It was June 16, 1942, and the United States was still reeling from the attack on Pearl Harbor six months earlier. The nation was building up its Army and Navy as quickly as possible by training draftees and volunteers.

And America’s industrial machine was converting from automobiles to tanks and other machines of war.

In fact, Carl Sanborn was working on a “secret weapon” called the “Mousetrap,” an antisubmarine rocket. He was doing something he had done “at least a dozen times”—which was constructing primer charges with magnesium and highly explosive potassium perchlorate.

Somehow, in mixing the new powder, it ignited—because of friction, others surmised. The explosion blew parts of the table top 20 feet away and knocked Sanborn to the ground.

“Am I burned too badly to live?” Sanborn, shivering from shock and unable to see, asked when he was found prone on the ground. He was bleeding from his swollen nose, with “a white cloudy film” in his eyes and his hair singed. Both legs were burned, both of his arms had multiple compound fractures, and “both [his] hands [were] partly gone, including several fingers and thumbs.” Medical help arrived, but Sanborn died early the next morning.
Sanborn became another casualty of war, but not on the battlefields of Europe or the islands of the South Pacific.

Sanborn was an employee of California Institute of Technology working with the U.S. Office of Scientific Research and Development (OSRD) near Pasadena to develop the antisubmarine rockets. Throughout the war, the OSRD worked to find new weaponry for America’s military to defeat Hitler's Third Reich and the Empire of Japan.

A wide variety of “inventive” proposals passed across the OSRD’s desks as the war effort brought fresh problems, which demanded creative solutions. Some projects never saw the light of day, while others filled up the files with myriad details of their development, testing, and shipping to the field.

While historic breakthroughs such as the atomic bomb and the invention of penicillin were widely covered products of U.S. scientific research during the war, many of the OSRD projects, whether successful or failures, remain largely unknown.

The Office of Strategic Services (OSS)—the precursor of the Central Intelligence Agency—and the military services turned to the OSRD and its director, Vannevar Bush, when they needed new equipment, whether it was a solution to malaria or a silenced pistol.

Under Division 19 (Miscellaneous Weapons), OSRD scientists brainstormed everything from edible plastic explosive (code-named “Aunt Jemima”) to pyrotechnic “panic creators.”

By the end of May 1943, the OSRD acknowledged 10 fatalities “occurring in connection with . . . OSRD work.” Other deaths would follow. In the course of their duties to develop innovative weapons and gear, scientists and workers perished in work-related accidents.

Just as OSRD projects were overshadowed by reports from the front, the deaths of its personnel in pursuit of scientific research fell into obscurity, despite the enduring popular interest in World War II.

The OSRD traced its origins to the creation of the National Defense Research Committee (NDRC) in June 1940. President Franklin D. Roosevelt appointed Vannevar Bush as its chairman.

Bush, president of the Carnegie Institute and chairman of the National Advisory Committee for Aeronautics, had a distinguished career. He had taught electrical engineering at Tufts University and Massachusetts Institute of Technology, helped create the Raytheon Company, and developed a machine that could solve differential equations. A prodigious tinkerer, Bush even created a special bird feeder “inhospitable to greedy pigeons and blue jays.”

After the war, when President Harry S. Truman told him he had a politician’s instincts, Bush replied, “Mr. President, what the hell do you think I’ve been doing around this town for five or six years?” Under Bush, the NDRC was to “conduct research for the creation and improvement of instrumentalities, methods and materials of warfare,” which it did with the help of scientists and engineers from U.S. companies and universities.

However, the NDRC was soon succeeded by another body: the OSRD.
Because the NDRC was only research-focused, it was necessary to create an agency that would handle both the research and development of projects. In addition, a new organization could properly coordinate research between military branches and manage much-needed medical research.

Accordingly, Executive Order 8807, issued June 28, 1941, by President Roosevelt, established the OSRD. Bush became its director, and the OSRD would comprise the NDRC—now with only the power to “advise and assist the Director”—along with the Advisory Council, Committee on Medical Research, Administrative Office, and Liaison Office. (Other divisions were later added.)

