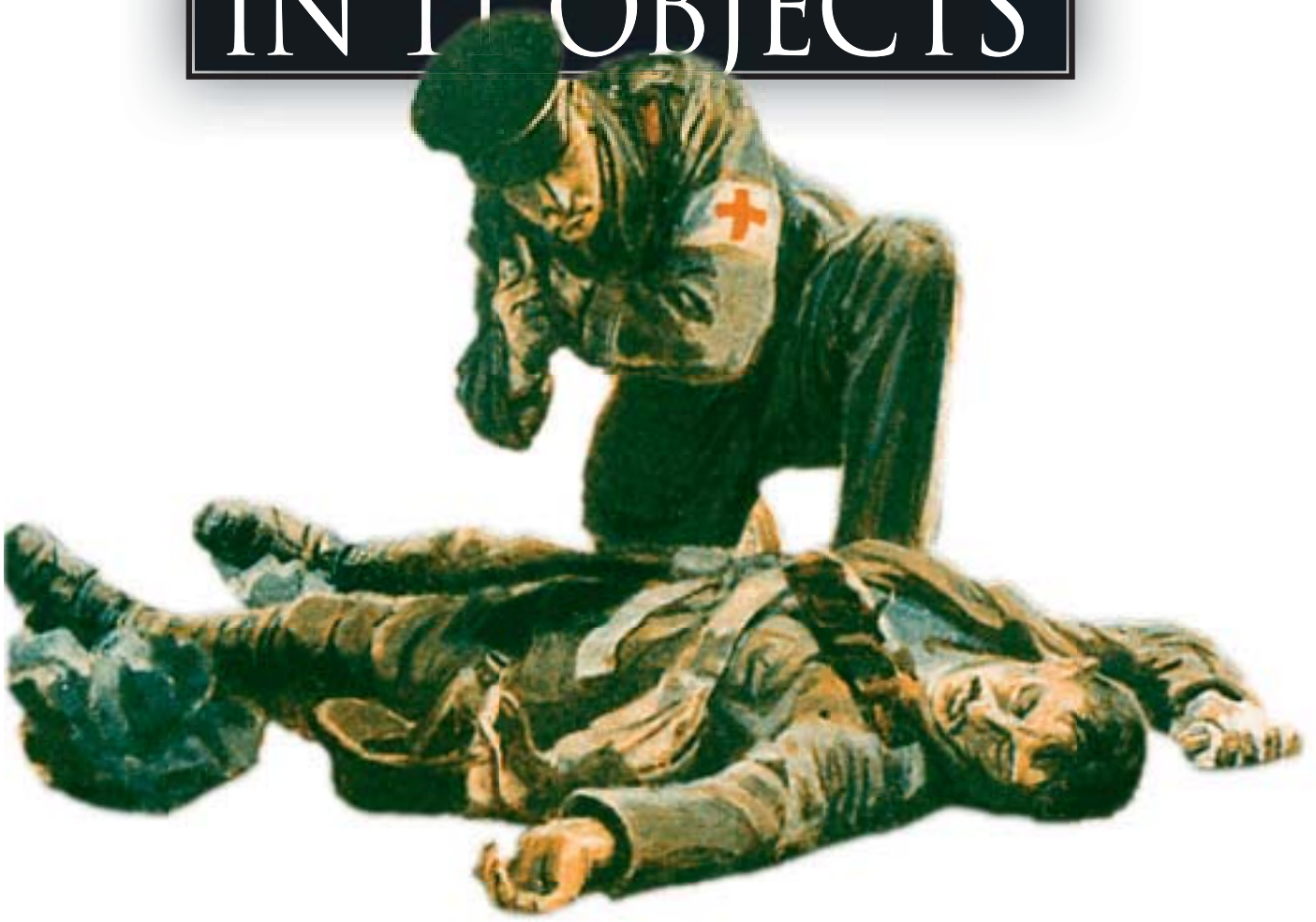
A HISTORY OF FIRST WORLD WAR TECHNOLOGY IN 11 OBJECTS



As we commemorate the centenary of the Armistice that halted the guns on the 11th hour of the 11th day of the 11th month of 1918, let's take a brief tour of 11 technologies that came to prominence during the 'war to end all wars'.

