

# Wayne Y. Lee, Ph.D., P.E.

## Education

Brigham Young University	Ph.D.	Civil Engineering (Geotechnical / Computational Mechanics)	2006
Brigham Young University	M.S.	Civil Engineering (Structural Mechanics / Computer Graphics)	1986
Brigham Young University	B.S.	Civil Engineering (Structural Mechanics)	1983
Brigham Young University	B.S.	Mathematics (Applied Mathematics)	1983
University of Washington	–	Applied Mathematics & Engineering	1978-1980

## Work Experiences

Civil & Environmental Engineering Capstone Program Director, BYU	2016 – Present
Adjunct Faculty, BYU	2016 – Present
Principal, Mountain West Engineering & Computing Consultations	1996 – 2016
Support Chief Technical Staff – Shock Physics Consultations, Raytheon	2013 – 2016
Shock Physics Consultations, PDS / Raytheon	2011 – 2013
Vice President / Director of Engineering, Pacific Engineering	2010 – 2011
Sr. Principal Engineer – Energetics / Shock Physics, Raytheon	2007 – 2010
Sr. Scientist – Weapon Effects, Applied Research Associates	2006 – 2007
Research Assistant/Ph.D. Candidate, BYU	2004 – 2006
Lead Engineer – Energetics & Shock Physics, Talley Defense Systems	1994 – 2004
Sr. Specialist Engineer – Composite Structures & Materials, Boeing	1990 – 1994
Sr. Engineer – Energetics & Materials, Talley Defense Systems	1986 – 1990
Engineer II – Energetics / Composite Structures, Hercules Aerospace Inc.	1984 – 1986
Research Assistant – DYNA-MOVIE.BYU, BYU	1982 – 1984
Engineering Intern – Solid Modeling, Control Data Corporation	1982

## Professional Services, Development and Consultations

- Principal investigator for the geophysics/seismic acoustic signal acquisition & processing effort under contract with the “Urgent Services” Branch of the US Air Force
- Principal shock physicist/technical consultant for multiple advanced high-performance warheads/penetrators development programs (BLU-13X, Griffin, Tomahawk, ACM, NLOS, Paveway and JSOW) that demonstrated successfully against various hardened targets such as ultra-hard (i.e. much greater than 10,000 psi compressive strength) reinforced concrete, geo-materials (soil, rocks etc.) and armors

- Principal designer of a deep and large ultra-hard reinforced concrete target structure for the successful demonstration of a deep-penetration warhead
- Principal researcher & shock physicist for Raytheon's advance multi-phase, multi-physics target neutralization / defeat projects with reactive warhead liners and low collateral damages that resulted in three sole-source contract awards including the Tomahawk JMEWS/JCTD multi-years demonstration program
- Principal shock physicist/developer of a small plastic reactive shaped-charge warhead successfully penetrated against a thick and hardened armor target
- Technical consultant for nuclear reactor spent-fuel subjected to seismic activities for Nuclear Regulatory Commission
- Lead technical advisor for composite man-based berthing units development program in support of the Littoral Combat Ship (LCS), NSWC Panama City, FL
- Chief Engineer/Technical Advisor for NUWC/NWPT's Anti-Torpedo Torpedo (ATT) Navy battleship defense systems
- Chief Engineer – PEOSUB PMS-415 NUWC/NWPT's undersea composite torpedo launch tube development project
- Author & principal technical lead of the US Navy's 2010 Phase I SBIR (N102-144) Project winning proposal for combat ship based composite hazardous material satellite storage lockers
- Lead technical advisor for SOCOM/USN-SEAL's ISR mini-sub's composite mast structure
- Principal technical advisor for the advanced warhead penetration design collaborative project by Northrop Grumman/Talley/DE Technologies' Active Protection System Program
- Author and C++ programmer for ARA/DTRA's Integrated Munitions Effects Assessment (IMEA) software's multiple weapons aim point distribution pattern
- Co-author and C++ programmer for IMEA's tunnel attack effects assessment module
- Principal shock physicist at Talley for USMC, Army and USN-SEAL/SOCOM's fire-from-enclosure (FFE) and confined space (CS) shoulder-launch multipurpose assault weapon's (SMAW) design and proof-of-concept validation/demonstrations that resulted in follow-on and production contracts
- Principal failure investigator for the F-16 seat-back rocket failure investigation that resulted in the transferring of a renewable production contract to Talley from a sole-source competitor
- Principal technical lead for the XM-982 extended range rocket energetics' fracture tolerance study and propellant grain structure redesign effort
- Lead physicist for the M72 Lightweight Anti-Armor Weapon warhead fuze trembler enhancement redesign against brush sensitivity and hard target glancing blow environments
- Technical advisor and shock physics consultant for Texas Research Institute's submerged composite structure blast-resistant design, analysis and test activities
- Principal designer for multiple high strength reinforced concrete target structures in support of full scale warhead performance demonstrations
- Author of composite curved plate bending module for Boeing's workstation software used for 777 design/analysis
- Principal designer of the reinforced concrete test structure at Talley Defense Systems for high-magnitude impulsive rocket thrust tests – fully functional & operational since 1988
- Solid rocket propellant designer/analyst at Hercules for missile programs (A3, C4, D5, PII, MX, HEDI, SRAM, SRAM II and AALM)