The OSRD also had the power to use government resources and to make contracts with individuals, companies, and other scientific organizations. This new organization provided the impetus for critical scientific research during the war.

“Evil Smelling Substances” Proposed as a Weapon

The most unconventional suggestions could succeed in the OSRD. On November 20, 1943, Stanley P. Lovell, director of OSS’s research and development, sent an unusual request in a letter to Division 19 head Harris M. Chadwell. He wanted “to provide civilian populations with . . . a liquid . . . [that] will produce unmistakable evidence of extreme personal uncleanliness.”

Amid the serious letters and reports in OSRD records is a memorandum concerning confusion over an apparent request for “five pounds of live monsters.” The puzzle was cleared up when someone realized that by correcting three letters, the monsters became “hamsters.”
Vannevar Bush headed the OSRD after President Roosevelt created the office in 1941. Bush had previously served as chairman of the National Defense Research Committee.

This memorandum inaugurated project “Who, Me?” (SAC-31), a joint venture with the Arthur D. Little Company, a chemical and engineering consulting company.

Researchers mulled over formulas for their “evil smelling substances,” focusing on “strange or novel” odors to alarm the targets, disperse crowds, and contaminate enemy supplies. They considered using mercaptans, sulphides, methyl telluride, ammonium valerate, and thi-aldine as ingredients.

Eventually, the first “Who, Me?” formula was developed in February 1944 to use against the Japanese. It consisted of n-Butyric acid, n-Valeric acid, n-Caproic acid, and Skatole; this particular batch had a “powerful and lasting” fecal odor.

By late 1944, the team decided that such a smell would be ineffective, so Dr. E. C. Crocker instead recommended a “skunky” mixture of alpha ionone, butyric acid and amyl mercaptan. After grappling with nagging difficulties—fragile glass containers breaking, accidental dripping onto users, and leaky tubes—the OSS finally shipped out 500 tubes of each formula on February 27, 1945.

The Arthur D. Little Company worked with the OSRD to fill a request from the OSS. The OSS wanted a foul-smelling substance that could alarm a population or contaminate enemy supplies. The “Who, Me?” research came up with several stinkers before settling on a “skunky” mixture.

Night Landings and Smokescreens Proposed for Army and Navy

Other ideas were less offbeat but equally innovative.

In 1941, the NDRC considered developing “illuminated smoke clouds” for use “in night operations against attacking aircraft.” Shells, rockets, or airplanes placed the smoke-screen, then flares would blind the marauders and silhouette them against the night sky, easy targets for anti-aircraft guns and fighters. Unfortunately, this method required tens of thousands of shells and flares an hour. Scientists estimated that 500 tons of smoke for every 100 square miles were needed to create “a totally obscuring cloud of minimum thickness.” The amount of equipment and materials needed was deemed “prohibitively large” by Division A (Armor and Ordnance) Chair Richard C. Tolman, who recommended that the plan be dropped.

When the Army Air Forces asked for a means of landing aircraft while hiding the bases from the enemy, the NDRC created ultraviolet reflector beacons that would demarcate the runway and aircraft-mounted UV lights that would pick them up, enabling a safe landing. In August 1942, flight tests were successful. The markers were viewed up to 4,000 feet “on a hazy night,” and the test plane was able to land.

The Navy was interested in using the system on its aircraft carriers and received another demonstration. However, the Army Air Forces advised against using the system, saying that “greater secrecy in night operation” was not necessary.
The OSS’s Project Fantasia was an attempt at psychological warfare. OSRD scientists were asked to create a device that would simulate a fearsome creature to terrify the Japanese.

Still, they encouraged further investigation into, and testing of, an “invisible beacon” for landing.

Some Division 19 projects, though, were truly absurd. The foremost among them was Project Fantasia (SAC-26), which arose from a May 21, 1943, OSS directive asking Chadwell for an “eerie,” luminescent balloon as a psychological weapon against the Japanese. Even though OSS official Lovell deemed it “questionable, [and] outre,” research began into the device.