By **Nick Smith**

THE GREAT WAR, as the First World War was then known, between the Entente Powers ('Allies') and Central Powers officially came to an end with the stroke of a pen one hundred years ago on 11 November 1918, when an armistice was signed in a railway carriage at Compiègne in northern France. For four years, three months and two weeks 'the war to end all wars' raged in theatres of conflict the world over, with 70 million mobilised military personnel involved. Today's estimates agree that this was at the cost of some seven million military and six million civilian lives. The world had never seen anything like it.

One of the chief reasons for such a prolonged loss of life was the sustained deadlock arising along key fronts, where 19th-century warfare techniques were being replaced by a mechanised, industrialised approach to combat. As the war developed, so too did chemical warfare, automated rapid-fire machine guns, aviation, submarines, armoured vehicles and communications.

For all the human tragedy, the First World War was a war of firsts, not just in tactics, but also in technology.

The second decade of the 20th century was a boom time in engineering, science and technology, as both powers put their industrial strength into getting the upper hand. Some of the results, such as the wristwatch or the tank, were natural evolutions of pre-existing ideas that had been in the works for centuries. Others, such as field photography and mobile radiology, seemed to come from nowhere. On the centenary of the Armistice, we look at 11 important developments that took place at that time.

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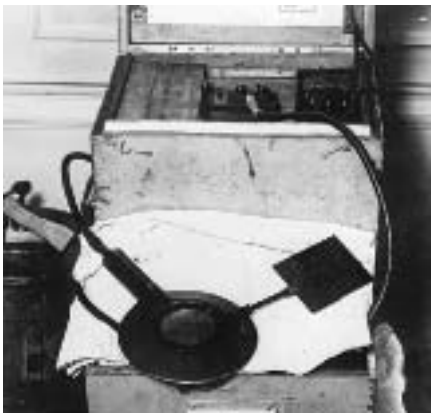
1
That sinking feeling: subsea acoustic hydrophone



During the First World War submarines came into their own for the first time, with the German U-boat (an Anglicised abbreviation for *'unterseeboot'* or 'underwater boat') wreaking havoc among Allied shipping. The development of subsea mines contributed to the underwater world becoming a new theatre of conflict, with US and European Allied Forces supply lines suffering continual attack. Losses on both sides totalled 146 war vessels, 267 auxiliary vessels and more than twice as many merchant ships.

Detection was key and the chief technology in the enterprise was the hydrophone, which, as its Greek name suggests, is a listening device to be used in water. At the outset it was little more than a stethoscope attached to a mechanically rotated receiver, allowing the sonar operator to hear (and so determine the direction of) propellers and engines. Technological development of the hydrophone was shrouded in secrecy, with none other than New Zealand physicist Ernest Rutherford pioneering research into piezoelectric devices as underwater transducers. Rutherford's only patent was for the hydrophone, which greatly reduced the impact of the U-boat campaign.

2
The balloon's gone up: 'kite' observation balloons

Although the use of lighter-than-air flight, in the form of observation balloons, pre-dated the First World War by more than a century (they were originally used during the French Revolutionary Wars and date back to 1794), this was a technology that had its heyday in the early 20th century. In widespread use by both Allied and Central powers, they enabled the highly accurate artillery fire from gun emplacements often several miles behind the front line.

At the start of the war, the British were still using spherical balloons that had been a feature of the Boer Wars in the latter part of the 19th century. These were soon replaced by tethered 'kite' balloons that were aerodynamically more stable and could be used in more disruptive wind conditions than their predecessor.

Because observation balloons helped combatants see far beyond the enemy's front line, they quickly became a target for 'balloon busters' in fixed-wing aircraft that were careful not to fly below 1,000ft due to the risk from anti-aircraft fire. Observation pilots were also the first aviators to routinely deploy parachutes.

