

= Leif Tronstad =

Leif Hans Larsen Tronstad DSO , OBE ( 27 March 1903 ? 11 March 1945 ) was a Norwegian scientist , intelligence officer and military organizer . He graduated from the Norwegian Institute of Technology in 1927 and was a prolific researcher and writer of academic publications . A professor of chemistry at the Norwegian Institute of Technology from 1936 , he was also among the pioneers of heavy water research , and was instrumental when a heavy water plant was built at Vemork .

During World War II Norway was invaded by Germany and Tronstad conducted domestic resistance for one year before fleeing the country for England . Here , he gathered valuable intelligence from Norwegian sources , both on the development of the V @-@ 2 rocket and the growing German interest in heavy water . In 1943 Tronstad planned Operation Gunnerside , in which the German access to heavy water processing at Vemork was severely impeded . His information about the V @-@ 2 rocket contributed to the massive Allied bombing of Peenemünde .

For a long time Tronstad had wanted to return to Norway to organize resistance work , however he was prevented by the Norwegian military authorities in Britain . In 1944 , however , he did travel to Norway , to organize Operation Sunshine , for the defence of Norwegian infrastructure . After five months in the country , he was killed in action after his team had taken the local bailiff hostage .

= = Early life = =

Tronstad was born in Bærum ; the son of Hans Larsen and Josefine Amalie Tronstad , Hans died three months before Leif was born . Leif thus grew up in Sandvika with his mother and four siblings . He graduated from middle school in 1918 , with top grades in mathematics . He then embarked on thirty months of professional practice in two local electricity companies , which was a requirement to enrol at Kristiania Technical School , a predecessor of the Faculty of Engineering at Oslo University College . When he enrolled in 1920 he chose technical chemistry instead of electronic engineering . He graduated in 1922 , the best chemistry student ; a fellow student recalled that he " did not have to read anything more than once " in order to remember it . In the spring of 1923 , he also took the examen artium after attending the Haagaas School for one year . He was ready to enroll at the Norwegian Institute of Technology , but waited one year , possibly wanting to strengthen his personal finances . In the meantime , he started on his compulsory military service .

He was an accomplished athlete and helped his hometown club Grane SK to two Norwegian 4 x 1500 metres relay records . The records were set in 1921 and 1923 , but broken by the team IL i BUL in 1926 . His brother John , a bronze medalist in 1500 metres at the 1917 Norwegian championships , was on the relay team as well . Both brothers used their father 's name Larsen at the time ; Leif took up his mother 's name Tronstad later .

In 1924 Tronstad moved to Trondheim to study at the Norwegian Institute of Technology , graduating in 1927 . His graduation paper was deemed exceptional and as such was reported to King Haakon of Norway . Regarded as a fully @-@ fledged academic work , it was published scientifically in 1928 . Tronstad had taken various stray jobs while studying , and also finished his military service , reaching the rank of Second Lieutenant in the Norwegian Army Corps of Weaponry in 1927 . From 1927 to 1928 Tronstad worked briefly as an assistant at the Norwegian Institute of Technology as well as in a private company in Kristiansand . In 1928 he returned to the Norwegian Institute of Technology as a research fellow . In the same year , Tronstad married Edla Obel , who was nine years his junior , in Trondheim . The couple had two children .

= = Academic career = =

Tronstad spent the first year of a research period as an assistant to Herbert Freundlich in Dahlem , Berlin . He studied the passivity of metal surfaces , and made a breakthrough when he managed to measure extremely thin oxide surface coatings , thus solving a problem dating from the time of Michael Faraday . He continued to Stockholm to study metallography under Carl Benedicks , and to elaborate further on his results from Berlin . The work was completed in 1931 and his thesis ,

spanning 250 pages , was published in German as Optische Untersuchungen zur Frage der Passivität des Eisens und Stahls . For it , he received the doctorate degree . He was hired at the Norwegian Institute of Technology as a lecturer in the summer of 1931 , although he spent the first year at the University of Cambridge , conducting further research with a scholarship from a memorial fund of Christian Michelsen . The research at Cambridge was a continuation of his thesis work , but this time he tested his method on mercury .

Following the death in 1934 of a professor of technical inorganic chemistry at the Norwegian Institute of Technology , Tronstad was appointed his successor on 17 April 1936 , effective from 1 May . At the time , he was one of the youngest professors in Norway . He was a member of the Royal Norwegian Society of Sciences and Letters , and in early 1940 he became vice president of the Norwegian Chemical Society . During his short scientific career , Tronstad penned about eighty scientific publications , including fourteen on heavy water @-@ related topics .

The properties of heavy water had been discovered in 1932 by Harold Urey . In 1933 , Leif Tronstad and Jomar Brun , the head of Norsk Hydro Rjukan , created a plan for industrial production of heavy water in Norway . As Norsk Hydro were already producing ammonia for nitrogen fertilizer , Tronstad and Brun had realized that large amounts of electrolyzed water were available . Tronstad was paid by Norsk Hydro as a consultant . Already in 1934 , Norsk Hydro had opened a plant near the power station at Vemork . This was the world 's first plant for industrial mass production of heavy water . Both French and German scientists expressed interest in the project .

