo Szilard
Hungarian-born physicist Szilard was a close friend of Einstein and the catalyst of the Manhattan Project. He eventually led a petition against use of the bomb on cities.

Robert Oppenheimer
A theoretical physicist and head of the 3,000-strong team of scientists at Los Alamos, Oppenheimer later opposed the development of the hydrogen bomb.

Enrico Fermi
Awarded a Nobel Prize in 1938 for his work on radioactivity, Italian physicist Fermi led the beginning of the Manhattan Project. He constructed the first ever nuclear reactor.

Otto Hahn
German chemist Hahn discovered nuclear fission and was awarded a Nobel Prize. He was not a part of the Manhattan Project, but his science formed the basis of the bomb.

Edward Teller
Hungarian-American Teller led a team in the theoretical physics division at Los Alamos. A strong supporter of nuclear weapons, he is known as 'the father of the hydrogen bomb'.

Hans Bethe
Nobel Prize winner, Bethe was chief of theoretical physics at Los Alamos. He worked with Teller to develop the hydrogen bomb but later campaigned for nuclear disarmament.

Seth Neddermeyer
Neddermeyer was an American physicist and the mastermind behind the implosion design of the Fat Man atomic bomb that was dropped on the Japanese city of Nagasaki.

James Chadwick
Chadwick was a Nobel Prize-winning English physicist who discovered neutrons. He led the British Mission collaboration with the Manhattan Project.

undertakings ever attempted, spanning several cities and employing tens of thousands of people from the areas of military, science and government. But the scientists still didn't know if their bombs would work.

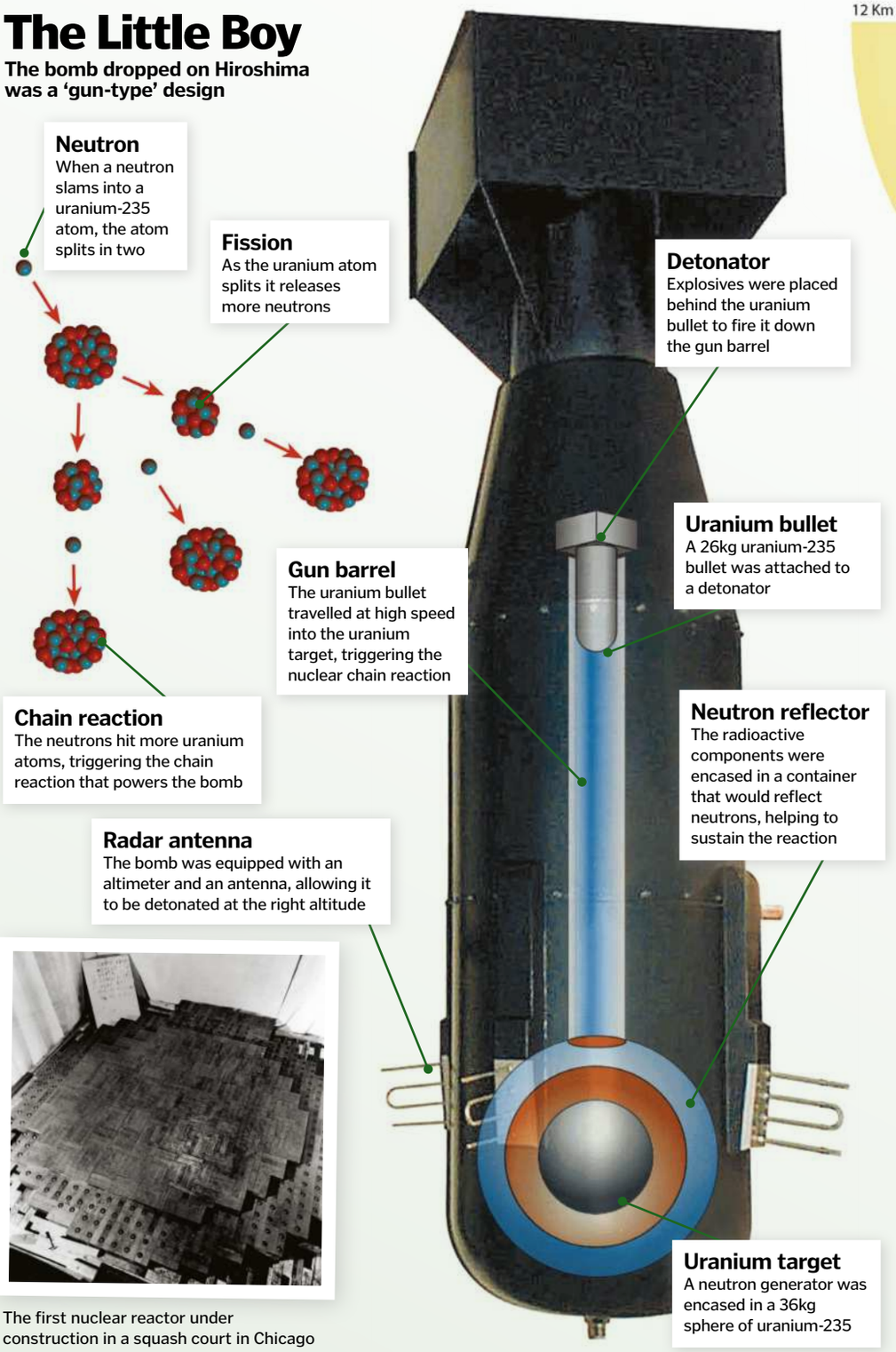
Creating enough uranium for even one bomb was proving challenging enough, so there would be no extra fuel left over for a test, but in 1941, plutonium was discovered. This human-made radioactive element could be produced by irradiating uranium in nuclear reactors, and it could potentially fuel a second bomb. Scientists in Chicago designed reactors to generate plutonium, and over 60,000 construction workers were set to the task of building a new plant in the desert at Hanford in Washington.

