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How Scientists' Work Protects our Soldiers



A Hawkei is subjected to a live-fire underbelly blast testing during trials in 2011

The top priority for Defence scientists is providing support for deployed ADF personnel on operations.

Reducing the risk posed by roadside bombs is an area of significant effort by Defence Science and Technology (DST) researchers. But collecting data on the battlefield is extremely challenging.

Scientists, therefore, seek out alternative means of gathering information to help them design better military vehicles for our troops.

Melanie Franklyn, from DST's Land Division, has adopted an innovative approach to investigating how extreme forces affect the human body by analysing data from hospital patients involved in serious falls.

"A fall from a height where the patient lands on the base of their pelvis generates vertical-loading conditions similar to those exerted on a soldier subjected to an underbelly blast from under their seat," Dr Franklyn said.

"As the loading conditions are similar, and the types of injuries sustained are the same, we can use more readily available data from this civilian scenario to gain important insights into what occurs in the military context."

A soldier travelling in an armoured vehicle that is struck from underneath by an underbelly blast is at risk of sustaining severe injuries to the pelvis and lower back that could be life-changing or fatal.

Gaining a better understanding of the relationship between impact conditions and the tolerance supports efforts to optimise safety measures in military vehicles.

In some studies, researchers have tackled this problem by conducting experiments using cadavers, but the age of the cadavers tends to be much older than the typical Australian soldier.

An advantage of cadaveric experiments is they provide data in a controlled laboratory environment. However, subjects of advanced age on average have an injury tolerance that is considerably lower than that observed among young, living subjects.

While a greater level of protection might at first seem desirable, this could have unintended consequences.

Dr Franklyn has worked with experts at the Royal North Shore Hospital in Sydney to review patient medical records and analyse their data.

“Before we started our work, the research proposal had to go through a rigorous ethical review process,” Dr Franklyn said.

Analysis of the data revealed that tolerance to serious pelvic and spinal fractures was significantly higher, on average, in the younger than older cadavers.

This suggests that military vehicle seat designs might be over-emphasising the need to protect soldiers from injuries to the pelvis and lower back.

“While a greater level of protection might at first seem desirable, this could have unintended consequences,” Dr Franklyn said.

“Seats designed to reduce the likelihood of less serious pelvic or spinal injuries generally require more vertical space, bringing soldiers’ heads closer to the roof of their vehicle and potentially increasing the risk of head and neck injuries.”

Researchers also assessed the likelihood of personnel sustaining injuries by conducting live-fire blast testing.

They put crash-test dummies inside armoured vehicles and blew them up to measure loading levels on different parts of the body to work out whether predetermined injury thresholds had been exceeded.

Dr Franklyn said the live-fire testing program that formed part of the LAND 121 Phase 4 selection process, in which the Hawkei prevailed, was an example of effective collaboration between multiple teams across Defence.

Her research has not only directly contributed to the enhancement of test programs for Army vehicles, but has also informed the development of a US Army blast dummy called Warrior Injury Assessment Manikin.

The findings of the hospital data study are expected to support the refinement of pelvis and spine injury tolerance curves for use by vehicle test experts in Australia and the US.

The Siege of Tsingtao

The Siege of Tsingtao, sometimes Siege of Tsingtau, was the attack on the German port of Tsingtao (now Qingdao) in China during World War I by Japan and the United Kingdom. The siege took place between 31 October and 7 November 1914 against Imperial Germany. The siege was the first encounter between Japanese and German forces, the first Anglo-Japanese operation of the war, and the only major land battle in the Asian and Pacific theatre during World War I.

Background

Throughout the late 19th century, Imperial Germany joined other European powers in an imperialist scramble for colonial possessions. As with the other world powers, Germany began to interfere in Chinese local affairs. After



two German missionaries were killed in the Juye Incident in 1897, China was forced to agree to the Kiautschou Bay concession in Shantung (now Shandong) to Germany in 1898 on a 99-year lease. Germany then began to assert its influence across the rest of the province and built the city and port of Tsingtao, which became the base of the German East Asiatic Squadron of the *Kaiserliche Marine* (German Navy), which operated in support of the German colonies in the Pacific.

Britain viewed the German presence in China as a threat and leased Weihaiwei, also in Shantung, as a naval port and coaling station. Russia leased its own station at Port Arthur (now Lüshunkou) and France at Kwang-Chou-Wan. Britain also began to forge close ties with Japan, whose developments in the late 19th century mirrored that of the European imperialist powers as Japan acquired colonial

footholds on the Asian mainland. Japanese and British diplomatic relations became closer and the Anglo-Japanese Alliance was signed on 30 January 1902. Japan saw the alliance as a necessary deterrent to its main rival, Russia. Japan demonstrated its potential by its victory in the 1904–1905 Russo-Japanese War, and the alliance continued into World War I.

