AMERICAN INSTITUTE OF AERONAUTICS AND ASTRONAUTICS

Historic Aerospace Site

Naval Ordnance Test Station

China Lake, California

American Institute of Aeronautics and Astronautics

Michelson Laboratory Main Shop, 1948.
The "Big Shop" was, from the start, one of the best-equipped experimental machine shops in the military and has been used to fabricate everything from wind-tunnel models to production hardware.

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In wartime, it has been shown, the true enemy is delay. This was particularly true during the twentieth century, where new technologies could not always be adapted for immediate use, even when the need was overwhelming. At China Lake, the emphasis has always been on developing user-friendly, reliable weapons in a hurry. This unwritten policy was in place from the very beginning.

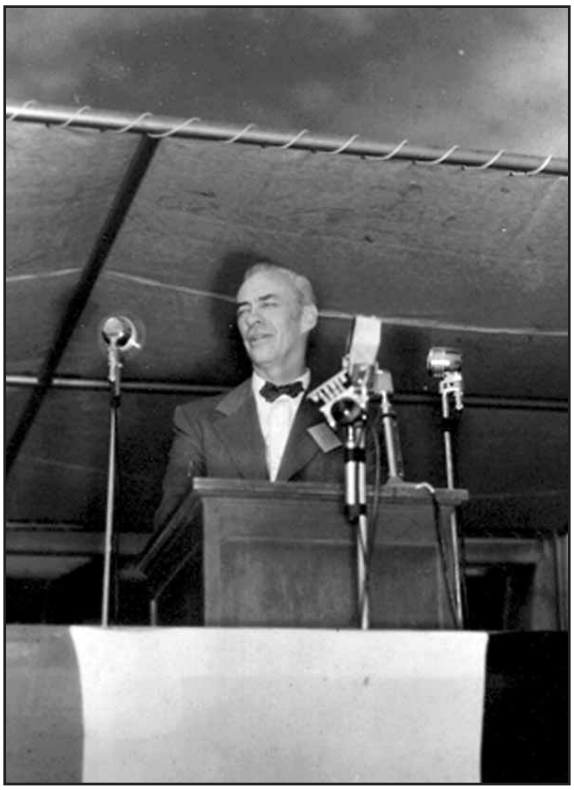
The "rocket-ridin' rabbit" was the first logo adopted for the Station; dating from the Station's earliest days. Various versions of this popular piece appeared on everything from flight jackets to bars to informal publications.

In 1943, in the midst of World War II, the Navy had commissioned the California Institute of Technology (CalTech) to develop urgently needed rockets, and adequate facilities were needed for their testing and evaluation. Unfortunately, testing these rockets near Cal Tech proved problematic—there simply was not enough room. Conveniently, the Navy also needed a new proving ground for all aviation ordnance. A space in the desert north of Los Angeles, near the small town of Inyokern, was mapped out in 1943, named the Naval Ordnance Test Station (NOTS). The NOTS mission was defined in a letter by the Secretary of the Navy dated 8 November 1943: "…A station having for its primary function the research, development and testing of weapons, and having additional function of furnishing primary training in the use of such weapons."

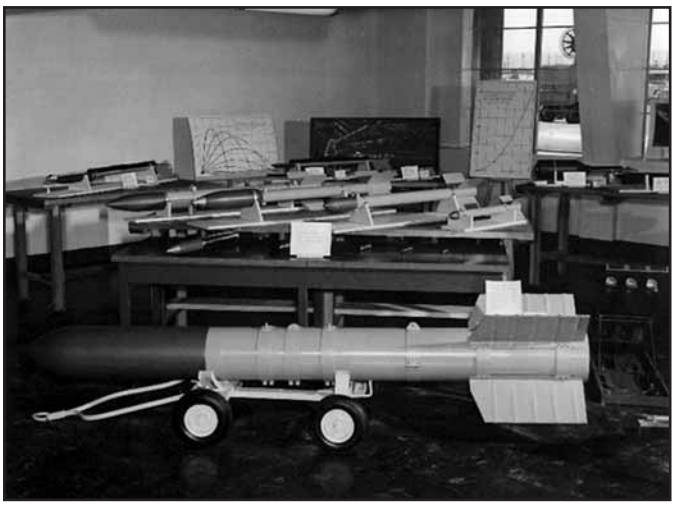
Testing began at China Lake within less than a month of the station's formal establishment, and by mid-1945 NOTS' aviation assets were transferred to the new Armitage Field at the China Lake site.