- Fiber-composite case structure delamination analyst at Hercules for Space Shuttle's proposed large composite case structure
- Electro-static discharge induced solid rocket propellant initiation researcher at Hercules
- Organized Raytheon Missile Systems' Mechanical/Electrical Sub-system Inter-department technical exchange seminar
- Organizer/chair for Boeing's International Technical Exchange Conference on Engineering Optimizations
- Co-Chair for the 6<sup>th</sup> AIAA Biennial National Forum on Weapon System Effectiveness Sessions: 14-WSE-14 & 23-WSE-23
- Organized and taught engineering analysis/simulation short courses/seminars at ARA, Boeing & Talley

## **Professional Licenses**

- Arizona & Washington, Professional Engineer (P.E.)
- Formerly in Utah, Professional Engineer (P.E.)

## **High Fidelity Modeling & Simulations**

- LS-DYNA Explicit/Implicit FEM, BEM, SPH, Meshless, and Solid – Particle multi-physics hydrocode, LSTC
- ANSYS Implicit/Explicit FEA solver, ANSYS Inc.
- CTH Eulerian Finite Volume hydrocode, Sandia National Laboratories
- ALE-3D Arbitrary LaGrange/Euler hydrocode, Lawrence Livermore Laboratories
- MSC NASTRAN Implicit FEA solver, MSC
- Texgap/Texcap Implicit FEA solver, Anatech/USAF
- Hercules Aerospace's 62124/62114 Quasi-Static FEA solvers

## **Honors and Awards**

- Raytheon Missile Systems' (RMS) Team Achievement Award, 2009, 2010, 2013, 2014
- RMS's Individual Technical Achievement Awards, 2009, 2010, 2013
- RMS's Tomahawk JMEWS/JCTD Program Technical Achievement Award, 2009
- RMS's Excellence in Engineering Award, 2009
- RMS's Tactical Tomahawk Program's Technical Achievement Award, 2008
- RMS's JSOW Program Letter of Commendation, 2008
- RMS's Conventional ACM Program Technical Achievement Award, 2008
- RMS's Strike Weapon Systems Division's Technical Achievement Award, 2007
- Tau Beta Pi, Engineering Honor Society, 1981
- Pi Mu Epsilon, Mathematics Honor Society, 1981

## **Publications/Presentations**

- BYU CEEEn Capstone Program, ASEE RMS Conference, 2017
- Advanced Ground-Based Depth Surveillance Technology Using Advanced Wireless Seismic Equipment, Urgent Services, 2015
- Deep Penetration Data Capturing & Processing Using Advanced Wireless Seismic Equipment, Urgent Services, 2014
- Advanced Multi-Phase/Multi-Physics Target Neutralization Methodology & Development Demonstrations, NAWS, China Lake, 2009
- Advanced Approach to Quantify Strength Consistency of Large High Strength Reinforced Concrete Target Structures for Full Scale Warhead Experiments, 6<sup>th</sup> AIAA Biennial National Forum on Weapon System Effectiveness, 2009
- Numerical Modeling of Blast-Induced Soil Liquefaction, 7<sup>th</sup> World Congress on Computational Mechanics, 2006
- Incorporation of Optimization Techniques in Finite Element Analysis of Structural Components, AIAA/ASME/SAE/ASEE Joint Propulsion Conference, 1989
- Solid Propellant Mechanical Properties Data Reduction Using Computer Code, JANNAF Propulsion Conference, 1987

