

WAR



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MEET THE TEAM

Chief Executive Editors

Jessica Philipsz
Sheli Patel

DIGITAL PRODUCERS

Jessica Philipsz
Sheli Patel

EDITORS

Kayan Ranina
Jasmine Campion
Caitlyn Beacall
Mihir Kandi

WRITERS (A TEAM)

Josh Obi
Hussein Mahamed
Meshayel Shah
Sean Matusiewicz
Roxy Cholewa
Caitlyn Beacall
Jessica Philipsz
Bayley Northern
Kohei Dunkley

WANT TO JOIN THE TEAM?

To join the Science Journal team as a writer, please get into

contact! Drop us an email at:

25252@mynsb.school (Sheli)

25256@mynsb.school (Jessica)

The background of the image is a detailed, high-magnification microscopic view of biological tissue, likely a cross-section of a plant stem or a similar natural structure. The tissue shows a complex, fibrous, and layered structure with various shades of brown, tan, and purple. A large, semi-transparent, dark purple circle is centered over the image, containing the text. The overall aesthetic is scientific and naturalistic.

MEDICINE & DENTISTRY

LEAD EDITOR: KAYAN RANINA

PHAGE THERAPY AND THE COLD WAR

WRITTEN BY: JOSH OBI

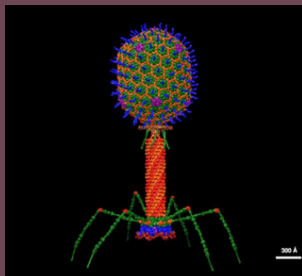
The challenges of war have pushed medicine to advance, such as through creating the modern **triage** system or improving plastic surgery and prosthetics. However, by overlooking the ongoing war between bacteria and **bacteriophages** in nature, have we overlooked a crucial solution to combat **antibiotic resistance**?

While medical research has reshaped the harsh realities of war, those same brutal realities also reshape medicine, driving advancements in the post-war world. For instance, the modern **triage** system, now a fundamental aspect of all emergency medicine, was first developed during World War I to determine the order of priority in treating the wounded. This system, born out of necessity to manage large numbers of casualties, has since been refined and frequently used in a modern-day context. [1] Expertise also developed in fields such as plastic surgery, neurology and **psychiatry** for the development of prosthetic limbs, as the number of veteran amputees increased. [2] Doctors and scientists are forced to innovate rapidly in such conflicts to manage overwhelming numbers of patients with diverse and complex conditions, accelerating the creation of new medical systems and practices.

Yet the Cold War, largely between the United States and the Soviet Union from around 1947 to 1991, has had the opposite effect, particularly through the case of phage therapy and **bacteriophages**. International political tensions may have kept us from developing and using an alternative to antibiotics long before the looming threat of **antibiotic resistance**. **Antibiotic resistance** is when bacteria evolve and mutate so that the antibiotics or medicine that are standard treatments for bacterial infections no longer work. This is projected to cause an estimated 10 million deaths annually by 2050 and is becoming an increasingly urgent problem.

Bacteriophages, or phages for short, comes from the Greek word “to eat”, meaning that **bacteriophages** are most simply put, bacteria eaters. In slightly more scientific terms, **Bacteriophages** are viruses—good viruses—that kill bacteria. They are probably the most prevalent biological entity, with an estimated 10³¹ (that’s a 1 followed by 31 zeros) **bacteriophage** particles on Earth. Phage therapy involves using **lytic phages** specific to a strain of bacteria to infect their host cell, hijack its machinery, and cause it to burst, killing the bacterium. [3] Unlike antibiotics, phages are precise, targeting only harmful bacteria and leaving the rest of the microbiome intact. Due to their abundance, selecting new phages is a rapid process that can be frequently accomplished in days or weeks, whereas developing a new antibiotic is a time-consuming process and may take several years. [4] They were first used in 1919 by Felix d’Herelle, enabling a 12-year-old boy suffering from a severe **gastrointestinal disease** to make a rapid recovery. [6] Despite promising early results, research into phage therapy stalled during the Cold War. None of the relevant Soviet Literature was ever translated into English, due to the distrust and fear of anything related to communism in the US at the time. Furthermore, Soviet biologists continued to develop phage therapy in isolation from international research, while internal Soviet debates about their nature, shaped by political pressure, led to a series of unique narratives emerging on **bacteriophages**. This divide slowed the global development of phage therapy, delaying what could have been a valuable alternative to antibiotics for decades.

The contrasting trajectories of medical advancements during wartime and the **stagnation** of phage therapy during the Cold War, illustrates the complex interplay between conflict, politics, and scientific progress. As the threat of antibiotic-resistant infections becomes increasingly urgent, there is renewed interest in phage therapy, yet is this too late for a cure against once treatable diseases?



Triage – The assessment of patients in order to determine the urgency of their need for treatment and the nature of treatment required.

Psychiatry – Medical field concerned with the diagnosis, treatment and prevention of mental health conditions.

Antibiotic resistance - When bacteria evolve and mutate so that the antibiotics that are standard treatments for bacterial infections no longer work.

Bacteriophages – Virus that infects and replicates within bacteria.

Lytic Phages – Bacteriophages which go through the lytic cycle, ending in the lysis or rupturing of the cell wall of the bacteria.