The OSS stipulated that Fantasia would need to be visible from 2,000 feet and “obliterated completely” after 15 minutes. Researchers at the drawing board postulated using radium salts, special paint, fireworks, UV devices, or even “phosphorescent gas” to illuminate Fantasia and “instill fear, terror, and despair.” Hoping to exploit perceived Japanese superstitions, the OSRD considered building the device in the shape of a “harmful demon, evil eye or a ‘hex,’” or perhaps a “grotesque animal” such as a fox or dragon. To incinerate the hydrogen-filled balloon, project members proposed using a delayed incendiary.

In a July 5 memorandum to Lovell, it was clear that “We do not contemplate widespread . . . use of the device,” and that it might only be effective against Japanese “under extremely trying conditions.” Memorandums suggested using the device “over Chinese lines” or possibly deploying it against “isolated groups” of Japanese. (These were considered vulnerable to panic.) Shortages of qualified personnel, high potential costs, and a general lack of enthusiasm finally put an end to Fantasia.

In response to a September 18 letter from Chadwell seeking an end to the project, Lovell complied. The failure of Fantasia “will serve as a critique to us in the field of pure reason,” the latter wrote. The OSRD seemed happy to dispose of Fantasia. The minutes from Division 19 on November 4 stated, “This problem of Fantasia has been mercifully completed,” and SAC-26 was relegated to “Dead as Dodo” status by July 6, 1944.
saying that such a weapon would only harm those within “the immediate vicinity.” He also mentioned that methane gas would cause severe injury. He stated that using incendiary rounds to ignite a kilogram of methane gas would release “approximately 13,000 kilocalories,” as opposed to the mere 250 kilocalories taken in by warming liquid methane.

Another Division 19 research project, “Blackout” (SAC-20), was more practical than Fantasia. It sought to engineer explosive lightbulbs for use in China, presumably against the Japanese occupiers. On May 17, 1943, a month after Chadwell received the order, Blackout ran into trouble. George Kistiakowsky, head of Division 8 (Explosives), wrote emphatically that “It is absolutely impossible to put enough explosive into the base of a transparent light bulb to make the result more harmful than the popping of a cracker.” Fragmentation would be limited, he wrote, the device’s lethal range would be two or three feet at best, and liquid explosives would be noticed in the clear bulb. Blackout experienced the same fate as Fantasia by July 6, 1944.

The most colorful proposals of all came from those eager to market a “death ray” to the government. From 1940 to 1943, no fewer than six separate inventors approached the NDRC and OSRD with their plans.

Christian H. Kenneweg was the first. He claimed to have a device that could produce a “highly concentrated molecular vibration” and destroy enemy aircraft “at or over experimentally ascertained distances of several miles.” He had already sent a letter to British Prime Minister Winston Churchill, without success.

Undeterred, Kenneweg wrote another letter to President Roosevelt days later, appealing to “The great humanitarian complex of the Chief Executive” and noting that “The era of the large bombing plane will definitely pass” thanks to his invention.

The government’s response was unenthusiastic.

K. T. Compton of the NDRC was “not optimistic about the possibilities of this invention,” noting that any blast energy would be “rapidly dissipated.” By year’s end, Antonio Longoria, George A. Finch, John C. Roberts, and Mike Cronis attempted to interest the government in their creations.

One official scoffed at Finch and Roberts, saying, “The technical description reads like ‘Amazing Science Tales.’” Despite the scientists’ claim to have killed five ducks in flight with their device, Tolman believed that they had sim-
ply used strychnine-laced grain, a “favorite stunt of self-styled death ray inventors.”

The OSRD soon tired of the “Death Ray Atomic Energy Machines” and “Lethal Ray Projectors.” After reading a 1943 report by one “Professor Kraus” on his supposed death ray, Bush personally rejected the proposal in a letter to J. Edgar Hoover, calling it “a rambling statement with a liberal use of scientific terms which makes . . . unsupported claims.” Little came of the death rays.

