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Tristan M. Bollenbaugh
Kennesaw State University

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by Tristan M. Bollenbaugh

Two questions most likely come to your mind when you read "China Lake." The first is probably, what is China Lake? The second question probably is, where is China Lake? To answer the second question first, China Lake is an integral part of a small desert town about a three-hour drive northeast of Los Angeles and wedged between the snow-capped Sierra Nevada mountains and the sweltering badlands of Death Valley. And no, there is no lake. The answer to the first question is China Lake is a Naval weapons laboratory established during World War II and still producing essential weapon systems for the United States today. By looking at the conflicts China Lake's weapon systems influenced, the competition it provided to private industry, and its unique organizational management, we can see that this small community has affected the fate of nations and the course of history, making it one of the most important places of the twentieth century.

The United States government gave the atomic weapons of the Manhattan Project the highest priority during World War II, but there were some problems that only China Lake could solve. Authors of the historical narrative "The Grand Experiment at Inyokern," J. D Gerrard-Gough and Albert Christman, describe the situation the Manhattan Project faced, where they could only supply one or two of the explosive cores needed for the implosion-type weapons (212). The government was also concerned about a potential accident at Los Alamos, where the

Manhattan Project was based, that could result in no ready replacement for the capability or knowledge required to produce vital bomb components (Gerrard-Gough and Christman 213). To address this concern, the government looked to China Lake, which had a close working relationship with some of the best engineering schools in the country, such as the University of California, Berkley, and CalTech. These relationships, coupled with unique expertise in designing and manufacturing explosives and munitions, made China Lake the ideal candidate for a second remote site. No other place had this exceptional talent, technical ability, and expertise, making China Lake a vital contributor to the United States' grand strategy for both World War II and the Cold War.

Because of China Lakes' technical capabilities and unique relationships with universities and industry, it quickly established the advanced explosive manufacturing facilities needed to create additional atomic bomb cores on a much larger scale than Los Alamos. Gerrard-Gough and Christman explain that the Salt Wells Pilot Plant was built and brought online in 115 days and started producing the implosion cores nine days after the first successful detonation of an atomic weapon called "Trinity" (212). This event was significant because the bombings of Nagasaki and Hiroshima followed soon after. The United States war strategy at the time required more nuclear weapons to follow up with additional attacks if Japan did not surrender. Many would cite the threat of invasion by the Soviet Union as the ultimate reason for Japan's surrender, not the United States' atomic weapons. This belief would seem to undermine the importance of China Lake's work for the nuclear weapons program, but it highlighted another critical need for additional weapons. The Soviet Union was an ascendant world power and a direct challenge to the United States and its allies. The capability to produce nuclear weapons in significant numbers

allowed us to enter the Cold War from a position of strength against the Soviet Union, and China Lake would continue to play a massive strategic role in that long-simmering conflict.

With the nuclear arms race that was taking place during the Cold War, the United States needed to maintain both a strategic and technological edge over the Soviet Union. What was needed was a submarine-launched nuclear ballistic missile, and the United States looked to China Lake for answers which it provided with the Polaris program. In the book, *The Station Comes of Age,* the author Cliff Lawson details China Lake's research into new technologies, materials, and studies to determine the minimum number of nuclear warheads needed to neutralize the government of the Soviet Union (107). With their broad-spectrum approach to designing Polaris, China Lake engineers reduced the size of the concept missile, which weighed 160,000 pounds, to 33,000 pounds (Lawson 107). This comprehensive solution to engineering challenges made it feasible to install ballistic missiles in submarines while increasing the number of missiles a submarine could carry (Lawson 107). The Polaris missile was a world first; no other country at the time could use a virtually undetectable submarine to launch a nuclear strike that could wipe out the government of a hostile country. China Lake single-handedly created a nuclear sea launch capability for the United States and presented the Soviets with a threat of mutually assured destruction by guaranteeing a retaliatory strike using Polaris missiles. The current generation of nuclear ballistic missiles that have their roots in China Lake's Polaris program are just as crucial to the United States nuclear policy today as they were during the Cold War.