Gastrointestinal disease – Disease which affects the gut or digestive system.

Stagnation - The state of not flowing or moving.

COMPLETE NARRATIVE OF THE DEVELOPMENT OF BACTERIOPHAGES AND SOVIET BIOLOGY

[INFORMATION SITE OF AN ACTIVE PHAGE THERAPY SITE IN GEORGIA \(INTERESTING COMPARISONS BETWEEN PHAGE THERAPY AND ANTIBIOTICS HERE\)](#)

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THE HISTORY OF BATTLEFIELD MEDICINE

WRITTEN BY: HUSSEIN MAHAMED

The history of battlefield medicine has been shaped by thousands of years of conflict, driving innovations in medical knowledge, technology, and practices. From the use of ancient medical remedies to the cutting-edge medical technologies used in today's conflicts, the development of battlefield medicine reflects the significant societal shifts throughout history as well as showcasing the harsh realities of war.

One of the earliest forms of medical practices in times of warfare was often in the hands of those who were not properly trained, healing warriors with **crude** methods of treatment. Dating back to around 3000 BCE, the Mesopotamian civilisation practiced basic methods to clean wounds, including washing them with water or wine, and using honey and poultices as antiseptics, as documented through **cuneiform** tablets which were also closely involved with religious rituals and magical practices [1]. On the contrary, the Romans had made significant contributions in laying the foundations for early medical knowledge. Understanding that the wounded must be treated quickly, they developed the first ambulances, and organised groups of 'litter bearers' to rush them away to military field hospitals [2]. Medical personnel would then employ their improved surgical techniques on the warriors, developed by army physicians such as Galen of Pergamon, who became known for his advancements in medicine. These include procedures such as **cauterisation** and amputation when necessary.

Expanding on Roman medical texts, the Islamic world further advanced the field of battlefield medicine, at a time where the loss of medical knowledge elsewhere proved to be a major obstacle during the Middle Ages. Al-Zahrawi, also known as the 'Father of modern surgery', is renowned for his groundbreaking medical encyclopaedia, 'The Method of medicine'. The 30th volume entitled 'On Surgery and Instruments' was by far his most significant achievement, its contents detailing the more than 200 surgical instruments he had invented, including a variety of scalpels, **retractors** and **curettes** [3]. These were especially useful in the treatment of trauma on the battlefield, where speed and precision were crucial. Moreover, Islamic physicians such as Avicenna recognised the value of opium as an effective painkiller, being one of the most widely used form of pain management of that time. Its use on the battlefield was vital in making painful procedures like amputations more tolerable for soldiers.

World War 1 marked the birth of modern battlefield medicine. The sheer scale of the war, combined with the increased lethality of weapons, created unprecedented levels of injury, thus requiring the invention of new medical approaches. The triage system emerged as a vital strategy for dealing with the influx of casualties presented during the war, where they were divided into three categories: 'Trivial' (minor injuries), 'Treatable' (serious injuries) and 'Terrible' (life threatening injuries). Soldiers with minor or serious injuries were either treated quickly and returned to the war or transported to base hospitals. However, those who suffered life threatening injuries were given pain relief, only being seen by surgeons once the other categories had been cleared [4]. This system helped to maintain robust front lines during combat whilst also prioritising the well-being of the soldiers. Triage brought organisation and efficiency to urgent medical care, and after the First World War, it became standard practice in battlefield medicine.

From ancient healers treating patients with herbal remedies to modern surgeons performing life saving operations in remote locations, the challenges of warfare have driven some of the most critical advancements in battlefield medicine. Today, portable medical devices are carried by combat medics to treat their soldiers while on extended missions, whilst the rise of telemedicine enables specialists to guide medics in the field remotely, further enhancing the care available in even the most dangerous environments. These innovations continue to push the boundaries of battlefield medicine, ensuring that future advancements will further improve survival rates and the quality of care in conflict zones.

Cuneiform – One of the oldest forms of writing known used in ancient Middle east.

Crude – Constructed in a way limited to basic principles.

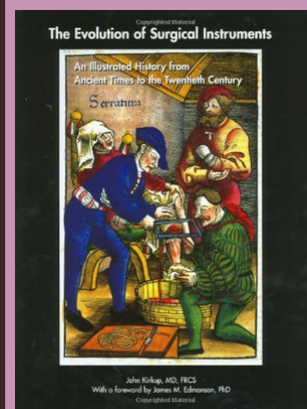
Cauterisation – Burning a part of a body to remove or close off a part of it.

Scalpels – A knife with a small sharp blade, used by surgeons.

Retractors – A surgical instrument used to separate the edges of a wound so that body parts underneath may be accessed during surgical operations.

Curettes – A small surgical instrument used to remove material by a scraping action.

WAR AND TRAUMA: A HISTORY OF MILITARY MEDICINE



The Evolution of Surgical Instruments: An Illustrated History from Ancient Times to the Twentieth Century
by John Kirkup

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DEVELOPMENT OF BLOOD TRANSFUSIONS DURING WAR

WRITTEN BY: MESHAYEL SHAH

War has played a significant role in advancing medical discoveries. The mass casualties and time restrictions faced by medical professionals on the battlefield forced them to innovate new medical treatments. Doctors developed more effective methods for wound care, trauma surgery, and infection control. Wars like World War I and II accelerated breakthroughs in blood transfusion, antibiotics, plastic surgery, and **prosthetics**, which were refined to meet the needs of wounded soldiers. These medical innovations, born of wartime necessity, had a **profound** impact on medicine.