Although it started as a big, empty place for developing and testing rockets, China Lake quickly took on more functions. The vast, sparsely populated desert around China Lake and Inyokern, with near-perfect flying weather

Top: An early wheeled rocket sled during tests on the Transonic (B-4) Track, 1948; China Lake was a pioneer in the design and operation of high-speed test tracks, operating several facilities over its more than 50 years in support of a wide variety of research, ordnance, and aircrew-safety programs.



Right: Dr. L.T.E. Thompson, China Lake's first Technical Director, at the 1948 dedication of Michelson Laboratory. "Dr. Tommy" was one of those most responsible for establishing the military–civilian partnership so essential to China Lake's success.



Above: Southwest corner of the China Lake complex, 1955, with the Sierra Nevada in background. Armitage Field is upper right, main industrial and community areas in center, and the 50-acre China Lake Pilot Plant in foreground; the guided missile and ground ranges are to the right (north).

Top left: Packing a "Fat Man" test shape at China Lake Salt Wells Pilot Plant, a highly secret facility of the Manhattan Project. Bomb-shape drops and explosives and explosive-lens development and production were part of Project Camel at NOTS; Salt Wells' relationship to the A-Bomb project remained secret for decades thereafter.

Bottom left: Rocket display, Michelson Laboratory, 1948. Shown are 11.75-inch Tiny Tim in foreground; 5-inch Holy Moses, 5.0- and 3.5-inch aircraft rockets, and 2.25-inch subcaliber aircraft rocket (left to right) on stands in center; Mousetrap antisubmarine rocket in right background; and barrage rockets in launcher in right foreground; note radar van outside window.

year-round and practically unlimited visibility, proved an ideal location not only for testing and evaluation, but also for research and development. The early Navy–CalTech partnership established a pattern of cooperative interaction between civilian scientists and experienced military personnel that continues to the present.

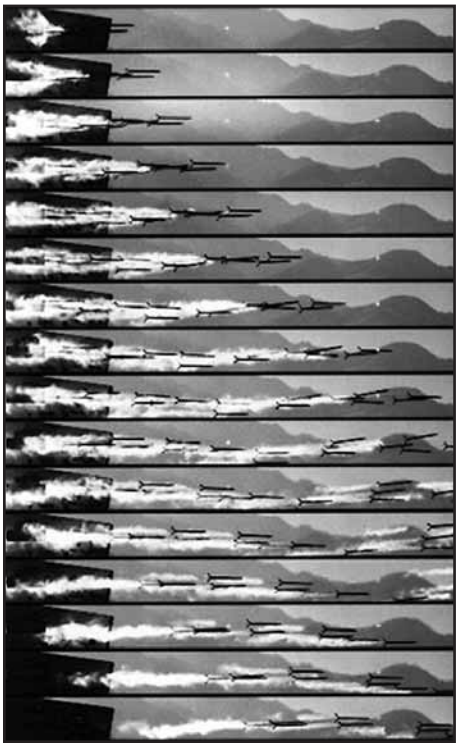
Early projects at China Lake included the test and evaluation of air-launched rockets, solid propellants, fire-control systems, and rocket and guided missiles. In the late 1940s, NOTS began research on fire-control systems that evolved into the concept of the Sidewinder guided missile. During World War II, the station also played a role in the Manhattan Project as the site of "Project Camel," which developed non-nuclear explosive bomb components—a role that continued into the 1950s. Air-to-ground rockets such as Holy Moses, Tiny Tim, and a family of spin-stabilized barrage rockets were fielded while the station was built. After the war, the Pasadena Annex was added to NOTS, bringing with it the torpedo-development program and other underwater-ordnance projects.

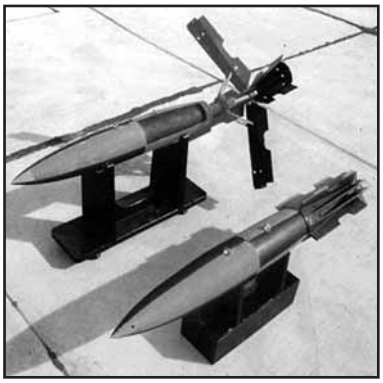
With the advent of the Korean conflict, NOTS rapidly gained cognizance over an even more extensive catalog of rockets, missiles, and torpedoes and an array of guns, bombs, and fuzes. The station sent the 6.5-inch tank-killing Ram rocket to the combat forces in Korea after only 28 days in development and testing, and the ensuing years saw the development and deployment of some of China Lake's most noted products, including the Weapon A, Mighty Mouse, and BOAR rockets; a series of torpedoes; new aircraft fire-control systems ("avionics" now); and, of course, the Sidewinder. By the late 1950s, research at China Lake had expanded into such diverse fields as weather modification and satellite-delivery systems. The station also played a significant part in the development and testing of the Polaris missile system.