When the war in Europe began in August 1914, Britain promptly requested Japanese assistance. On 15 August, Japan issued an ultimatum, stating that Germany must withdraw her warships from Chinese and Japanese waters and transfer control of its port of Tsingtao to Japan. The next day, Major-General Mitsuomi Kamio, General Officer Commanding (GOC), 18th Infantry Division, was ordered to prepare to take Tsingtao by force. The ultimatum expired on 23 August, and Japan declared war on Germany.

At the beginning of hostilities, the ships of the East Asia Squadron under Vice Admiral Maximilian von Spee were dispersed at various Pacific colonies on routine missions. Spee's ships rendezvoused in the Northern Mariana Islands for coaling. SMS *Emden* then headed for the Indian Ocean, while the rest of the squadron made their way to the west coast of South America. The squadron engaged and destroyed two obsolescent ships of a small Royal Navy squadron at the Battle of Coronel, before itself being destroyed at the Battle of the Falkland Islands in the South Atlantic.

German Defences

The Boxer Rebellion at the beginning of the century had led Germany to consider the defense of Tsingtao. The port and town were divided from the rest of the peninsula by steep hills. The natural line of defense lay along the hills, from the *Kaiserstuhl* to *Litsuner Heights*. A second 17 km (11 mi) line of defense was set up along a closer line of steep hills. The final line of defense was along hills 200 m (660 ft) above the town. A network of trenches, batteries and other fortifications had been built in preparation for the coming siege. Germany had strengthened the defenses from the sea, laying mines in the approaches to the harbour and building four batteries and five redoubts. The fortifications were well equipped (though some with obsolete Chinese artillery) and were well manned.

Prelude

On 27 August, the Imperial Japanese Navy (IJN) sent ships under Vice-Admiral Sadakichi Kato, flying his flag in the pre-dreadnought *Suwo*, to blockade the coast of Kiaochow. The British Royal Navy (RN) strengthened the Japanese fleet by sending the China Station's pre-dreadnought HMS *Triumph* and the destroyer HMS *Usk*. On October 14th, the *Triumph* was slightly damaged by a German shore battery, killing one member of its crew and injuring two others. The blockading fleet consisted mainly of nearly obsolete warships, though it did at times include a few modern vessels. These included the dreadnoughts *Kawachi*, *Settsu*, the battlecruiser *Kongō*, her sister *Hiei*, and the seaplane carrier *Wakamiya*, whose aircraft became the first of its kind in the world to attack land and sea targets. These Japanese aircraft would also take part in another military first, a night-time bombing raid.



Suwo was the flagship of the Japanese expeditionary fleet during the Siege of Tsinatao.



Japanese troops coming ashore near Tsingtao

The 18th Infantry Division was the primary Japanese Army formation that took part in the initial landings, numbering some 23,000 soldiers with support from 142 artillery pieces. They began to land on 2 September at Lungkow, which was experiencing heavy floods at the time and later at Lau Schan Bay on 18 September, about 29 km (18 mi) east of Tsingtao. China protested against the Japanese violation of her neutrality but did not interfere in the operations.

The British Government and the other European great powers were concerned about Japanese intentions in the region and decided to send a small symbolic British contingent from Tientsin in an effort to allay their fears. The 1,500-man contingent was commanded by Brigadier-General Nathaniel Walter Barnardiston and consisted of 1,000 soldiers of the 2nd Battalion, The South Wales Borderers; later followed by 500 soldiers of the 36th Sikhs. Following a friendly fire incident, British troops were given Japanese raincoats to wear

so they would be more easily identifiable to the Japanese.



British troops arriving at Tsingtao in 1914

The Germans responded to the threat against Tsingtao by concentrating all of their available East Asian troops in the city. Kaiser Wilhelm II made the defense of Tsingtao a top priority, saying that "... it would shame me more to surrender Tsingtao to the Japanese than Berlin to the Russians". The German garrison, commanded by naval Captain and Governor Alfred Meyer-Waldeck, consisted of the marines of *III Seebataillon*, naval personnel, Chinese colonial troops and Austro-Hungarian sailors, for a total strength of 3,625 men. He also had a modest complement of vessels, including the torpedo boat *S-90*; four small gunboats: the *Illtis*, *Jaguar*, *Tiger*, and *Luchs*; and the Austro-Hungarian protected cruiser *Kaiserin Elisabeth*, whose crew was initially divided in two: half to man the ship, and half to fight with the German land forces.

On 22 August HMS *Kennet* of the China squadron, under the command of Lieutenant Commander F. A. Russell, while routinely monitoring the naval trade routes, encountered and was damaged in action by the German torpedo boat SMS S90, the German gunboat SMS *Lauting* and a 4-inch shore battery off Tsingtao. She was hit twice from the retreating S90.