Blood transfusions developed rapidly during the world war. Early blood transfusion attempts date back to the 17th century, but it wasn't until the 20th century that blood transfusions were reliable and widely used. The first successful human-to-human blood transfusion was made by James Blundell in the 19th century to treat **postmortem hemorrhage** in a patient. Although blood transfusions remained extremely risky due to transfusion reactions and clotting, it wasn't until Karl Landsteiner's discovery of ABO blood groups in 1901 that safer transfusions were now possible, as it significantly reduced the risk of incompatible blood transfusion, which was fatal previously.

During World War I, the demand for blood transfusions increased as doctors dealt with a number of casualties. Blood transfusions on the field were not possible as blood clotted easily and could not be stored for long periods of time. Canadian surgeon Lawrence Bruce Robertson was among the first to use **anticoagulants** like sodium citrate to prevent clotting during transfusions. This development was crucial because it allowed blood to be stored and transported rather than requiring direct person-to-person transfusion. This was developed further in 1917 by Geoffrey Keynes, who designed a portable blood transfusion kit that made it easier to perform transfusions on the front lines. This made it more practical during wartime. World War II saw even greater advancements in blood transfusion technology, largely due to the efforts to establish blood banks. The concept of blood banks allowed for the collection, storage, and distribution of blood on a much larger scale. The British government and American Red Cross both set up large-scale blood donation programs during World War II to meet the overwhelming demand for transfusions on the battlefield. These advancements were also supported by the development of new preservation techniques, such as the use of acid-citrate-dextrose (ACD) solution, which allowed blood to be stored for longer periods. This was critical during the war, as it enabled the transportation of blood to various locations where it was most needed, ensuring a reliable supply during critical moments. The innovations in blood transfusion during the world wars had a lasting impact on medical practice.

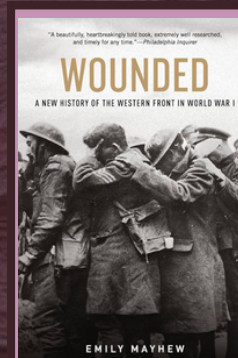
The establishment of blood banks, improved storage techniques, and a better understanding of blood types laid the groundwork for modern transfusion medicine. The concept of large-scale blood donation programs, first developed to address wartime needs, became a staple of healthcare systems worldwide. The development of blood transfusions during war was a vital advancement in medical history. Driven by the necessity to treat massive numbers of wounded soldiers quickly and efficiently, doctors and researchers made significant strides in understanding blood types, developing **anticoagulants**, and establishing blood banks. These innovations not only saved countless lives during the wars but also transformed healthcare in the years that followed.

Anticoagulants – A substance that is used to prevent and treat blood clots in blood vessels and the heart - also called blood thinner.

Postmortem hemorrhage – Loss of more than 500 ml or 1,000 ml of blood following childbirth.

Profound – Very great or intense.

Prosthetics – An artificial body part.

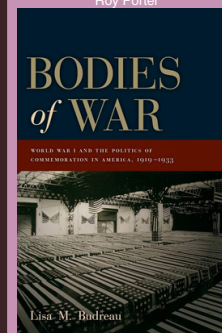


Wounded: A New History of the Western Front in World War I
Emily Mayhew

Blood and Guts: A Short History of Medicine
Roy Porter



Bodies of War: World War I and the Politics of Commemoration in America, 1919–1933
Lisa M. Budreau



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THE CELL

LIFE SCIENCE

LEAD EDITOR: JASMINE CAMPION

HOW WAR LED TO THE DEVELOPMENT OF REHABILITATION

WRITTEN BY: SEAN MATUSIEWICZ

Rehabilitation is the action of restoring someone to health or normal life through training and therapy after imprisonment, addiction or illness. After the consequences of World War 2 on soldiers and civilians' lives, it led to significant changes within the world of rehabilitation. Due to advances in medicine, a lot more soldiers had survived with major spinal injuries that left them **paraplegic** or **quadriplegic**. As a result, many programmes were established to help support these injured soldiers who not only had to cope with trauma from the war but also the trauma of being limited in everyday activities.

During World War Two, a lot more knowledge on the mental impacts on soldiers such as shellshock and battle fatigue were more widely accepted. This caused a lot more **innovation** within rehabilitation and a strong need for rehabilitation for soldiers to return to normal working lives [1] “with serious neck and spinal injuries”. Thus, Dr Ludwig Guttman, regarded as the father of the Paralympics, became head of the National Spinal Injuries Centre at Stoke Mandeville hospital in Aylesbury. Guttman was a pioneer in having sport play a major factor for **paraplegic** rehabilitation. He stressed the fact that it provided patients with [2] “integration and motivation” which is kept in practice till today. Guttman’s influence really shaped how rehabilitation is done in modern day medicine.