3
Zeppelin rules: the killer rigid airship

Until the 20th century the British public had been largely unaffected by wars that tended to be fought overseas in remote territories. But with the First World War came the innovation of the air raid, developed by the Central powers as a morale-breaking tactic.

The thinking was that if the home front were vulnerable to air attack the Allied forces would capitulate. The chief instrument of the plan was the Zeppelin rigid airship that, although invented in the late 19th century, had until that point only been used for civilian transportation. With a payload of two tonnes of incendiary bombs and a speed of 85mph, the Zeppelins would be able to sail over the deadlocked front in Western Europe and strike at the Allied nerve centre, London.

Not all went according to plan for the Germans who succeeded only in a few raids on East Anglia, with their first on London hitting a house in Stoke Newington with no casualties. In all, the raids claimed a total of 500 lives on UK soil, with the effort being widely regarded as a success only in reconnaissance and propaganda terms.

4
The soldier's camera: first compact snapper

War photography dates back to the Mexican-American War of 1846-48, when cameras used by soldiers in the field were large and, with their slow shutter speeds, difficult for the untrained user to operate effectively. But in 1912 Kodak launched the first successful attempt at a 'compact' camera. Called the Kodak Vest Pocket (KVP) camera, it was to shift one million units by the time it was discontinued in 1926. The main reason for its phenomenal popularity was its size, allowing users to carry it in a 'vest' (i.e. waistcoat) pocket.

In 1915 an upgraded model appeared, Called the 'autographic', it allowed photographers to write on their negatives with a stylus, the writing then appearing in white on the developed print. The camera introduced the 127-film format, which is still in production (although serving only a niche market after the advent of digital photography).

However, it wasn't all good news for amateur war reportage photographers. While photography by Allied servicemen was initially unregulated, unauthorised taking of pictures was made a military crime in 1915, although enforcement of the regulation was lax, especially among officers.

5
Talking to the sky: air traffic control

In 1920, an airfield to the south of London – Croydon Airport – became the world's first aerodrome to introduce air traffic control (ATC), a ground-to-air communications channel that guides pilots through airspace. This innovation was the direct result of developments in two-way radio technology that evolved during the First World War.

Radio communication existed before the outbreak of war, but it made massive strides during 1914-18 due to its usefulness to the military, particularly in the air. By 1916 US Army technicians could send a radio signal over a distance of 160 miles (260km) and radiotelegraph messages could be exchanged between two aeroplanes in flight. Prior to this breakthrough in two-way radio, a pilot on a reconnaissance or attack mission effectively lost contact with ground support once he had got airborne. Microphone boom arms and acoustically damped headgear followed in order to make communication easier.

Shortly after the war, the US Post Office integrated the technology into the first Air Mail Radio Stations (AMRS) and air traffic control as we know it today came into existence.

6
X-rays to go: mobile radiology

More than a million wounded soldiers of the First World War underwent an X-ray examination. This was largely due to the efforts of Marie Curie, who to this day is better known as the Nobel laureate who discovered the radioisotopes of the elements radium and polonium.

The advent of war effectively brought an end to her scientific research, so having packed away her stock of radium in a lead-lined box, she turned her attention to how she could use her scientific knowledge for humanitarian purposes as part ofthe war effort.

Curie turned to the work of Wilhelm Roentgen to see how his discovery of X-ray electromagnetic radiation could be applied in field medicine. While X-rays were being used in hospitals, mainly in big cities, Curie recognised the need for the technology to be taken to the battlefield to assist army surgeons in treating their patients. The result was the 'radiological car' (also known as the 'Little Curie'), which was equipped with X-ray machines and dark-room photographic equipment. Curie then trained 150 women to be operators of the Little Curie and mobile radiology was born.

7
Now you see me: the arrival of camouflage

From a French verb meaning 'to make up for the stage', camouflage was only widely taken up as recently as the First World War. And while concealment and deception have always played a role in conflict, it wasn't until 1915 that it was taken seriously as a military tactic, when the French military became the first to form a dedicated camouflage unit (its practitioners, many drawn from the world of art, were known as 'camoufleurs').