“A Very Secret and Very Important Matter”

As the war took millions of lives at Saipan and Stalingrad, at Caen and Cassino, at Kasserine and Kursk, and at countless other battlefields across the globe, OSRD members also gave their lives in the line of duty.

On June 8, 1942, while U-boats roamed the Atlantic Ocean in search of Allied cargo ships, the OSRD tested a new anti-submarine weapon—underwater flares—off of Manasquan, New Jersey. In order to shoot photographs, the Navy lent two blimps. On board airship G-1 that night were C. R. Hoover, L. S. Moyer, and F. C. Gilbert, while airship L-2 carried A. B. Wyse and I. H. Tilles. Accompanying the scientists were eight Navy servicemen.

According to eyewitnesses on a Coast Guard boat, at 9 p.m. L-2 “passed over the bow” of the vessel, signaling with its blinker, but the crew below asked that they signal again “as none of the seamen aboard clearly read it.” As L-2 circled to repeat the signal, “the gondola of L-2 struck the bag of G-1,” and both plummeted into the dark ocean. The boat picked up one survivor and fired off all its red flares to call for help.

The two blimps, held afloat by air pockets, were being towed back to shore in the hopes of rescuing any survivors, but G-1 detached along the way. The crew decided that it would be better to continue towing one blimp rather than risk losing both by trying to retrieve the second blimp. Another boat picked up the G-1, but it sank once more in water estimate-
ed to be 60 feet deep and was not recovered. Upon reaching shore, the bodies of Wyse and two crewmembers were found in L-2. Tilles’s body was found in the water the next morning.

Altogether, 12 men died, and one lucky ensign had escaped. Each scientist left a widow. Wyse, the youngest at 32 years old, left behind two young sons; Hoover, the oldest at 56 years old, had one son in medical school and another in the Army.

Four days later, Bush composed identical letters to each grieving widow.

“No word that I can write can of course lessen your grief,” he explained. “Not every man who serves his country does so in uniform.” While unable to disclose the “very secret and very important” flare project, Bush wrote that each man “made a real contribution to the work . . . he has given his life for his country . . . as though he had been in the front line trenches.”

However, the OSRD’s work was not done here. Due to a bureaucratic loophole, the scientists “were in a unique and unfortunate situation.” As they were affiliated with universities and paid by them, they did not fall under the Employees’ Compensation Act. In May 1943, Bush sent a drafted bill designed to correct that problem to the House Committee on Claims, and later urged the President to approve it.

The bill, which designated Wyse, Hoover, Moyer, and Tilles as civil employees (Gilbert had insurance and was deemed “adequately provided for”), entitled their families to government compensation and was signed by Roosevelt on March 24, 1944. Sadly, Bush’s sympathy letters would be repeated many times to yet more survivors of fallen OSRD workers.

Developing Protective Gear
Risky Business for Staff

Even OSRD personnel working to develop protective equipment were at risk. In an effort to avert the horrors of the last war’s chemical weapons, the Commercial Solvents Company was given a contract to produce “a compound to be used . . . as a protection against poison gas.” The resulting product, S-461 protective ointment, was produced in Terre Haute, Indiana, where 28-year-old laborer Roy Nelson Hurt worked in the drying facility.

At 6:45 in the morning of September 23, 1942, smoke billowed from the dryer building’s south door, and Joseph Roman, a fellow plant worker, dashed inside. With a cloth around his nose and mouth to ward off the thick, noxious smoke, he stumbled toward Hurt and managed to help him out of the building, despite being “nearly overcome by the fumes and by shock.” An ambulance arrived within eight minutes, but a doctor caring for Hurt at the hospital found him “semi-conscious,” with “second and third degree burns involving practically the entire body.” Even Hurt’s eyes had suffered third-degree burns and “practically complete destruction of the corneas.” Despite blood plasma infusions and hot paraffin dressings, Hurt died at 7:30 p.m.