As for general practices there is a lot of encouragement with sports for people with spinal injuries and further research in physiotherapy has also helped people recover from even worse injuries. Furthermore, Guttman also established the International Medical Society of **Paraplegia** (IMSOP) which was also a vital factor in developing rehabilitation. Not only did this enhance the knowledge surrounding rehabilitation methods but allowed foreign doctors and administrators to discuss the effects of **paraplegia** on patients and the methods to treat them. This then expanded the knowledge regarding **paraplegia** and led to more significant developments in methods of treating **paraplegia**, such as developing more medicines, in other countries as well as the UK.

In addition, it is paramount to also include mental rehabilitation. Shellshock was the primary mental disorder that was identified during the first world war. Symptoms such as blindness, memory loss, depression were all prevalent in soldiers in WW1. Although at the start of the war shell shock was seen as desertion and weak, it became more widely accepted as more soldiers suffered from it. It was only after the war where psychologists could analyse and test treatments for the patients. Peter Lesse analysed Queen Square’s hospitals records and found that the results were [3] “heavily skewed towards the early part of the war”. This meant that rehabilitation was further researched as it led to the understanding and creation of rehabilitation programmes to treat shell-shocked soldiers and overall **innovate** more developments for rehabilitation.

Although Lesse did not investigate the **psychopathology** of the patients, it did give a great reference point for many psychologists to build on.

Paraplegia - partial or complete paralysis of the lower half of the body with involvement of both legs that is usually due to injury or disease of the spinal cord in the thoracic or lumbar region

Quadriplegia - paralysis below the neck that affects all of a person's limbs.

Innovate - make changes in something established, especially by introducing new methods, ideas, or products.

Psychopathology - features of people's mental health considered collectively.

[The National Library of Medicine: Artificial Limbs Fixing spinal cord injuries with ‘dancing molecules’](#)

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THE LASTING ECOLOGICAL SCARS OF CHEMICAL WARFARE

WRITTEN BY: ROXY CHOLEWA

This article explores the environmental impact of chemical warfare, with a focus on the harmful effects on soil and water. It also highlights the role of international agreements in deterring the use of such weapons and advocating for environmental protection.

Background of Chemical Warfare Agents (CWAs)

The large-scale use of chemical warfare agents (CWAs) first occurred during WWI, where chemicals like chlorine, phosgene, and mustard gas were deployed. These toxic compounds left a lasting impact, not only in terms of human casualties but also on the environment. As these agents became more sophisticated, so did the damage they caused, often affecting the soil and water systems that supported local ecosystems. To curb the use of such destructive agents, the Geneva Protocol of 1925 attempted to ban chemical warfare, yet due to limitations in enforcement, chemical agents continued to be used in later conflicts. The infamous deployment of Agent Orange in Vietnam showed the true danger of these chemicals, where the highly toxic compound dioxin spread through the environment, seeping into soil and water systems leaving contamination still present to this day. This lasting pollution has led to a decreased biodiversity, disrupted habitats and soil erosion.

Environmental Effects of Chemical Warfare Agents

Chemical warfare agents are categorised by their distinct modes of action. For example, choking agents, such as phosgene and chlorine, primarily target the respiratory system, whilst damaging the surrounding environment. During WWI, phosgene was widely used, and upon reaction with water, it produced hydrochloric acid, acidifying soil and water in affected areas. Such pH changes affect soil health, leading to soil erosion along with degradation of vegetation, and harm to aquatic life. Similarly, chlorine acidifies soil and water, which leads to the gradual loss of plant and animal species, hence reducing biodiversity.

Blister agents like mustard gas cause severe skin and respiratory injuries and are particularly persistent in the environment. Mustard gas binds to organic particles in the soil and retains its toxicity over extended periods, resulting in soil infertility. Areas affected by mustard gas often become dry with sparse vegetation and struggle to support plant regrowth, leaving landscapes vulnerable to erosion and resulting in biodiversity loss.

Blood agents, such as hydrogen cyanide, inhibit cellular oxygen use in organisms presenting unique risks when they enter the environment. Although cyanide is volatile, when it seeps into soil or water, it becomes highly toxic to plants and aquatic life, disrupting food webs and so reducing biodiversity within ecosystems.

Nerve agents affect the nervous systems of exposed organisms. This includes chemicals like sarin, which although degrades relatively quickly, poses immediate risks to wildlife, poisoning organisms upon contact and leading to swift population declines in areas of high exposure. The disruption of food chains and local populations from nerve agents results in long term instability within the ecosystem, as key species are lost. When chemical agents are released into the environment, they often lead to significant changes in the types of plants and animals that can survive in those areas. Native species may struggle to adapt to the new, toxic conditions, while invasive species may take advantage of the weakened ecosystem. For example, in regions affected by Agent Orange, aggressive non-native plants have been known to outcompete local vegetation, leading to a further decline in biodiversity.

International Treaties

International treaties have played an important role in controlling the use of CWAs and their environmental effects. While the Geneva Protocol of 1925 was an initial attempt to ban chemical and biological weapons, it lacked specific provisions for environmental safety. The Chemical Weapons Convention (CWC) of 1997, established a legally binding framework that prohibited CWAs and emphasised the importance of safe disposal and **remediation** of contaminated areas. This treaty has led to significant progress in the elimination of chemical weaponry and in protecting affected environments, slowly restoring the damages made. Countries that support the CWC have an emphasis on decontaminating impacted soil and water systems, which remain essential in countries like Vietnam, where **remediation** projects have worked to reduce dioxin contamination in bodies of water and restore damaged soils to support local biodiversity once again.