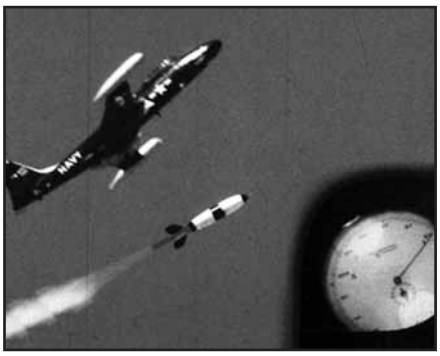
One of the more interesting, if not completely successful, satellite-delivery programs was NOTSNIK. In the late 1950s, the general public was aware of the Vanguard and Explorer satellites being developed as a response to Sputnik. But China Lake was working on one of their own, called NOTSNIK. Although the original goal was a response to Sputnik, the NOTS scientists developed a longer range goal of proving that their unusual launch system could be used throughout the Navy for multiple purposes. The satellite and launch system were created quite quickly, but only one of the six satellites launched showed any success, and that was very brief.

Involvement of the United States in Southeast Asia in the 1960s quickened the tempo of activities at NOTS, and a new generation of "smart" bombs, cluster weapons, and night-attack systems was developed to meet Fleet needs. The station had been preparing to meet conventional-warfare requirements, and the "Eye" series of free-fall weapons first saw action in Vietnam. Snakeye and Rockeye bombs, the Zuni rocket, the ASROC antisubmarine system, the Shrike antiradar missile, the TV-guided Walleye, and advanced Sidewinders were among the station's products in the fleet. NOTS developed and applied forward-looking infrared (FLIR) technology and systems, fuel-air explosive (FAE) devices, weather-modification systems, and space and undersea research vehicles during the decade; electronic warfare also received major attention, and the station made significant contributions to countermeasures, special-warfare, and strategic-missile systems.

China Lake undersea research ranged from the development of submarines to research into the nature of the sea itself. Submarines developed by China Lake and the Pasadena Annex during the 1960s included Moray, a two-man deep-diving submarine that was the research prototype for a sort of underwater fighter plane; Deep Jeep, the first U.S. manned submersible to descend over 2000







Above left: "Mighty Mouse" 2.75-Inch Folding-Fin Aircraft Rocket (FFAR); originally conceived as an air-to-air weapon, and first used in combat in the Korean War, the 2.75 (with its expendable pod launchers) became the standard ground-attack rocket.

Middle: Polaris missile launch at NOTS San Clemente Island range, 1959; China Lake's participation in the Polaris program included propulsion and launch testing and, more significantly, studies and analyses that were instrumental in defining the final system concept and the nature of the sea-based deterrent.

Top right: Snakeye was fielded in 1964 and used extensively since; the retarder tail allowed low-level, high-precision attack while avoiding bomb-fragment damage to delivery aircraft and retaining a low-drag delivery option.

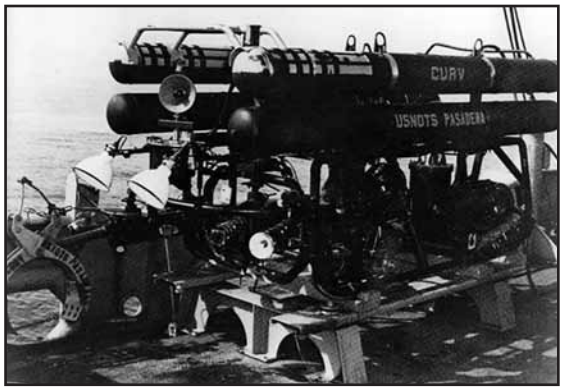
Bottom right: Test firing of 30.5-Inch Bombardment Aircraft Rocket (BOAR), sans warhead, 1955; one of the earliest rockets designed to carry a nuclear warhead.

NOTS Project ("NOTSNIK") test shape ready for flight on F4D, Armitage Field, 1958.