For the uranium bomb – later named Little Boy – the scientists were basing their design on a gun, firing one chunk of uranium into another to set off the chain reaction, but for the plutonium bomb they devised an outer shell of explosives that would detonate around a plutonium core. The shockwaves would push the plutonium atoms together, triggering the chain reaction.

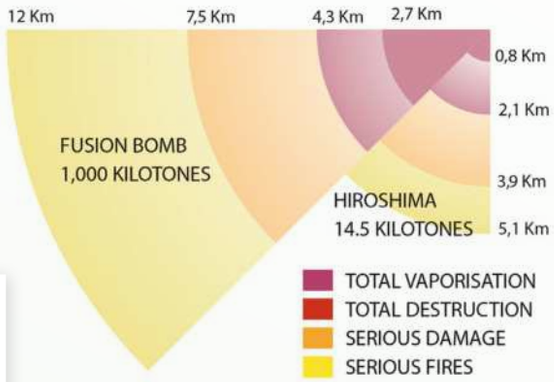
On 12 April, 1945, President Roosevelt died, and a month later, Nazi forces surrendered, but Japan refused to end the war, and America's project to develop their atomic bombs continued. President Truman made the decision to drop the bombs on 1 June that year, and in July they performed the first test on American soil, detonating a replica of the plutonium bomb - Fat Man - and releasing a blast equivalent to 20,000

The Little Boy

The bomb dropped on Hiroshima was a 'gun-type' design



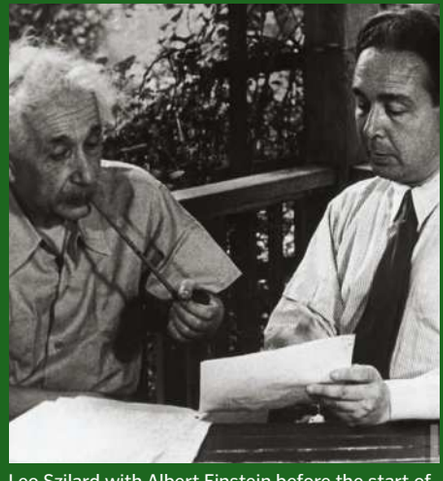
The first nuclear reactor under construction in a squash court in Chicago



Trying to stop the bomb

Physicist and inventor Leo Szilard had been the catalyst for the start of the Manhattan Project, but by 1945 he and many other scientists had become seriously concerned about the bombs that they'd helped to create. Szilard penned a petition to the president which read, "Atomic bombs are primarily a means for the ruthless annihilation of cities... a nation which sets the precedent of using these newly liberated forces of nature for purposes of destruction may have to bear the responsibility of opening the door to an era of devastation on an unimaginable scale."

The petition was signed by 70 scientists working on the Manhattan Project, but in April of 1945 President Roosevelt died. Szilard didn't know how to get the message to the new president, and Truman never saw it before the bombs fell.



Leo Szilard with Albert Einstein before the start of the Manhattan Project

Nagasaki before and after the atomic bomb was detonated

tons of TNT. This was right at the upper end of their estimates, and it turned the desert sand into glass.

On 6 August 1945, Paul Tibbets boarded the Enola Gay, named after his mother, and flew over Hiroshima with Little Boy. It had taken 120,000 people and over $2 billion to develop the atomic bombs, and within moments 90 per cent of the city was flattened and 150,000 people were killed by the blast or subsequent radiation sickness. Two days later, Fat Man was detonated over Nagasaki, killing a further 75,000. Japan surrendered on 15 August 1945.

Oppenheimer, who led the Manhattan Project said, "We knew the world would not be the same. A few people laughed, a few people cried, most people were silent. I remembered the line from the Hindu scripture, the Bhagavad-Gita. Vishnu is trying to persuade the prince that he should do his duty, and to impress him takes on his multi-armed form and says, 'Now I am become Death, the destroyer of worlds.' I suppose we all thought that, one way or another."