As well as devising large-scale objects, such as modified netting to provide disruptive patterning to conceal gun emplacements, units such as the British Army's Special Works Park RE (Royal Engineers) under the command of Lieutenant-Colonel Francis Wyatt developed personnel combat uniforms to remove features that were conspicuous at a distance. This in turn led to the adoption of the colours and patterns that are still being developed to suit specific terrains and to counter surveillance technologies.

Ships were painted with 'dazzle' camouflage (geometric shapes in contrasting colours), though this was to lessen in its effectiveness as a result of the increasing effectiveness of radar during the 20th century.

8
Time for action: the 'hands-free' wristwatch

Wearing a timepiece on the wrist goes back to the second half of the 16th century, when Queen Elizabeth I set the trend by tying a small clock to her arm with a ribbon. But, the regal innovation never took off, and well into the early 20th century, the style was for officers to carry their watch in their waistcoat pocket. The drawback was that telling the time took up at least one hand that could be otherwise employed. Things changed with the introduction of the First World War tactical innovation of the 'creeping barrage' – artillery fire calculated to land just in front of advancing troops that would 'creep' along with the men, offering sustained cover from the defending enemy. Because field communications weren't sufficiently evolved to radio to the troops on the battlefield, and because visible flag signalling would have given away operational details to the enemy, the procedure was instead done by synchronising troop movement to artillery fire with precise timings. To achieve this, officers needed 'hands-free' technology and so the new-fangled wristwatch was reluctantly adopted.

9
Fire on demand: the flamethrower

Designed to do what its says on the tin, the flamethrower (the word comes from the German *'flammenwerfer'*) has been around since the time of the Ancient Greeks. But it only became a strategic weapon during the First World War after a portable unit was invented by German scientist Richard Fiedler, based on his research work into developing nozzles for spraying liquids.

By the end of the war Fiedler had accumulated 11 patents in technology related to the process, the last of which was for a model for aviation. Fiedler was assisted in his work by Bernhard Reddeman, who was a chief firefighter in Breslau and Leipzig.

Contrary to common belief, relatively few soldiers were injured by flamethrowers in combat, as it was used principally to 'flush out' enemy troops into the open.

Although it might appear that the flamethrower is one of those technologies that has no positive application, it has been put to constructive purpose, occasionally being deployed for snow clearance, while in forest fire management it has been used for the rapid creation of 'fire-breaks' – a case of fighting fire with fire.

10
Combined innovation: the armoured tank

The three basic components of the tank are mobility, armour and firepower. The combination of these concepts goes back at least as far as Leonardo da Vinci. But it wasn't until the early 20th century, when the innovations of the internal combustion engine along with armour plating and continuous (or 'caterpillar') track vehicle propulsion started to mature that the tank as a frontline fighting machine could evolve into a format that is recognisable today.

The term 'tank' was applied to British 'landships' that were in development in 1915 as a code word after the original 'water carrier' had been rejected on the grounds that its initials – WC – would be 'unsuitable'. The name stuck and the tank made its First World War debut during the Battle of the Somme in 1916. The French and British were convinced of their worth both as a tactical and attack weapon and built them in their thousands. The Germans, who had been developing similar armoured attack vehicles, remained unconvinced and made just 20. Although the first models to see active service were unreliable, the tank played a critical role in overcoming deadlock on the Western Front.

11
Floating airports: the aircraft carrier

With development of fixed-wing aircraft occupying the decade before the outbreak of the First World War, it's not surprising that aircraft carriers – warships that act as a seagoing airbase – were yet to make their mark. In 1912 the Royal Navy's HMS Hibernia hosted the first aeroplane take-off from a ship, but couldn't accommodate its landing. In 1917 HMS Furious became the first ship to successfully receive a plane on deck. But the vessel that would lay down the blueprint for the aircraft carrier – supporting both launch and recovery of aircraft on a full-length flight deck – was HMS Argus. Under construction as an ocean liner when war broke out, the design was changed to provide air support from the sea. By the time of completion in 1918, Argus had missed the war, but was kept for testing aircraft carrier technologies and saw service in the Second World War.