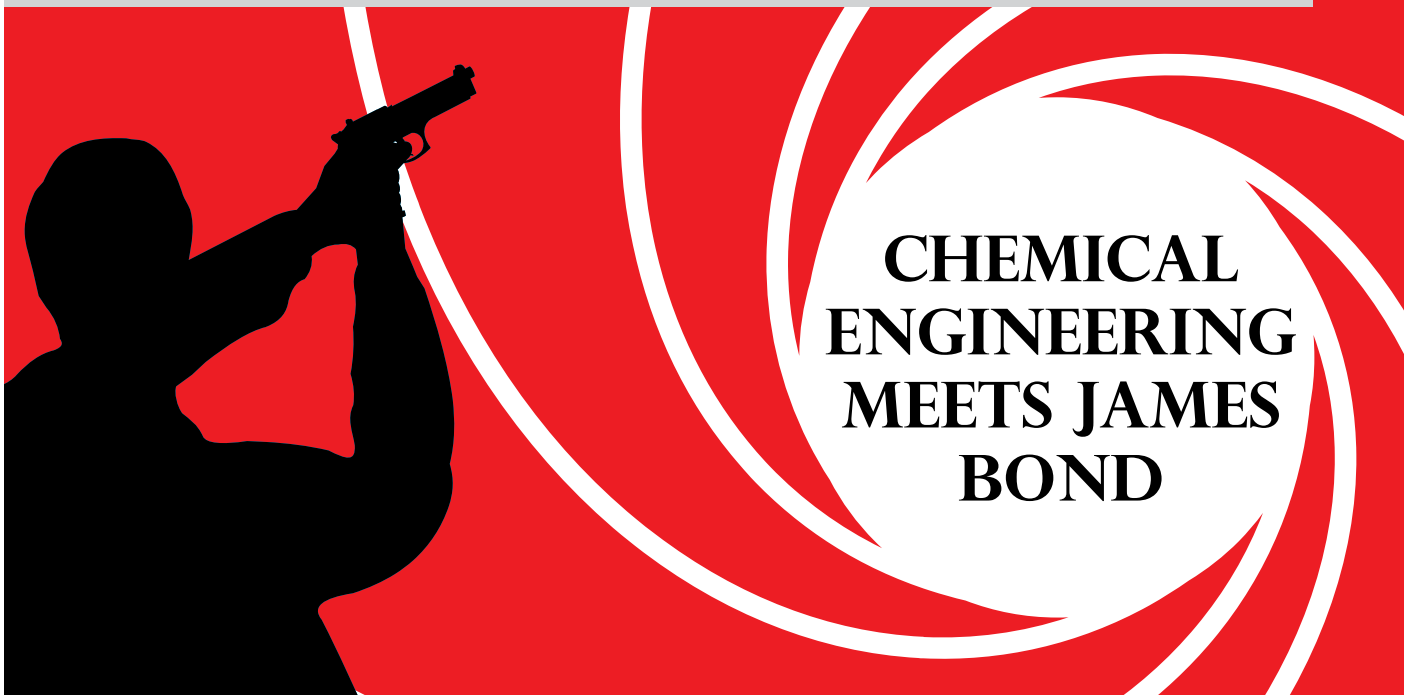

CHEMICAL ENGINEERING MEETS JAMES BOND

Claudia Flavell-While goes on the trail of Dudley Maurice Newitt

IT is a fanciful notion indeed. On the one hand you have the world of James Bond – secret agents, daring missions, the most amazing array of gadgets ever conceived, not to mention escorting the Queen on an Olympic skydive – and on the other hand there is, well, chemical engineering. Could there be a link?

Enter Dudley Maurice Newitt. Professor of chemical engineering at Imperial College London, former president of IChemE, and, during World War II, director of scientific research at the UK's Special Operations Executive (SOE) – the legendary 'Ministry of Ungentlemanly Warfare' charged with developing devices that would give British agents an edge in a secret war. (There are several theories as to who or what inspired James Bond author Ian Fleming to create the chief gadget-maker Q, but all of them were part of the SOE.)

As director of scientific research, Newitt was responsible for all of the SOE's physical-chemical, engineering, operational and camouflage research, and led the teams responsible for developing some of the SOE's most infamous devices.

Born in 1894 in London as one of seven children, chemistry and engineering loomed large in Newitt's family from the start: his father was a largely self-taught ballistics engineer, while his elder brother was a chemist specialising in explosives, among other things.

from Ardeer to Mesopotamia

After completing secondary school in London, Newitt in 1910 joined his brother at Nobel Explosives' plant at Ardeer, Scotland, as assistant chemist. Determined to be a scientist but unable to pay to attend university full time, he attended evening classes at the Royal Technical College in Glasgow.

