



Advanced Conventional Weapons

Leveraging LLNL's stockpile stewardship capabilities to help meet operational needs of the U.S. warfighter.

Serving U.S. Warfighters

Lawrence Livermore National Laboratory (LLNL) supports the Department of Energy/National Nuclear Security Administration's enduring mission in stockpile stewardship to ensure the safety, security, and reliability of the nation's nuclear weapons. The world-class scientific and technological capabilities needed for stockpile stewardship are also being used to enable development of advanced conventional (non-nuclear) weapons for Department of Defense (DOD) customers.

LLNL works closely with DOD military and civilian researchers to stay at the forefront of future conventional weapon capabilities. LLNL scientists and engineers leverage the nation's investments in high-performance computing and expertise in materials science and engineering, high explosives, systems engineering, and modeling and simulation as well as its wide range of experimental facilities. These resources enable the rapid development of new munitions that are helping to reshape the modern battlefield through enhanced military effectiveness.

LLNL offers the full spectrum of munitions development activities, from warhead design concepts, modeling and simulation of weapon effects and aerodynamics, to novel high-explosive formulations coupled with testing at the High Explosives Applications Facility (HEAF) and larger-scale testing conducted at our remote Site 300.

Accomplishments

Over the past decade, LLNL teams have shown how emerging technologies, advanced simulations, and new manufacturing capabilities can be coupled into a tightly integrated, holistic development cycle to produce advanced conventional weapons that rapidly and precisely meet warfighter needs. At the same time, this development cycle reduces costs, production schedules, and acquisition risks.

As one flagship example, LLNL partnered with the U.S. Air Force to develop and field the BLU-129/B 500-pound bomb in less than 18 months, in response to a Joint Urgent Operational Need calling for enhanced lethality on targets while providing highly circumscribed effects that protect nearby noncombatants and friendly forces. This accomplishment demonstrated the ability of an LLNL-DOD-industry team to greatly streamline the design-build-test cycle through the disciplined use of well-validated simulations and models, in the process breaking down classical cost and schedule paradigms.

Other accomplishments include:

- Supported the third production run of the BLU-129/B low-collateral-damage bomb, and expansion of the bomb to applications beyond the originally specified capability.
- Development and deployment of the GBU-39A/B Small Diameter Bomb "Focused Lethality Munition," which furnishes unique and valuable warfighting capability.
- Extensive warhead development and testing in support of the Conventional Strike Missile, Conventional Prompt Global Strike, and Conventional Prompt Strike projects, which have paved the way to multiple ongoing DOD hypersonic weapons systems programs.
- Developed new insensitive high explosives that maintain or improve energetic performance while providing greatly enhanced munitions safety.

Although much of LLNL's most important work in conventional weapons remains classified, there are many significant efforts underway in which LLNL—working closely with its DOE, DOD, and industry partners—continues to develop extremely powerful yet highly precise (and affordable) weapon capabilities.



Scientific Underpinnings

The underpinnings of LLNL's role in research and development for conventional weapons derive from decades of experience designing and sustaining the nuclear deterrent. Nuclear weapons are very complex systems that present numerous scientific challenges in such fields as materials science, physics, chemistry, and high explosives. Livermore researchers are also demonstrating smarter, more cost-effective pathways of designing, testing, and qualifying advanced conventional weapon systems.

LLNL's high-performance computers provide "virtual" test beds, enabling scientists and engineers to examine weapon design options to better predict and optimize military effectiveness. Computer simulations also realistically model weapon effects on target environments where experiments would be too difficult, dangerous, or expensive. Simulations are used to converge design options into a single innovative weapon system design that is ready for the battlefield more quickly than previously possible. Additionally, LLNL provides the following world-class capabilities:

- LLNL is the NNSA Center of Excellence for the research, development, synthesis, formulation, and characterization of explosives. The High Explosives Applications Facility (HEAF) encompasses all aspects of energetic materials R&D.
- The ability to conduct research at HEAF and LLNL's Site 300 is demonstrating how novel high explosives offer greater military effectiveness and safety with no degradation of performance.
- LLNL materials scientists study and provide expertise on properties and behavior of complex composite materials and ceramics that are of interest to DOD for a variety of weapons and delivery systems.
- Livermore researchers are at the forefront of advanced manufacturing capabilities (e.g., additive manufacturing or 3D printing), which are being used to tailor materials properties for weapons applications. Additive manufacturing is making possible new high explosives with advanced properties.
- LLNL's ability to quickly assemble teams of experts in diverse science and engineering fields such as high explosives, aerodynamics, materials science, system engineering, and supercomputing simulation is key to our successful engagement for meeting warfighter needs.

The Future

DOD continues to seek advanced non-nuclear weapon capabilities that reduce development costs, while shrinking the time to field new operational capabilities. Building on the Laboratory's extensive experience in weapon payloads and delivery systems, including Conventional Prompt Global Strike and related research efforts, LLNL is intimately involved in a number of national programs that are developing hypersonic weapons to counter rapidly evolving threats. LLNL's advanced modeling, simulation, and experimental tools are being used to develop precision warheads can be scaled in size and mass to address a wide range of military targets

LLNL's continued R&D of novel energetic materials is being applied to other DOD mission needs, including new gun propellants, bombs designed to penetrate hardened or deeply buried targets, and high-speed explosive projectiles.

Principal Sponsorship

DOD, including Office of the Secretary of Defense (OSD), military departments, combatant commands, Joint Staff, and other support agencies, as well as U.S. defense-supporting industries.