= = World War II = =

= = German invasion of Norway = =

Tronstad , holding a military rank , had a standing order to report to the Norwegian military headquarters in Oslo in the face of a military peril . When Germany invaded Norway on 9 April 1940 , he first informed his students of the situation , and then drove towards Oslo . He brought his wife and children with him , but having no intention of taking them to a possible theatre of war , he left them in the Drivdalen valley . He continued alone but shortly after , upon learning that Oslo was the first city to fall to the invaders , he stopped at Dovre . The family had a cabin in the vicinity . Here , he helped organize volunteers from local rifle associations to form a line of defence meant to repel any advancing German forces . German Fallschirmjäger paratroops did land at nearby Dombås , but were surprised by a contingent of regular Norwegian forces already in the area , who ensured a tactical victory for Norway in the ensuing Battle of Dombås .

= = Resistance = =

When the Norwegian Campaign ended and the German occupation of Norway was a reality , Tronstad became involved in resistance work , largely based around the Norwegian Institute of Technology . He was associated with the radio agent group Skylark B , which had regular contact with London from January 1941 . Among other things , he sent reports on the interest shown by German authorities in the heavy water plant at Vemork . One source of this information was Tronstad 's old companion , Jomar Brun , still in charge of the plant , who also helped people to flee the country by sea , via the Møre coast . After exposure of the group in September 1941 , Tronstad himself had to flee the country . Another resistance member , who had already been jailed , managed to warn Tronstad , who travelled from Trondheim to Oslo by train . The following day , the Gestapo visited his house to arrest him . After a few days in hiding , Tronstad was driven by car to Østfold , and then travelled on foot to Töcksfors via Ørje . From there he continued by plane to England , rejecting an offer of a civilian job in Sweden .

He reached England in October 1941 . He already had a broad network of contacts there , stemming both from his academic career as well as from his radio operations . He also maintained several contacts abroad , including scientists whom he knew from the Norwegian Institute of

Technology : Harald Wergeland and Njål Hole . The opportunity to work directly for the British was presented to Tronstad , but instead he chose to aim his efforts towards disrupting the German occupation of Norway and improving the Norwegian resistance work . He even wanted to enrol in active duty , but was stopped by the Norwegian military command , who considered him " too valuable " for the war theatre . Tronstad 's foremost skill was that of organization , which he owed to his experience in science . Thus , Tronstad became a part of the staff of the Ministry of Defence , and later of the Norwegian High Command . From 1943 , he headed a section in department 4 ( FO IV ) . This had been established in December 1942 under the leadership of Colonel Bjarne Øen , and Tronstad was brought in as a reinforcement as the work burden increased . Also , he had recently been promoted from Captain to Major . Tronstad 's section was responsible for the special operation towards industry and shipping ; training of the Norwegian Independent Company 1 ( Kompani Linge ) ; technical advice on sabotage , and towards the end of the war also the protection of Norwegian industry . He established the Norwegian High Command Technical Committee , which included other Norwegian scientists @-@ in @-@ exile such as Svein Rosseland , Helmer Dahl and Gunnar Randers . The Technical Committee is considered as the precursor to the Norwegian Defence Research Establishment , established in 1946 .

= = = Heavy water sabotage = = =

Already in 1941 , Tronstad was aware that heavy water production at Vemork had greatly increased . In the beginning , Tronstad had not been aware of the connection between heavy water and atomic weaponry , but it eventually became clear that Germany could be running a nuclear energy project , especially after Harold Urey visited the United Kingdom in November 1941 . Tronstad later learned from Jomar Brun that further expansion of heavy water production was being discussed . Brun had been a part of a small conference on the issue , hosted by Kurt Diebner in Berlin , in January 1942 . Brun would later communicate with England through Einar Skinnarland , a covert Special Operations Executive agent hailing from Rjukan . In October 1942 , Brun was summoned to England , reportedly at the request of Winston Churchill . Instead , a team of agents were parachuted into the area to gather more intelligence , under the codename Operation Grouse .

The idea of subjecting the heavy water facility at Vemork to heavy air bombing surfaced , but Tronstad was a staunch opponent of such an idea , which he saw as too hazardous . He warned of the presence of civil housing , and argued that bombing was not even guaranteed to succeed , given that the heavy water facility was located in the armoured basement of the electrolyzing plant . The first attempt to take out the facility , in November 1942 , had consisted of British personnel using gliders to land near Vemork . The operation , codenamed Freshman , was a catastrophe , as all units except for one towing aircraft perished , either due to crash landings or in German captivity .