Like many, the arrival of World War I prompted him to join up, but instead of Flanders his journey took him to Mesopotamia – a region in the Middle East comprising Iraq plus parts of Syria, Turkey, and Iran. He made a name for himself in the capture of Samaria (the northern part of the West Bank in Israel), got promoted to the rank of Major and received the Military Cross. He also claimed to have caught a record 110 lb fish in the Tigris (and to have held up an advance of the expeditionary force by 45 minutes while he landed it!).

After the end of the war, Newitt returned to his study and in 1921 completed his chemistry degree at the Royal College of Science, excelling in practical chemistry.

the birth of IChemE

Writing Newitt's memoirs, AR Ubbelohde comments: "Newitt had long been keenly taken up with the development of chemical engineering as a science in Britain. Under the leadership of professor Hinchley he was a member of the founding committee in 1922 of the British Institution of Chemical Engineers, and had done much towards the proper characterisation of its activities."

Determined to standardise the pressure measurement of steam, Newitt became somewhat an expert in the physical-chemical measurement of substances at high pressure, which led to him being offered a readership at Imperial College in high-pressure technology. Interest in this research is credited with fuelling the rapid expansion of Imperial's chemical engineering department. With the outbreak of World War II, this expertise proved to

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be in demand, and Newitt soon became involved in a project to liquefy methane for potential use as a petrol substitute.

the Baker Street Irregulars

In 1941, Newitt was quietly appointed to the SOE, nicknamed the 'Baker Street Irregulars' for their initial base in Baker Street. As director of scientific research, his job was to supervise the development, manufacture and supply of technologies and devices that would give British spies a crucial advantage in the war.

Newitt and his team soon moved out of Baker Street and into the rather more welcoming surroundings at The Frythe, a former hotel at Welwyn just to the north of London, where they operated as "Station IX" (since then, The Frythe has maintained its links with the chemical industry, and the site in turn housed research and associated facilities for ICI, Unilever, Smith, Kline & French and today GlaxoSmithKline).

Operating in utmost secrecy, Station IX brought together hand-picked experts from across the Armed Forces, together with a clutch of professors, other scientists and craftsmen. The details of their work were only revealed many years later, for obvious reasons, but they've since become the focus of much interest and fascination – indeed many of SOE's best-known devices were at Station IX under Newitt's lead.

the Welbike

The Welbike (all devices developed at Station IX were named with the Wel-prefix, because of the station's location at Welwyn) was an extremely light folding motorbike that could be stowed in a parachute container ready for use by paratroopers being dropped off behind enemy lines. It had been developed by motorbike enthusiast Harry Lester, based on an idea by Station IX's commanding officer, John Dolphin.

Parachute containers were not big, measuring a mere 130 cm by 38 cm by 30 cm, which placed severe restrictions on the size of the bike. To save space, the Welbike had no suspension, no lights and no front brake. Even so, it could be assembled in a mere 11 seconds, had a maximum speed of 30 mph and a range of 90 miles. Weighing in at just 32 kg, the 98 cc bike was the smallest motorbike ever to be used by the British, and over 3,600 units were issued.

After the war, Dolphin set up the Corgi Motorcylce Co to produce sturdier civilian versions of the Welbike.

the Welman

The Welman submarine was a midget submarine designed for a single person to deliver a massive explosive charge below an enemy ship. Barely over 6 m long, the 910 kg submarine could carry another Station IX project: magnetic mines, also known as limpet mines. These mines, first successfully used by Italian frogmen during World War I, use magnets to attach an explosive payload to the hull of a ship; the Welman could carry 193 kg worth of Torpex explosives.

The submarine however did not have a periscope, and the only way to see was through small armoured glass segments, resulting in poor visibility. Unlike other similar submarines, the Welman was not able to cut its way out of anti-submarine nets. This was to be the undoing of the only Welman ever to be used in action, in a 1943 raid by the Norwegian army, as the submarine was forced to surface after running into an anti-submarine net, at which point it was spotted by the Germans.

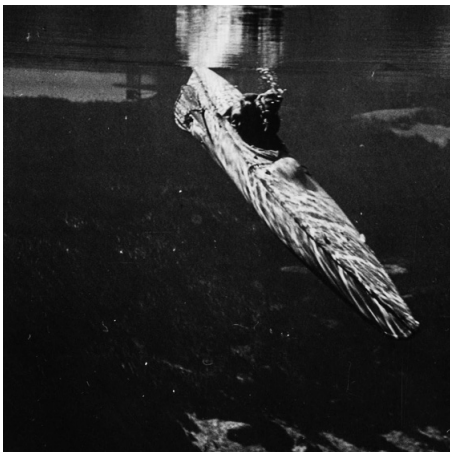
Its slightly larger cousin, the two-man Welfreighter, was not much more successful, and only became available in late 1944 – too late to have much of an impact on the war.