NOTSNIK

The NOTSNIK satellite was a minuscule doughnut-shaped design, 8 inches across and weighing 2.3 pounds. It perched on the nose of a five-stage booster. The entire vehicle was 172.5 inches long with a maximum diameter of 30 inches, not including the fins. There were no moving parts. It launched at 40,000 feet from an F4D-1 Skyray, a transonic delta-wing fighter plane. Once launched, it would continue on, guided only by gravity and spin. The stages would fire at different times to get it to orbit.

The total weight was 2100 pounds, making it the smallest launch vehicle ever designed. It was also the first all-solid-fuel orbital launch vehicle, predating NASA's Scout rocket by two years.



Top: Moray test vehicle (TV-1A) during testing at China Lake. The Moray concept was for a two-man, deep-diving, fast submarine that would serve as an undersea "fighter plane"; the Moray TV was designed and built at China Lake, and manned testing was later conducted at sea; several propulsion and materials options were investigated.

Bottom: The Cable-Controlled Underwater Recovery Vehicle (CURV). Developed by NOTS to retrieve torpedoes from its underwater ranges, CURV was also used to retrieve an Air Force nuclear weapon lost in 2800 feet of water off of Palomares, Spain; updated CURVs are still in use.

feet; and CURV, a remote-controlled diving vehicle designed to recover torpedoes and used in 1966 to recover a lost nuclear weapon in deep water off the coast of Spain. NOTS was also talking to dolphins in those days—"Notty" was the first of these—and studying the way fish swim.

In 1967, NOTS China Lake and its Pasadena Annex were separated, and NOTS China Lake and the Naval Ordnance Laboratory, Corona, joined to form the Naval Weapons Center (NWC). The Corona facilities closed in 1971 and their functions were relocated to China Lake. With the Corona activity came guided missile and fuzing expertise and a history of accomplishment stretching back to World War II.

During the 1970s, the NWC's direction changed along with the Navy's shift to more advanced, computer-intensive systems. Aircraft systems—avionics—became a major area of effort, as did advanced electronic-warfare systems and simulation efforts. Weapon System Support Activities (WSSAs) were developed for the AH-1, A-4, A-6, A-7, AV-8B, and F/A-18 combat aircraft, and NWC began fielding avionics software and hardware for everything from weapons integration to advanced self-protection techniques. The center continued to develop advanced versions of the Sidewinder, Walleye, Shrike (including the original HARM program), and FAE weapons. Major support and improvement programs were also conducted for Sparrow, Phoenix, Harpoon, and Maverick missiles.

Loading AGM-45 Shrikes at Armitage Field for fleet training exercise, 1974. NOTS developed Shrike, the first successful antiradar missile, beginning in 1958 as a direct response to fleet needs, and China Lake personnel took the missile to the carriers in Southeast Asia.

The Sidewinder Missile

The Sidewinder is a supersonic, air-to-air heat-seeking guided missile carried by aircraft. It has a high-explosive warhead and a passive infrared guidance system. It can be carried by many types of aircraft, including helicopters. The infrared seeker allows the pilot to launch the weapon and then leave the area or take evasive action before the missile reaches its destination.

The missile was developed at China Lake in the 1950s under the direction of Dr. Bill McLean; a prototype was first fired in September 1953 and the official deployment was in 1956. The missile has steadily improved since.

China Lake research extended the technology base in optical and laser systems, advanced propulsion technologies, and antiradiation guidance.

The NWC acquired the National Parachute Test Range function in 1979, adding a new area of major concentration to the NWC mission. China Lake now serves as the Navy's parachute research and development facility.

During the 1980s, NWC continued to expand its aircraft weapons integration and avionics activities and to further develop its simulation capabilities. New projects included the Advanced Common Intercept Missile Demonstration (ACIMD) program, which developed and demonstrated technologies for the next-generation air-to-air missile; the Sidearm and HARM Low-Cost Seeker antiradar-missile programs; the Skipper 2 laser-guided weapon; vertical-launch weapon programs, including Vertical-Launch ASROC; and advanced Sidewinder developments. China Lake's Sidewinder missiles were again combat-proven in the Middle East and in the Falklands. Parachute systems (including the Space Shuttle escape system) received major attention, as did the further development of full-scale aircraft targets, such as the QF-86 and QF-4. NWC also became a major contributor to the Tomahawk Cruise Missile program.