## **Inventions and Patents**

- USP 8240251 (P.D. 07W216): Reactive Shaped Charge Patent, 14 Aug, 2012
- USP 9347754 (P.D. 13-5443): Fuze Shock Transfer System, 24 May, 2016
- P.D. 09W023: Banshee Resonant Acoustic Effector (Intruder Deterrent), Pending, 2010
- P.D. 13-5426: Pyro Shock Dampening Device, Pending 2013
- P.D. 13-5515: Maximum Effect for Area Neutralization Weapon, Pending, 2013
- P.D. 14-6729: Low Collateral Target Defeat Mechanism for Hard Target Penetrators, Pending, 2014
- P.D. 13-4420: Enhanced Fragmentation for Hard Target Penetrator, Pending, 2013
- P.D. 13-4420-WO-PCT1: Penetrator Munition with Enhanced Fragmentation, Pending, 2015
- P.D. 13-4420-WO-PCT2: Shock-Resistant Fuzewell for Munition, Pending, 2015
- P.D. 13-4420-WO-PCT3: Munition with Nose Kit Connecting to Aft Casing Connector, Pending, 2015
- P.D. 13-4420-WO-PCT4: Munition with Outer Enclosure, Pending, 2015
- P.D. 13-4420-WO-PCT5: Munition with Multiple Fragment Layers, Pending, 2015
- 15759557.0-1655 (WO 2015/175036 A2) International Patent (AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR): Shock-Resistant Fuzewell for Munition, World Intellectual Property Organization, European Patent Office, Munich, Germany, 11 Feb., 2015

- 15759558.8-1655 (WO 2015/175037 A2) International Patent (AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR): Munition with Outer Enclosure, World Intellectual Property Organization, European Patent Office, Munich, Germany, 11 Feb., 2015
- 15759559.6-1655 (WO 2015/175038 A2) International Patent (AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR): Penetrator Munition with Enhanced Fragmentation, World Intellectual Property Organization, European Patent Office, Munich, Germany, 11 Feb., 2015
- 15759560.4-1655 (WO 2015/175039 A2) International Patent (AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR): Munition Comprising a Penetrator and an External Harness, World Intellectual Property Organization European Patent Office, Munich, Germany, 11 Feb., 2015
- 15759561.2-1655 (WO 2015/175040 A2) International Patent (AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR): Munition with Multiple Fragment Layers, World Intellectual Property Organization, European Patent Office, Munich, Germany, 11 Feb., 2015

## **Programming Languages**

- C++, C#, C, FORTRAN, Unix/Linux Shell Scripts

## **Professional & Technical Software Development**

- SEG-Y seismic data interpreter, data reduction, and graphical post-processing modules (C#/C++/C)
- Mechanical and hydro-dynamic properties of metal/composite pre-processing modules for hydro-code and FEA software (C/C++)
- Warhead trajectory and fragmentation dispersion post-processing graphical display modules (C#/C++)
- Warhead jet-formation trade-study geometry definition module (MathCad/C++)
- AutoCad/ANSYS/MathCad/LS-DYNA – CTH LaGrangian-Eulerian model translator and geometry builder (C/C++)
- Advanced 2D / 3D fiber composites quasi-static and dynamic analysis modules (C/C++)
- LS-DYNA graphical pre-processing modules for composite structures (C/C++)
- ANSYS – LS-DYNA Implicit FEA – Explicit FEA Modeling Translator (C/C++)
- Structural mechanics, vibrations and blast shock physics-based closed-form analysis modules (C/C++)
- 2-D/3-D Calligraphic Graphics Processing Modules for FEA & internal ballistics post-processing module (FORTRAN/C/C++)

- XBOLT thread geometry and load analysis module (C/C++)
- TEXCAP/TEXGAP Pre- and Post-Processors (FORTRAN)
- DYNA-MOVIE.BYU – Contour Triangulations for High Performance Calligraphic Display (FORTRAN, MS Thesis)
- Advanced Mortgage Analysis Program (MAP) – Loan Pay-Off Optimizations (C/C++)

## **Languages**

- Read, write and speak Chinese

## **Professional Affiliations**

- Former member of AIAA, NDIA, SAMPE, SAE, JANNAF and ASCE
- Former JANNAF Solid Propellant Mechanical Behaviors Sub-Committee member
- Former JANNAF Modeling & Simulations Sub-Committee member