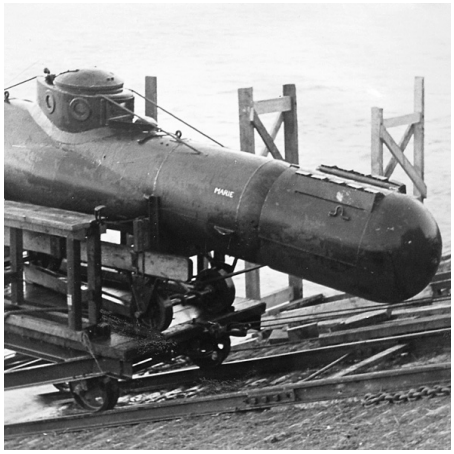
the Welgun and Welrod

The Welgun was a prototype submachine gun with a folding stock for easy concealment. However the gun never went beyond the prototype stage.

Its smaller cousin, the Welrod, did. Also

Clockwise from top left: Welbike and BSA Polish paras 1943; 'Sleeping Beauty' underwater; Welman trialled at Queen Mary reservoir, Staines; Welman submarine





designed at Station IX, the Welrod was a bolt-action pistol designed for those wanting to eliminate a person with utmost discretion. Dubbed the 'Assassin's Pistol', the Welrod's main attribute was its quietness – it only produced 73 dB of noise when fired. Given its intended use in covert ops the Welrod did not have any marks to identify country of origin or manufacturer, and the 2,800 units produced have reportedly seen action well beyond World War II, reaching to the Falklands War, and Operation Desert Storm in Iraq.

the Sleeping Beauty

The Sleeping Beauty – formally known as the Motorised Submersible Canoe (MSC) – was a battery-powered aluminium submersible for clandestine attacks on harboured enemy ships. The idea was for a heavy bomber to drop the craft (and the frogman who would pilot it) near the harbour. The 3.8 m long vessel could travel up to 74 km with a top speed of 4.4 knots (8 km/h) while submerged at up to 50 ft (15 m), though it would have to resurface periodically for the pilot to check his bearings. The pilot would need to breathe through a rebreather, as the canoe was not enclosed.

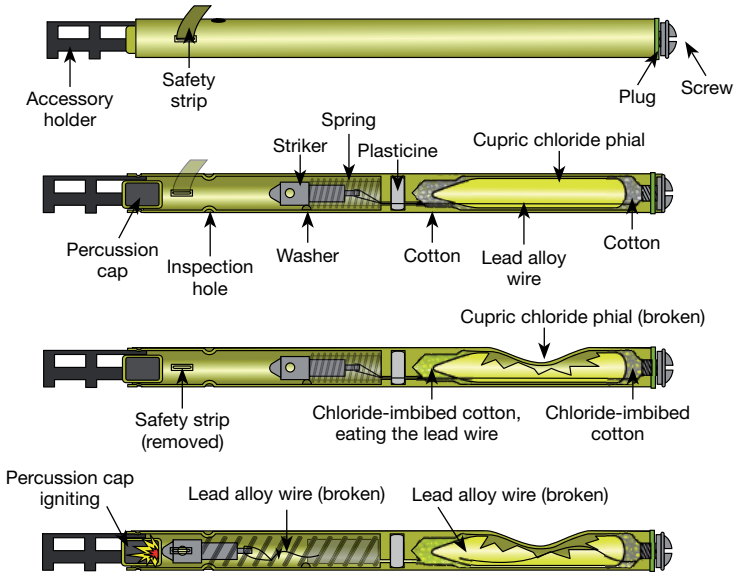
The Sleeping Beauty could carry nine limpet mines weighing up to 1.6 kg which could be either planted directly or the pilot could leave the craft and swim to the target.

The craft showed promise in tests but was unlucky in active operations – several were due to be part of the ill-fated Operation Rimau, a strike on Japanese ships in Singapore in 1944 that was disturbed by a patrol. The vessels had to be scuttled, and the men involved in the operation were either killed during the fight or captured and executed. Two other Sleeping Beauties are thought to have fallen into German hands. Nevertheless Sleeping Beauties were one of the early forebears of the Swimmer Delivery Vehicle used by naval special forces today.

the Time Pencil

The 'Time Pencil' was a delayed-ignition device, about the size and shape of a pencil, that could be used to set off a detonator. It was a popular item: some 12m units were produced at Station IX over the years.