Close up of the tubes that fed uranium into the Hanford reactor

"We knew the world would not be the same" – Robert Oppenheimer

Nuclear power now supplies over ten per cent of the world's energy

The Manhattan Project's legacy

After the end of the Second World War, America continued to conduct atomic tests. The world had never before seen a weapon capable of such rapid and complete destruction, and as the atomic age dawned, several countries joined the nuclear arms race, stockpiling their own weapons to deter attacks from other nuclear states.

The Soviet Union, using information leaked by spy Klaus Fuchs, tested their atom bomb for the first time in Kazakhstan in 1949. The UK detonated the Hurricane in 1952, France joined in with Blue Gerbil in 1960, and China did their first test in 1964.

America also rushed to develop the hydrogen bomb, which they detonated in 1952 in the Pacific Ocean, completely vapourising the island of Elugelab. And, using more information from Fuchs, the Soviets designed their own, culminating in a 58 megaton blast in 1961.

In 1968, the US, USSR and UK agreed to a Non-Proliferation Treaty to limit the spread of nuclear weapons. They also encouraged the sharing of peaceful nuclear technology across the world, helping positive new developments like nuclear power and nuclear medicine to reach as many people as possible.

Sikorsky MH-60 Black Hawk

Designed for special operations in hostile environments, this was a new kind of war machine, built for a new kind of battlefield

From the chaotic skies over Somalia during the Battle of Mogadishu in 1993, to the covert operation to kill Osama Bin Laden in 2011, Black Hawk helicopters are among the deadliest, most effective tools available to any modern military. After its experiences in the Vietnam War in the 1960s and 70s, the US military knew just how essential it was to have tough, multi-role helicopters available. Not only were these aircraft useful for rapidly transporting combat personnel to and from battlefields, they could even remain on the front line to provide direct support. However, the existing Huey helicopters were out of date.

Two US companies, Boeing Vertol and Sikorsky, went head-to-head with their rival designs for the new combat helicopter, with the latter finally winning the contract with its S-70 prototype. Since the model first took to the skies in 1974, a huge number of variants have gone into production, each with its own specific role to play in a combat zone. For instance, the secretive 'MH-X' version – used during the mission to kill Al-Qaeda's chief – was rumoured to be equipped with stealth technology, making it almost undetectable to radar.

The MH-60 variant seen here was developed from the standard UH-60 Black Hawk for use during special operations. The machine's effective range was greatly increased with the addition of a more efficient fuel tank, the installation of systems for aerial refuelling, and the improvement of the craft's overall survivability. It was during a special operation that these assets would be put to the ultimate test, an incident known as Black Hawk Down.

The Black Hawk is capable of carrying a range of weaponry, and will often house a door gunner for protection in hostile environments

Inside a Black Hawk

The high-powered tech behind the MH-60 military machine

Machine guns
Two electrically powered M134 Miniguns, capable of firing a combined 12,000 rounds per minute, can be mounted on the aircraft

Optional extras
Black Hawks can be fitted with Hellfire anti-tank missiles and rocket pods, as well as additional fuel tanks for long-haul missions

"Black Hawk helicopters are among the deadliest and most effective tools available to any modern military"

The Battle of Mogadishu

On 3 October 1993, American Rangers flew into Mogadishu, the capital of Somalia, to capture a wanted terrorist leader. They swooped down on the target's base in a convoy of helicopters, with MH-60 Black Hawks hovering overhead to provide support. However, when two of these aircraft came under fire, they crash-landed into the maze of streets and alleyways below. What was supposed to be a smooth operation soon turned into chaos as soldiers battled through the streets to reach the downed aircraft and their stricken crew. The ensuing battle is now most famously known as Black Hawk Down, due to the 1999 book of the same name, which was adapted into the 2001 Oscar-winning film.

A Black Hawk flies over Mogadishu during Operation Restore Hope, a year before the Battle of Mogadishu

Twin engines

Two General Electric engines pack a combined 3,988 shaft horsepower, enabling the aircraft to reach a top speed of 280km/h

The use of night-vision (infrared) technology enables pilots to safely conduct special operations in total darkness

Safety features

The fuel tank, landing gear and body frame are all reinforced to protect the crew in the event of a crash. Even the pilots' seats are designed to absorb and nullify any critical impact

Radar

As well as GPS capability, the MH-60 is fitted with multi-mode radar capable of tracking the terrain below, even in poor weather conditions

Passengers

Up to 18 personnel can be transported in the rear of the aircraft, which has an operational range of over 2,200km

Night vision

A forward looking infra-red (FLIR) video camera pod captures the surrounding environment and relays it to the pilot, enabling safe flight in total darkness