Large strategic nuclear weapons were not the only projects at which China Lake excelled; they also had extensive expertise in rocketry and guidance systems from their development of other air-launched weapons during World War II. In the book *Sidewinder: Creative Missile*

Development at China Lake, author Ron Westrum details a competitive missile test between Hughes Aircraft's Falcon and China Lake's Sidewinder missiles. Before the initial trial between Falcon and Sidewinder in 1955, Westrum described the Sidewinder as so simple that the small China Lake team required only two pieces of equipment to get Sidewinder ready (11). In contrast, the Hughes Aircraft team took a more sophisticated approach with the Falcon missile, which required enough equipment to cover 40 feet of workspace and 19 technicians (Westrum 11). Since the Air Force was looking for a self-guided missile to intercept enemy bombers, they set up a live demonstration in 1956. During this testing, the Sidewinder destroyed two target drones. The overly complex Falcon had technical issues which kept it grounded and unable to compete (Westrum 12). China Lake proved that it could provide simple solutions to complex problems while also providing needed competition against private contractors looking to win government contracts. By stepping out of the traditional role of most government laboratories, China Lake was instrumental in ensuring that private contractors had to develop better weapons systems and that the government could select the best from a more comprehensive array of choices.

The Sidewinder's simplicity contributed to its reliability and substantially impacted the missile's cost. If we adjust the price per missile for inflation to 1960's dollars, Sidewinder costs approximately $20,000 per missile (AIM-9 Sidewinder). By comparison, using the same inflation adjustment, one Falcon missile costs $96,000 (Hughes AIM-4 Falcon). You could buy almost four Sidewinders for the cost of one Falcon missile. Very few government procurement officers would see this as an insignificant detail. Even fewer military leaders would turn down a proven and effective missile that allowed their pilots more live-fire training practice made possible by the low cost. The low cost of Sidewinders also meant the allies of the United States

could afford to field American-made Sidewinders with their air forces. Sidewinder eventually became the primary short-range, air-to-air, heat-seeking missile for most Western countries and is still in service almost 70 years later.

The Formosa Crisis of 1958 highlighted the simplicity, reliability, and cost-effectiveness of Sidewinder. During this conflict, Taiwan was under threat of invasion by China, and in *Magnificent Mavericks,* Elizabeth Babcock covers Sidewinder's performance in the crisis. She quotes an Office of Naval Intelligence report regarding the missiles' combat performance, "Four (4) F-86F, Sidewinder equipped, engaged CHICOM MIG-17s. First employment of the system in combat. Six (6) weapons fired- four (4) kills" (Babcock 471). This engagement was not only Sidewinder's first employment in combat but also the first self-guided missile ever used under combat conditions. This performance was impressive because the Taiwanese flew outdated F-86 fighters against newer and more capable Soviet-made MiG-17s. Critics of Sidewinder might argue that Sidewinder's success stemmed from the fact that the Chinese pilots had never encountered a heat-seeking missile and had no strategies to counter it. However, the Sidewinder's purpose was to intercept slower, less maneuverable bombers, not more agile fighters like the MiG-17. Sidewinder was used outside its intended purpose and was still effective in real-world conditions outside a laboratory setting. Babcock includes an analysis of the incident from Howard Wilcox, a lead designer on Sidewinder, "I felt this was an ideal application of the Sidewinder missile, to suppress what had promised to become a shooting war because it made it clear to the other side that they were not going to be able to dominate the air. They were not even going to be able to compete in the air" (Wilcox qtd in Babcock 471). Sidewinder proved to be an effective deterrent against hostile countries that threatened America's allies and demonstrated that China Lake produced weapon systems that shaped significant events that have impacted the

world up to the present day. By providing Sidewinder missiles to Taiwan, China Lake helped ensure the country remained independent.