Several **remediation** techniques are utilised including **phytoremediation**, which is slow but improves soil health and allows vegetation to regrow, and **bioremediation**. In aquatic systems sediment dredging occurs, removing contaminated layers of sediment, as well as filtration systems to reduce pollutant levels in water. Restoration projects that reintroduce native species also help stabilise soils and promote nutrient cycling, increasing plant growth. These methods combined allow the restoration of the health of ecosystems harmed by CWAs.

The environmental impacts of chemical warfare are far-reaching, with effects that can persist for decades in soil, water, and biodiversity. The long-lasting toxicity of CWAs illustrates the enduring ecological toll of chemical weapons, disrupting ecosystems and damaging essential resources like soil and water. International agreements, like the Chemical Weapons Convention, have been crucial in curbing the use of CWAs and promoting environmental safety. However, continued commitment to proactive environmental protection and **remediation** is needed. By combining global cooperation with effective **remediation** practices, we can work to heal the ecosystems affected by chemical warfare and support long-term recovery efforts worldwide.

Unprecedented - never done or known before

Remediation - the correction of something that is damaged, reversing environmental damage

Phytoremediation - where certain plants can absorb and break down toxins over time gradually detoxifying the soil

Bioremediation - using microorganisms to break down toxins in soil, helping restore the ecosystem by neutralising harmful compounds

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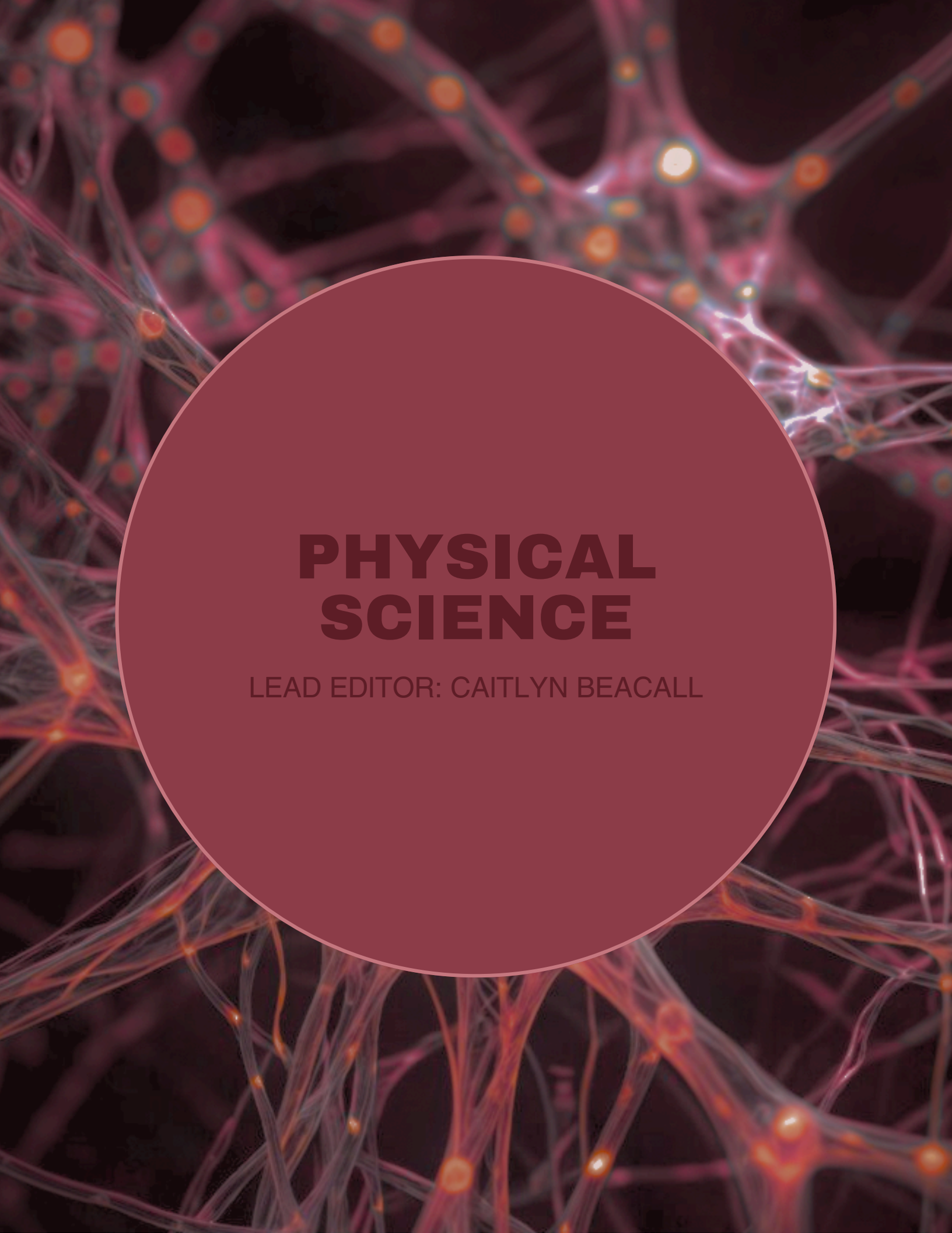
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PHYSICAL SCIENCE

LEAD EDITOR: CAITLYN BEACALL

HOW DID ANDERSON SHELTERS SAVE LIVES?