The center began the 1990s with significant support to Operation Desert Storm. True to its heritage, NWC was ready with quick-reaction, on-demand efforts to support the operating forces; many of these efforts were conducted in concert with the operating forces and with other Navy activities. The center conducted efforts that modified, improved, tested, and validated various aspects of Sidewinder, Tomahawk, FAE, HARM, and Shrike weapon systems to meet the immediate needs of the troops in the Arabian Gulf. NWC developed electronic-warfare system upgrades, developed and hand-delivered operational-flight-program upgrades, and developed and fielded new/improved weapon-integration and weapon-targeting software for combat aircraft, including the F/A-18, AV-8B, A-6E, and F-14. Major flight-test support was provided for Navy and Air Force squadrons, especially using China Lake's Echo Range electronic warfare threat environment simulation, to help validate and update avionics and tactics. A variety of threat-analysis tasks, including weapon survivability and vulnerability analyses, were also conducted and supported by the center to help ensure maximum effect with minimum attrition, and NWC supported efforts to protect Allied forces against the potential use of chemical weapons by Iraq. Numerous small quick-reaction projects also were conducted in support of various aspects of the combat operations; many of these projects were aimed at improved aircrew safety.

The ability of the NWC's military–civilian team to meet these challenges depended to a large extent upon the China Lake combination of research and development laboratories and test and evaluation ranges and facilities. This unique, highly capable combination of in-house technical talent backed up by operational expertise with available facilities for all aspects of RDT&E has supported the fleet for 50 years and significantly increased the Navy's tactical flexibility.

In 1992, the NWC was disestablished. Certain functions were combined with those of three other Navy activities to form the Naval Air Warfare Center Weapons Division; the NWC facilities, military administration, and airfield functions were consolidated into the Naval Air Weapons Station China Lake.

Today, China Lake carries out the complete weapon-development process—from basic and applied research through prototype hardware fabrication, test and evaluation, documentation, and fleet and production support. China Lake is home to approximately 4400 civilian employees and about 1000 military personnel (including tenant Operation Test and Evaluation Force squadron VX-9) and is supported by over 1500 contractor employees.

Major China Lake programs include continuing support for Sidewinder, Sparrow, and Phoenix air-to-air missiles; fuzes for the Standard Missile and a wide variety of other surface-to-air and air-to-air missiles and free-fall weapons; Harpoon antisurface weapon system; Tomahawk cruise missile; Sidearm and HARM antiradiation-missile programs; parachute systems and subsystems for aircrews and equipment; avionics hardware and software and total-combat-system operational flight programs (OFPs) for most Navy fighter and attack aircraft; and tactical electronic-warfare and countermeasures systems.

China Lake brought to the Navy the advanced technologies, the engineering disciplines, and the integrated laboratory-operational perspective that resulted in the Navy–industry team that proved so phenomenally successful during the years of China Lake's growth and maturity, and laid the foundations for its continued success in the future.

Significant portions of this text were taken from "From the Desert to the Sea: A Brief Overview of the History of China Lake," published in the 4 November 1993 edition of The Rocketeer, *China Lake's in-house newspaper.*

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THE AIAA HISTORIC AEROSPACE SITES PROGRAM

For over 65 years, the American Institute of Aeronautics and Astronautics (AIAA) has served as the principal society of the aerospace engineer and scientist. Formed in 1963 through a merger of the American Rocket Society (ARS) and the Institute of Aerospace Sciences (IAS), the purpose was, and still is, "to advance the arts, sciences, and technology of aeronautics and astronautics, and to promote the professionalism of those engaged in these pursuits." Today, AIAA has more than 30,000 professional and 5000 student members.

In addition, AIAA sponsors many technical conferences, seminars, and short courses per year, and publishes *Aerospace America*, the *AIAA Student Journal*, and seven archival technical journals (including one on-line journal). The Institute also publishes conference papers and proceedings, technology assessments, position papers, audiovisual information packages, many books, and a variety of career-related educational materials. The Institute conducts a rigorous public policy program and works closely with other societies and governments in broad areas of mutual concern.

AIAA established the Historic Aerospace Sites Program in January 2000 to promote the preservation of, and the dissemination of information about, significant accomplishments made in the aerospace profession. In addition to China Lake, other sites recognized by the Historic Sites Committee include the original Bendix Aviation Company in Teterboro, New Jersey; the Boeing Red Barn, Seattle, Washington; Kitty Hawk, North Carolina; the site of the first balloon launch, in Annonay, France; and Tranquility Base, on the moon.

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