A brass or aluminium tube, it had a copper end with a glass vial containing cupric chloride ($CuCl_2$) and a spring-loaded striker held taut by a metal wire. The timer was set by crushing the copper section and the glass vial, releasing the cupric chloride. This would in turn corrode the wire holding the spring in place which, once released, would release the striker to hit the percussion cap at the other end of the detonator tube (see above).



Based on Rama/Wikimedia Commons

The pencil detonator known as 'Switch No.10 delay'

The detonators could be designed with a broad range of delays, ranging from ten minutes to 24 hours, though the delay was strongly affected by the ambient temperature

exploding rats and wire cutters

It is less clear whether Newitt was directly involved with some of the more esoteric gadgets produced by the SOE because many of the most Bond-esque devices were not produced at Station IX in Welwyn but at Station XV in nearby Borehamwood. Specialising in camouflage and booby traps, the most infamous 'product' of Station XV was the rat bomb – quite literally a dead rat stuffed with explosives. The idea was to place these rats with the coal piles on the railway system and wait for the operator to find and dispose of them by throwing them in the furnace. Unfortunately, German forces intercepted a container of ready-prepared rats, so they were never used. However the discovery quite possibly caused even more disruption, as increasingly paranoid Germans searched through thousands of coal piles looking for more rats.

Similar logic underpinned Station XV's explosive coal, while other gadgets to emerge included itching powder made from extract of the macuna plant, fake logs, wine bottles, cigarettes (to smuggle maps, explosives or whatever else may be required), as well as gadgets to burst car tyres, cut telephone wires and many more tools of the trade of the professional agent.

undercover

All of this work, naturally, had to be conducted in utmost secrecy. The staff working at the secret SOE stations had to be very careful not to tell anyone what they were

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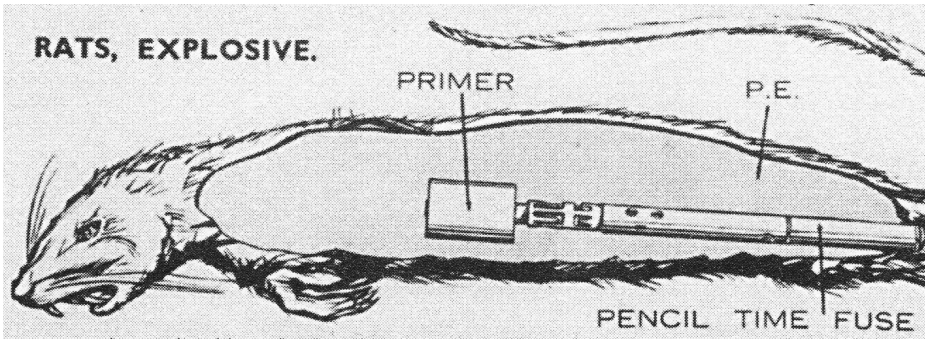

A cutaway drawing of an 'exploding rat' showing the fuse, primer and plastic explosive (P.E.)

doing, nor could they give people in the area any clues as to their covert activities. If anyone got injured during their work, they had to come up with a suitably-convincing cover story for the hospital; if they needed to obtain any raw materials or equipment they had to have a plausible excuse. For example, the vendor supplying the rats for the rat bombs was under the impression his 'student' customers were conducting medical experiments.

Details of the work of the SOE – and Newitt's involvement in it – remained a closely-guarded secret until recently, with detailed accounts only emerging since 1999. Indeed Newitt's entry in the book *Presidents of the Institution of Chemical Engineers* merely mentions that working for the "Inter-Services Research Bureau" – a front given to the SOE – he'd "rendered national service of a high order known only to few"; and his 1981 entry in the *Biographical Memoirs of Fellows of the Royal Society* only contains the briefest mention of his non-academic work.

Not that his contribution to academia was trivial – following his return to Imperial College in 1945 as Courtaulds chair of chemical engineering, he authored many scientific papers, particularly in the field of high-pressure engineering; he sat on numerous government committees; spent many years on IChemE's Council, publications committee and education committee, not to forget his two years as president in 1949 and 1950.

But it is his role with the Ministry of Ungentlemanly Warfare that stands out, not just for Newitt's contribution in harnessing the determination and inventiveness of a nation but for contributing to the creation of a legend which, through Ian Fleming's writing, has transcended the generations. **tce**

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Next month: Trevor Kletz, pioneer of inherent safety on process plants