WRITTEN BY: CAITLYN BEACALL

In the height of World War Two (1939-1945), **air raids** were a common part of life with 103 German **air raids** taking place over the duration of the war. As this was a looming threat to British citizens, especially those in big cities, a solution needed to be made and quickly. This solution was founded by William Patterson, who designed a suitable shelter that would provide protection from bombs dropped nearby. These shelters were known as Anderson Shelters, with 3.5 million being found in British gardens by the end of the war.

These shelters were made of six curved sheets of galvanised, corrugated steel that were bolted together at the top to make a small, contained shelter. The 'doors' of the shelter would be attached by the homeowner and added the last layer of protection from potential bomb debris and shockwaves. There were 3 main factors that ensured the strength and integrity of these structures that were protecting Britain:

- The material was steel
- The steel was corrugated
- The steel was galvanised

Steel

The material being steel played a vital role in providing the necessary protection for those hiding in them. Steel is an **alloy** of iron and carbon which is stronger, more fracture resistant and can withstand tougher conditions than either of those elements on their own. Steel has an irregular **lattice** structure due to the difference in size between the iron and carbon atoms. This distorts its structure as the atoms no longer sit tidily next to each other. Due to this, the material becomes much stronger as the layers of metal cannot slide over themselves and fracture because of the disturbance by the carbon atoms. This was massively effective in protection from bombings as more force was required to damage or break the steel sheets that made up the shelter.

Corrugation

The steel sheets were not flat as this made them too flimsy and required the sheets to be made thicker, which was difficult during war times as materials were precious. To overcome these problems, 'folds' were added to the sheets which provided increased strength without the need to make them thicker. These folds were so effective as they increased the surface area and the grooves added stiffness to the material. They were effective especially against bombs as it could distribute a large, targeted force more evenly spread across a larger area. This works the same way as corrugated cardboard, as you will be able to see that cardboard with a folded, zig-zag inside (like those used for packing boxes) is much more durable than single, flat cardboard (like those used for cereal boxes). Corrugated steel is still used in building applications, such as roofs, today.

Galvanisation

The sheets used were coated in a thin layer of zinc (galvanised), as it prevented rusting and **corrosion** from weakening the structural integrity of the metal **alloy**. In 1939, the 'Hot dip method' was used to add the protective layer to the sheets. This process included **degreasing** the sheets and **pickling** it using an acidic solution. The material was then fluxed to prevent oxidation within the air before the protective layer could be added and finally, the sheets were left in a molten zinc bath until the temperature of the metal equalised to the temperature of the molten zinc. If this had not been done, when the Anderson shelter was subjected to the outside elements, it would have produced weak, fragile spots that would break during the impact of a bomb and this would no longer protect the families taking shelter inside. By the end of the war in 1945, a new method of galvanising materials was developed. This method was called electro-galvanisation and involved electrical current and allowed these protective layers to be made from zinc, tin, nickel and cadmium which was helpful as more materials could now be used to form protective layers around metals.

Conclusion

I believe that it is a mixture of these factors, along with the location of the Anderson shelters being underground which made them so secure and safe during the war. Families would often put bunk beds for children to sleep in and store food and tools in-case of emergencies. Although they may not have been the most comfortable or luxurious place to spend the night, with cold and damp often settling inside with the families, they undoubtedly saved thousands of lives.

Air raid – when bombs would be dropped from planes, primarily over big cities

Alloy – a mixture of different materials, to make one material with desired properties

Lattice structure – a 3D arrangement of atoms or ions in a material

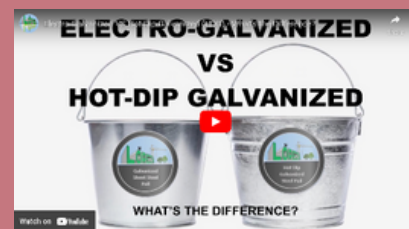
Corrosion – the deterioration of materials by chemical reaction

Degreasing – removing grease and oils from the surface of a material

Pickling – removing impurities from the surface of a material

What is electro-galvanising?

Electro-Galvanized VS Hot-Dip Galvanized (HDG) - What's the Difference?



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ONE DAY OF CEASEFIRE: WILL IT HELP CLIMATE CHANGE?

WRITTEN BY: JESSICA PHILIPSZ

Back in the lockdowns of 2020, NASA satellites discovered that carbon emissions dropped by 5.4% [1]. Would the same effect occur if all war and conflict stopped for a single day? In this article, we are going to focus on the US military's carbon emissions, alongside the destruction of ecosystems, to try to answer this question.