Tronstad then organized the next attempt . He had wanted to take an active part in the sabotage mission , but again he was stopped by his commanders , who regarded him as inexpedient . Tronstad and Brun supplied the would @-@ be saboteurs with extensive knowledge of the facility , and organized the training . The operation , codenamed Gunnerside and led by Joachim Rønneberg , was carried out successfully between 27 and 28 February 1943 . However , after three months , Germany managed to resume production . Against the will of Tronstad , in July 1943 , an American @-@ led raid by 161 aircraft bombed Vemork as well as the shipment yard at Herøya . The two bombings claimed the lives of 76 people , many of whom were civilian . The heavy water plant was not directly affected by the bombing , nevertheless production was halted due to a damaged generator . The Germans then tried to disassemble the production facility , followed by a retreat from Vemork with the remaining stock of heavy water . This resulted in the sinking of SF Hydro by Norwegian saboteurs , halting the heavy water transport , but again claiming many civilian lives . Tronstad had given his consent to the latter operation , reportedly with a " heavy heart " .

Concealed listening posts at Rjukan and Notodden also revealed high @-@ level German discussions of long @-@ range weaponry . The place name Peenemünde was frequently mentioned . As this intelligence reaching Tronstad 's ear via his contacts in Norway , he forwarded it

to the British . As a result , the Royal Air Force bombed the Army Research Center of Peenemünde in August 1943 . Further raids were made by the US Army Air Force in July and August 1944 . The bombing halted the weapons program there , which centered around development of the V @-@ 1 flying bomb and the V @-@ 2 rocket . Fellow scientists Rideal and Evans later wrote that Tronstad " contributed directly to the speedy victory of the Allied Nations , besides saving the region which came to be known as ' Southern England ' from an even longer and more severe ordeal than it actually endured " .

= = = Operation Sunshine = = =

In 1944 , when the tide of war was turning against Germany , the German forces started to retreat from Northern Norway . However , they used the scorched earth tactic as they retreated . Consequently , Tronstad started to plan how to organize a defence of industrial sites in Southern Norway . The first plan pertained to Øvre Telemark , and was codenamed Operation Sunshine . Its basic principle was to build a defence force from the existing Milorg pockets in the district . Tronstad , who earlier had been stopped from travelling to Norway himself , did so this time . He felt that it was time to deal a decisive blow to a dwindling German war power , and called for the " full effort ... from all who would be called men " .

Tronstad was parachuted into Hardangervidda on 4 October 1944 , together with eight Norwegian Independent Company 1 members . The group included Gunnar Syverstad , Jens @-@ Anton Poulsson and Claus Helberg . They lived in a small cabin built by Einar Skinnarland .

However , after a few months a situation arose that could compromise the operation . It was feared that Torgeir Lognvik , the bailiff installed by the Nazis in Rauland municipality , had become suspicious . Thus , the people behind Operation Sunshine created a plan to lure him to the mountains , and capture and interrogate him there . On 11 March 1945 , resistance member Jon Landsverk managed to travel with Torgeir Lognvik towards the mountains on the pretext of showing him some stolen goods . The two were soon met by Gunnar Syverstad and Einar Skinnarland , who captured the bailiff . He was taken to a lodge in the hills of Syrebekkstølen , where he was to be interrogated by Landsverk , Syverstad and Tronstad . However , on the same day , Torgeir 's brother Johans became suspicious and decided to follow the ski trails , which led him to Syrebekkstølen . Armed , he entered the lodge , firing several shots , taking the Resistance fighters by surprise . Gunnar Syverstad was killed in the initial attack . Torgeir , who was not bound , grabbed a rifle . In the struggle , Tronstad charged at Johans , but was killed . The two brothers then escaped . Jon Landsverk survived , and together with Einar Skinnarland he disposed of the two bodies in a lake . However , the next day the bodies were found and burned by German forces . After the war , Jon Landsverk testified against the Lognvik brothers as a part of the legal purge in Norway after World War II . While Landsverk claimed that the wounded Tronstad had been killed by a blow from the butt of a rifle held by Torgeir , the court found Johans guilty of both murders , and Torgeir of attempted murder . Johans was sentenced to a ten @-@ year prison term , and Torgeir to a five @-@ year term .

= = = Diaries = = =

Tronstad 's coded diaries from 1941 to 1945 are preserved , and the 13 original books are kept by the National Archival Services of Norway . They have been transcribed and made available to historians , and are regarded as an important source of information from the " outer front " .

= = Awards and legacy = =

Tronstad had a military funeral on 30 May 1945 , being buried at Vestre gravlund in Oslo . He was awarded Norway 's highest decoration for military gallantry , the War Cross with sword , as well as the Norwegian War Medal and the Defence Medal 1940 ? 1945 . In addition to his Norwegian decorations , Tronstad received the Order of the British Empire , Chevalier of the French Légion d

'honneur and Croix de guerre and the US Medal of Freedom with bronze palm as well as the British Distinguished Service Order .

A memorial stone was raised at Syrebekkstølen , commemorating the death of Tronstad and Gunnar Syverstad . Also , several streets in Norway have been named after him . A statue of Tronstad today stands at the square Leif Tronstads plass in Sandvika , the administrative centre of Bærum . It was commissioned in 1965 by the local Rotary club , and erected in 1973 . Abstract , it was sculpted by Fritz Røed .