An investigation soon determined the cause of the accident. “ Inferior quality” S-461, unstable with impurities, had decomposed. Over a half-ton of the material had been destroyed. Mrs. Hurt received $2,000 from a company insurance plan, plus $5,000 more from Indiana’s Workmen’s Compensation Act. Homer Adkins, who inspected the plant, added that he hoped “that it may be possible for O.S.R.D.
to assist Mrs. Hurt financially,” but noted that “No mention of this possibility . . . has been made by anyone so far as I know.” On August 14, 1946, Bush wrote to Mrs. Hurt to explain the circumstances of her husband’s death. The fear of “horrible suffering and disfigurement [by] poison gas” had driven the need for S-461, which had been shipped out to Guadalcanal just days after Hurt’s death. Bush even thanked Roman for his heroism, commending his “quick thinking and prompt action.” While the property damage to the plant was dismissed by Adkins as “inconsequential,” the human cost was anything but trivial.

“The Whole Thing Had Gone”

The Budget and Finance Office’s “Accident” file mentions that one E. R. Barnard, an assistant project director at Standard Oil, was injured in a flamethrower accident, but gave few details. The full story is held in the Standard Oil contractor files. The company, which frequently worked on OSRD projects, was tasked on April 1, 1943, with creating a tank-mounted flamethrower. Engineers devised a tank-towed trailer containing jellied gasoline fuel and compressed air. The pressure chamber was highly problematic and required multiple repairs after leaks during tests.

On May 29, 1944, the flamethrower was due for another test involving 13 workers, ranging from the project director to the driver. As the compressors were brought up to a pressure of 500 psi, the right compressor failed but was soon restarted. Its low-pressure unloading valve remained open, but a tap with an iron bar solved that problem. As research engineer W. A. Proell turned his back and walked away, he heard “some strange noise,” but when he turned his head, “he realized that the whole thing had gone.”

Another bystander saw a “sheet of flame on the left side of the trailer,” then was hurled to the ground by “a violent shock wave” as the pressure chamber exploded. Two others remembered little more than that “everything was on fire.” The tank was “completely burned out,” and the wreckage of the “badly disintegrated” pressure vessel was strewn across over half a mile. Senior research engineer F. K. Ovitz, research engineer J. G. Nellis, and experimental mechanics J. J. Hanusin and J. M. Leonard were all mortally wounded. Nine others were injured, two of them seriously.

Inquiries by Standard Oil, its subcontractor Merz Engineering, and the OSRD eventually determined the cause of the catastrophic failure. The vessel was flawed from the start. Analysts

An internal memo to Vannevar Bush noted the risks—sometimes fatal—OSRD personnel faced.

To learn more about...

- Records relating to World War II research and development in the National Archives, go to www.archives.gov/research/guide-fed-records/groups/227.html.
- Records relating to World War II research and development at the Library of Congress, go to www.loc.gov/rr/scitech/trs/trsosrd.html.
- Records of the Office of Strategic Services in the National Archives, go to www.archives.gov/research/military/ww2/oss.html.
complained that it did not abide by industry standards, was poorly welded, and had an unsound design. Weakened springs and lubricating oil deposits had caused the right compressor’s troublesome valve to stick open; as a result, recompression and high temperatures ignited carbon or oil deposits. Fuel leaking into the compressor was set ablaze, then “forced back into the fuel chamber, thereby igniting the entire supply of fuel.” An OSRD memorandum regarded the disaster as “just one of those unfortunate mishaps which may occur in the course of any research on dangerous instrumentalities of war performed at an accelerated pace.” (In a bit of twisted irony, the earlier “Firefly” project assigned to Standard Oil was a device designed to detonate gas tanks.) It was concluded that “direct connection of an air compressor to the fuel container is extremely hazardous.” A faulty valve and shoddy engineering had cost the lives of four men.

During testing of a flamethrower towed by a tank, four personnel were mortally wounded when the poorly designed and fabricated vessel catastrophically failed.