Siege

As the Japanese approached their positions, Meyer-Waldeck withdrew his forces from the two outer defensive lines and concentrated his troops on the innermost line of defense along the hills closest to the town. The Austro-Hungarian cruiser, SMS *Kaiserin Elisabeth*, was stationed in Tsingtao at the start of the war. On 2 September 1914 the German gunboat *Jaguar* sank the stranded Japanese destroyer *Shirotaye*. On 5 September a Japanese reconnaissance aircraft scouted the port and reported that the Asian German fleet had departed; the Japanese ordered the dreadnought, pre-dreadnought and cruiser to leave the blockade. The next day, the first air-sea battle in history took place when a Farman seaplane launched by the *Wakamiya* unsuccessfully attacked the *Kaiserin Elisabeth* and the *Jaguar* in Qiaozhou Bay with bombs. Early in the siege, the *Kaiserin Elisabeth* and German gunboat *Jaguar* made an unsuccessful sortie against Japanese vessels blockading Tsingtao. Later, the cruiser's 15-cm and 4.7-cm guns were removed from the ship and mounted on shore, creating the *Batterie Elisabeth*. The ship's crew took part in the defense of Tsingtao. On 13 September, the Japanese land forces launched a cavalry raid on the German rear-guard at Tsimo, which the Germans gave up and retreated. Subsequently, the Japanese took control of Kiautschou and the Santung railway. Lt. Gen. Kamio considered this the point of no return for his land forces and as the weather became extremely harsh he took no risk and fortified the troops at the town, returned the reinforcements that were on the way, re-embarked and landed at Lau Schan Bay.



German front line at Tsingtao 1914; the head cover identifies these men as members of III Seebataillon (III Sea Battalion) of Marines.

As the siege progressed, the naval vessels trapped in the harbor, *Cormoran*, *Illtis* and *Luchs*, were scuttled on 28 September. On 17 October, the torpedo boat S-90 slipped out of Tsingtao harbor and fired a torpedo which sank the Japanese cruiser *Takachiho* with the loss of 271 officers and men. S-90 was unable to run the blockade back to Tsingtao and was scuttled in Chinese waters when the ship ran low on fuel. *Tiger* was scuttled on 29 October, *Kaiserin Elisabeth* on 2 November, followed finally by *Jaguar* on 7 November, the day the fortress surrendered to the Japanese.

The Japanese started shelling the fort and the city on 31 October and began digging parallel lines of trenches, just as they had done at the Siege of Port Arthur nine years earlier. Very large 11-inch howitzers from land, in addition to the firing of the Japanese naval guns, brought the German defences under constant bombardment during the night, the Japanese moving their own trenches further forward under the cover of their artillery. The bombardment continued for seven days, employing around 100 siege guns with 1,200 shells each on the Japanese side. While the Germans were able to use the heavy guns of the port fortifications to bombard the landward positions of the Allies, they soon ran out of ammunition. When the artillery ran out of ammunition on 6 November, surrender was inevitable. The German garrison was able to field only a single *Taube* aircraft during the siege, flown by Lieutenant Gunther Plüschow. (A second *Taube* piloted by Lt. Friedrich Müllerskowsky crashed early in the campaign). The *Taube* was used for frequent reconnaissance flights and Plüschow made several nuisance attacks on the blockading squadron, dropping improvised munitions and other ordnance on them. Plüschow claimed the downing of a Japanese Farman MF.7 with his pistol, the first aerial victory in aviation history. Plüschow flew from Tsingtao on 6 November 1914 carrying the governor's last dispatches, which were forwarded to Berlin through neutral diplomatic channels.

On the night of 6 November, waves of Japanese infantry attacked the third line of defence and overwhelmed the defenders. The next morning, the German forces, along with their Austro-Hungarian allies, asked for terms. The Allies took formal possession of the colony on 16 November 1914.

Analysis

As the German garrison was able to hold out for nearly two months despite a total Anglo-Japanese blockade with sustained artillery bombardment and being outnumbered 6 to 1, the defeat nevertheless temporarily served as a morale booster. The German defenders watched the Japanese as they marched into Tsingtao but turned their backs on the British when they entered into town. So deep was their Anglophobia that some German officers spat in the faces of their British counterparts.

Casualties

Japanese casualties numbered 733 killed and 1,282 wounded; the British had 12 killed and 53 wounded. The German defenders lost 199 dead and 504 wounded. The German dead were buried at Tsingtao, while the remaining soldiers were transported to prisoner of war camps in Japan. The 4,700 German prisoners were treated well and with respect in Japan, such as in Bandō prisoner-of-war camp. The German troops were interned in Japan until the formal signature of the Versailles peace treaty in 1919, but due to technical questions, the troops were not repatriated before 1920. 170 prisoners chose to remain in Japan after the end of the war.



German gun destroyed by Japanese fire



German PoWs returning to Wilhelmshaven, Germany from Japan in February 1920

Wikipedia edited for newsletter