Not all China Lakes projects were successful; many failed to win against competitor systems offered by private industry. What is notable about many of China Lake's projects is they often operated on shoestring budgets and skeleton crews of engineers and scientists. Looking at the difference in the design teams working on a new medium-range intercept missile for the United States government, we can see that China Lake did more with less. In the documentary *Secret City, Part 2,* the former China Lake Technical Director compared their Advanced Common Intercept Missile Demonstration (ACIMD) program to the competing Hughes Aircraft project Advanced Medium Range Air-to-Air Missile (AMRAAM) (01:36:17). ACMID was successful in competing against AMRAMM despite having only 25 personnel working on it against AMRAAM's 1,200 staff (Secret City Part Two 01:36:17). AMRAAM would become the American military's medium-range air-to-air interceptor missile and is still in service today. However, the fact that China Lake could provide substantial competition against a much better-funded and staffed private company speaks volumes about the efficacy of China. Without the competition from a government laboratory whose sole motivation was to provide the best weapon system, AMRAAM would not be as good as it eventually became. Even in failure, China Lake provided a valuable service to the government, ensuring that private industry brought their best products to the table.

China Lake is home to brilliant engineers and scientists, but all the best people in the world can struggle with projects, as we saw with the Hughes Aircraft AMRAAM project. What made China Lake notable and gave them an edge over other government facilities and private contractors was the "China Lake Way." Doctor William McClean was both the Lead Designer

of Sidewinder and China Lake's Technical Director from 1954 to 1967 and the creator of the core tenants of the "China Lake Way." Author Ron Westrum outlines these tenants: "Get the right people, give them the right challenges, give them the proper tools, put as few barriers in their way as possible and hold them accountable for successes; ignore failure" (Westrum 18). The last two points of removing barriers and focusing on successes were highly effective and the key to China Lake's success. By allowing engineers and scientists to focus on their work and not have to deal with obstacles introduced by government bureaucracy and politics, China Lake personnel were able to work toward results more quickly and efficiently. Not lingering on failure meant they were faster to move on to find solutions, thus keeping the various groups' momentum and morale high. This unique management approach and environment would spawn the first successful anti-radiation missile, the AGM-45 Shrike, and the first successful television-guided glide bomb, the AGM-42 Walleye (Westrum 18). Both weapons saw extensive use in the Vietnam war, where the Shrike suppressed and destroyed enemy anti-air radar, and the Walleye precisely targeted enemy infrastructure and minimized collateral damage. China Lake's numerous and impactful breakthroughs in weapons technology stemmed from Doctor McClean's unique and insightful approach to organization.

Because of their approach to weapons design and development, China Lake had a tremendous impact on the Vietnam war through its contributions to the research, development, testing, and evaluation of weapon systems used extensively in the conflict. In *Secret City*, former Secretary of the Navy, Robert McNamara, is quoted as stating that seventy-five percent of all air-dropped munitions in Vietnam were developed at China Lake (00:46:44). In terms of tonnage, we can look at the study "The Long Run Impact of Bombing Vietnam" by Edward Miguel and Gerard Roland which indicate that the United States Air Force, Navy, and Marine Corps dropped

a total of 6,312,000 tons of ordinance from 1964 to 1973 (2). This total tonnage means just over 4.5 million tons of China Lake-designed munitions were used in Vietnam. This statistic is significant because many other private companies and government laboratories were involved in developing air-borne weapon systems. It indicates that the products that China Lake designed, tested, and evaluated for both the Navy and other services were so effective compared to other competing weapon systems that most military commanders utilized them in strike missions. Looking at China Lake's successes helps explain why many of China Lake's weapon systems were employed in the Vietnam War. China Lake had a unique blend of talent, management, and experience found nowhere else and produced fantastic results.

From 1943 to today, a span of 79 years, China Lake has answered countless challenges thrown against it by foreign aggressors and domestic competitors. It has provided answers to a government that knew they could rely on China Lake to produce results. The scientists and engineers of China Lake forged the hearts of nuclear weapons and created missiles that could clip the wings of foreign air forces. China Lake has a history of excellence that is evident in its track record, which sets it far above its peers and secures its place as a shaper of the fates of entire nations and one of the most influential places in the twentieth century.

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