Mixing of Chemicals Can Produce Explosion

Other grave accidents merited attention in the OSRD files. On April 3, 1943, an explosion at Servel, Inc., which produced oil smoke pots for the OSRD, “destroyed the laboratory,” fatally injuring technical aide Clarence O’Bryan. He suffered serious burns and critical injuries to his legs and lower body. He died three days later in the hospital from kidney failure. O’Bryan had been married for less than a month. The cause of the blast was unknown, but it was speculated to have been the spontaneous combustion of the chlorated sawdust and charcoal in the dryers.

The widow of Frank Ovitz, one of those killed in the flamethrower explosion, wrote to Vannevar Bush expressing the hope that her husband’s research work would eventually save other lives.

When the OSRD conceived a device capable of “extracting oxygen from the air” and recycling it, they contracted the University of Pennsylvania to develop it. Scientists working on the project, which was deemed “of great importance to the war effort,” used salcomine, a “cobalt-containing organic chelate,” to absorb and release oxygen. On April 18, 1944, the pressurized experimental device sprang a leak, spraying salcomine into the air. Theodore A. Geissman stopped the leak but suffered “severe toxic hepatitis” in the process, which required expensive medical treatment. Years later, the OSRD urged passage of a relief bill for Geissman in a July 29, 1947, memorandum to the Bureau of the Budget. (A scribbled annotation confirmed the bill was approved.)

Under another OSRD contract, Samuel Ruben, “the best young experimental chemist in the country,” in one colleague’s eyes, worked at the University of California, Berkeley. In late September 1943, an experimental vial of phosgene shattered,
spraying the contents into his face. He was rushed to an oxygen tent, but his condition deteriorated. He died the next day, leaving “a wife and three small children.” Since he had previously been involved in ordinary research on non-toxic butane gas, he did not have extra-hazardous insurance. These lamentable cases and others like them would stay out of the limelight, effectively forgotten.

In the OSRD, sacrifices were made and conspicuous heroism was displayed, from Joseph Roman’s attempt to save his colleague to Geissman’s stopping the toxic salcomine leak with disregard for his own safety. In October 1942, in the wake of the fatal blimp crash, Commercial Solvents fire, and Caltech deaths, OSRD Executive Assistant Carroll L. Wilson acknowledged that “Many of our personnel . . . expose themselves to serious risks . . . our people are working with poisonous chemicals, with high explosives . . . with infectious diseases . . . Our men have not hesitated to take these risks.”

One notable death was that of Wallace B. Caufield, Jr., an employee of Harvard’s Radio Research Laboratory, who was strafed by Luftwaffe aircraft in Luxembourg on January 1, 1945, as the Battle of the Bulge raged. As shown by its drafted relief bills and lobbying, the OSRD was reluctant to leave the families of its fallen employees in desperate financial straits and worked to compensate them. The story of the OSRD, encompassing both its unconventional projects and the losses it suffered, is a potent reminder of the risks and rewards of scientific research during World War II.

Carl Sanborn’s death in June 1942 was not the first civilian victim claimed by the war at sea. Caltech had already suffered a death in connection to Mousetrap on March 27, when assistant mechanic Raymond L. Robey was fatally burned.

In a letter to Caltech, Bush conceded that “It is an exceedingly difficult thing to strike a proper balance between . . . security of personnel on the one hand and . . . an important and dangerous undertaking on the other.” The final chapter of the Sanborn tragedy came on January 6, 1948, when Congress passed a law to relieve his dependents, with Bush lobbying for recognition of Sanborn’s “supreme patriotism.”

While he emphasized the need for vigilance and safety precautions, he added: “It is never possible to be absolutely perfect . . . If we were to strive for absolute perfection, we simply could not . . . work at the speed which the war effort warrants.” Bush pointed out that “If we can make speed we will save lives . . . [and] we will increase the safety of this country in a critical period of the anti-submarine effort.”

Relatively little public interest in the U.S. experience in World War II has focused on the efforts on the home front to supply troops with war-winning equipment, and even less attention is devoted to the OSRD’s work. While its inventions were not always accepted, any research organization makes missteps. The endless ingenuity of its scientists demonstrated the extent of human creativity.