Carbon Emissions

Carbon emissions is widely recognised at the forefront of climate change, contributing to 80% of global warming [2]. Shockingly, a definite proportion of these emissions are from warfare alone, with 1-5% of global emissions being from armed forces [3]. Let's consider the US F-35 fighter jet. It can fly at speeds of 1200 mph, and can travel a distance of 1200 miles before refuelling [4]. In travelling 100 **nautical miles**, it would take 5.8 minutes for it to release 1.4 tonnes of carbon dioxide [5] into the atmosphere (equivalent to 1400 bags of flour)- the same is emitted from a single car in the UK over an entire year [3]. Over the past 20 years, the US military has conducted on average 46 airstrikes in a single day [6], whether missiles or bombs. If we assume that all 46 of these strikes are carried out by 46 different F-35 fighter jets, and the aircrafts travels one single journey without refuelling, we can calculate that the total carbon emissions for a single day would be 773 tonnes. Initially, this may seem like a lot, but when you compare it to the daily global emissions of 35 billion tonnes [7], these aircrafts only emit 0.0008% of all carbon dioxide in a single day.

Destruction of Ecosystems

The direct influence of war on climate change is clearly visible through its contributions to **greenhouse gases**. However, it is the indirect destruction of the environment and its ecosystems that pose the larger threat to climate change. It is not unknown that the US military uses a lot of natural resources to fuel its army: they are the largest institutional consumer of oil in the world [8]. This oil used in military vehicles contaminates water supplies in warzones, alongside **depleted uranium** from various ammunition [8]. Not only that, but the widespread bombing also destroys forest cover and increases the loss of vegetation [9]. This all furthers the effect of climate change, as the plants that were once there would have absorbed the excess CO₂ emissions for **photosynthesis**, decreasing the concentration of **greenhouse gases** in the atmosphere.

Why is this all a problem?

Increasing the amount of carbon emissions into the atmosphere, and taking away resources that remove it, all increase the **greenhouse gases** in the ozone layer. This layer in the atmosphere causes heat from the sun to be reflected into the earth, warming the planet. [10] The increase in temperature is dangerous for a multitude of reasons: sea levels will rise due to ice caps melting in the poles, causing more flooding of coastal areas; increases wildfires from hotter temperatures; more destructive storms, as more moisture is evaporated from the earth's surface; increased drought; more CO₂ being absorbed by the ocean because of its warmer temperature, making it more acidic, endangering marine life.

So, will a day of total ceasefire help climate change?

Personally, I believe not. While my estimations only consider the US Military Airforce, and doesn't take into account the various wars around the world at this time, the impact of these other factors will only be trivial in comparison to the total global emissions in a single day. As well as this, the long-term effects of destroying ecosystems and polluting the environment cannot be prevented, neither erased in a single day. It is up to our governments now to find sustainable solutions to climate change, and prevent irreversible damage to our planet.

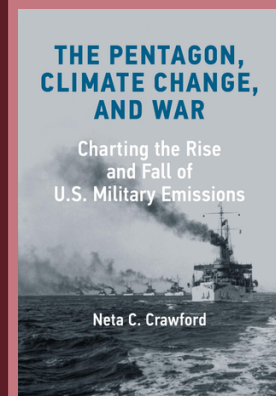
Nautical miles- a unit used in measuring distances at sea, equal to 1,852 metres

Greenhouse gases- gases in the earth's atmosphere that trap heat

Institutional- relating to an organisation

Depleted Uranium- a dense, weakly radioactive metal used in military armour and ammunition.

Photosynthesis- the process by which plants make food using sunlight, water, and carbon dioxide.



THE PENTAGON,
CLIMATE CHANGE,
AND WAR:
CHARTING THE
RISE AND FALL OF
U.S. MILITARY
EMISSIONS
NETA CRAWFORD

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ENGINEERING & TECHNOLOGY

LEAD EDITOR: MIHIR KANDI

WAR & CONFLICT

WRITTEN BY: BAYLEY NORTHERN

Throughout the past century, developments in technology have been astounding. As technology develops further and integrates itself with our lives, the malicious use of technology grows proportionately due to our reliance on it. This can be shown clearly by studying the use of technology in recent conflicts. Not only has technological advancements been weaponised, reducing the access that a country has to modern technology using a variety of techniques has been demonstrated as a siege-like tactic vital to winning most conflicts.

Israel – Hezbollah Pager Attacks

When studying recent conflicts, a clear example of the impact technology has had on conflict is the recent pager attacks on the 17th and 18th of September in Lebanon and Syria[1]. This attack involved the use of thousands of sabotaged pagers and radio devices, resulting in the injury of thousands of people and 37 deaths[2].

Regression

Hezbollah has relied heavily on pagers as a way of communication. They used low-tech methods to try and evade location tracking by Israel[3]. This was chosen after mobile-phones were abandoned due to being too vulnerable following the assassination of Yahya Ayyash in 1996, a notorious bomb maker, by rigging his phone with explosives[4]. However, despite this, the external party manufacturing these pagers turned out to not have Hezbollah's safety interests in mind[5].

How was it done?

It is theorised that, to achieve the strength of the explosions in the attack, the pagers must have had up to 3 grams of explosives added to them beforehand. This would have been done by tampering with the supply chain[6]. This led to them, once a message had been sent, exploding synchronously.

The pagers were manufactured under the Gold Apollo trademark, a Taiwan pager manufacturer. However, they denied ever making the pagers used in the attack and attributed them to a Hungarian company named BAC[7], which have not responded on the situation.

This has led some to, after investigation, claim that BAC consulting was affiliated with Israel and led to the manufacture of the tampered pagers[8].

Conclusions

Overall, this poses an interesting question about the development of technology during conflict. Even though some major concerns revolve around developing highly advanced contraptions with the sole purpose of winning conflict, there should also be an equal concern about the vulnerability of the technology in use by the general population, although not to this scale.

As technology has developed, its integration in our society has furthered. As shown by the attacks, by potentially sabotaging supply lines and exploiting vulnerabilities, this siege-like strategy of tampering and preventing access to technology could become more viable in future conflicts.

However, it could also be said that this type of attack is only possible due to a poor choice in supplier by those who bought these pagers and isn't something which is possible to extend to all conflicts, due to the factors which had to align.

Overall, while it isn't something to be afraid of, it provides an interesting perspective into the landscape of future conflicts.

Malicious – Having negative intentions or motives.

Integrates – Becoming a part of something.

Proportionately – Having a related growth or change to something else.

Regression – A return to a less developed state.

Notorious – Well known and/or recognised.

Synchronously – At the same time.

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DEVELOPMENT OF THE LOCKHEED RAPTOR F-22

WRITTEN BY: KOHEI DUNKLEY

In the early 1980s, the **USAF** would outline the requirements for an ATF (advanced tactical fighter) - a military fighter jet that would provide air superiority in the skies. To achieve air superiority, these fighter jets would require the ability to achieve and maintain control of the skies through stealth, maneuverability and pure speed in particular, countering emerging threats from the likes of new Soviet offerings: the MiG-29 and Su-27 fighter jets.

In September 1990, the Lockheed YF-22 fighter jet would make its first flight having won the USAF's ATF (advanced tactical fighter) competition. The YF-22 was a **prototype**, designed to demonstrate its potential for replacing the aging F-15 Eagle and F-16 Fighting Falcon jets that had been in service since the 1970s. The YF-22 **prototype** would pave the way for development of the Lockheed Raptor F-22, which would ultimately make its first flight in September 1997.

To meet requirements set by the USAF, the Raptor F-22 was engineered to succeed in air-to-air combat, ensuring air superiority. The slim airframe of the F-22 would significantly reduce the visibility of the aircraft to enemy radar systems, providing the aircraft an advantage when performing aerial engagements with other aircraft. The aircraft's stealth would be proven through its low RCS (radar cross-section), thereby making the aircraft look smaller and less significant to radar systems.

A low RCS value was achieved on the Raptor F-22 thanks in part to the involvement of advanced **composite** materials. These materials would absorb radar waves, reducing the number of waves that return to their source and provide information for aircraft detection systems. Additionally, the use of flat and sharply angled control surfaces allowed for the ability to also deflect waves, therefore no longer traveling at the required angle to return to their source. Sharply angled control surfaces such as those that made up the swept-wing design of the airframe, would also support the aircraft's supersonic capabilities.

The Raptor was able to cruise at Mach 1 speeds without the use of an **afterburner**, a feat not previously possible with prior generations of fighter jet. The swept-wing design of the aircraft would minimize air resistance, allowing for higher maximum speeds, as well as higher levels of efficiency. The origins of said swept-wing design date all the way back to Germany's first fighter jet, the Messerschmitt Me 262, which was introduced some 50 years earlier in 1944. As well as improved aerodynamics, the Pratt & Whitney F119-PW-100 turbofan engines were equally noteworthy, providing a noticeable increase in efficiency as well as thrust to make sustainable supersonic flight a reality while also supporting the Raptor's claim to air superiority.

While excelling in the **USAF's** requirements of air superiority, the Lockheed Raptor F-22 would showcase other abilities, helping the Raptor to completely outclass its Russian opponents. This could be identified through the F-22's impressive maneuverability thanks to its thrust vectoring engines.

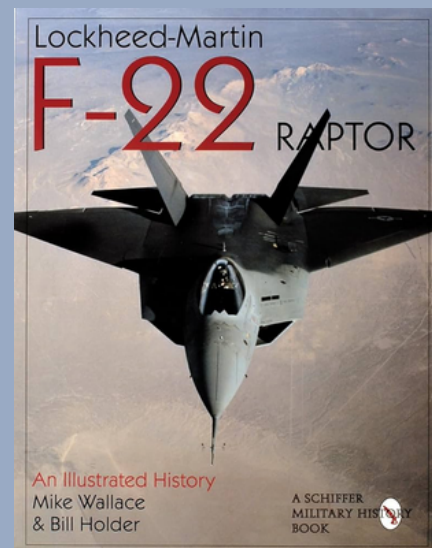
The Lockheed Raptor F-22 revolutionized military aviation, becoming the baseline for newer models of aircraft. Even though development started in the 1980s, the aircraft remains in service to this day, complementing the newer and more advanced F-35 Lightning II.

USAF - United States Air Force

Prototype - a first test version of a device that is developed/improved upon

Composite - made up of many different materials

Afterburner - an additional combustion component in which fuel is burned to create more thrust



Lockheed-Martin F-22
Raptor: An Illustrated History
By Mike Wallace

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