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## Curriculum Vitae

### NATHAN JAMES MACDONALD, PE, CSP

#### PROFILE

#### MECHANICAL ENGINEERING EXPERT

Experienced mechanical engineering consultant with a Bachelor of Science in Mechanical Engineering. Lead engineer on the design and analysis of numerous projects, including ziplines, exercise equipment, trailers and towing equipment, aerial lifts, and other hydraulic pneumatic, and electronic equipment. Licensed Mechanical Engineer (PE) in Utah, and Certified Safety Professional in comprehensive practice.

Familiar with reading, interpreting, and using standards in the engineering design process including, among others, ANSI, ASTM, OSHA, and SAE Standards. Dedicated to high engineering standards, practice, and quality of work and product. Retained expert or lead associate on over 80 cases, including 30+ patent suits, and 40+ product liability and personal injury cases.

#### WORK EXPERIENCE

Began employment with Alpine Engineering & Design in 2012. Consulted on projects in the areas of new product development, design analysis, and forensic engineering.

#### Amusement Rides

Performed extensive work with various amusement rides and devices including working with powered ziplines, drop rides, pendulum swing rides, and slingshot rides. Conducted comprehensive analysis for compliance with ASTM standards, and structural analysis for static and fatigue loading conditions including preparation of full calculations packages and reports. Analytical work for structural analysis of amusement rides included finite element analysis modeling, hand calculations, fatigue analysis of structures including welded structures, and dynamic and kinematic analysis. Also performed physical testing of amusement rides, including accelerometer testing.

## **Exercise Equipment**

Extensive work with exercise equipment including weight machines, electromechanical exercise machines in various form factors, exercise assistance products and semi-automated massage equipment. Designed multiple pieces of exercise equipment from the ground up and performed analysis to assure compliance with applicable ASTM standards including structural calculations. Structural analysis work included comprehensive calculations packages based on finite element analysis, hand calculations, and fatigue analysis. Experience with prototyping.

## **Electronics and Firmware**

Designed, built, and used/tested numerous special-purpose passive and active electronic circuits including for aerial lift controls, fiber optic controls, electrohydraulic valve controls, repeatability and timing circuits, biological testing systems, fatigue cycle testing, and motor control. Designed and built many instrumentation circuits including for strain gauges, anemometers, optical measurement, proximity sensors, capacitive sensors for fluid detection, thermocouples and RTDs, and more. Done work in battery life testing, automation of common daily tasks using servo controls, detonation circuitry, and PWM control of LEDs, solenoids, Peltier modules, and more. Work also included circuit design, calculations, microcontroller firmware development and deployment, prototyping, thermal and noise stabilization, and analog and digital signal processing.

## **Other Heavy Equipment**

Experience designing and operating heavy equipment including aerial lifts. Experience in accident reconstruction involving MEWPs of various form factors, counterbalance forklifts, telehandlers/rough terrain forklifts, bulldozers, automated refuse trucks, and tow trucks. Work included hazard analysis, foreseeable misuse analysis, and considerations of safer alternative designs. Performed physical cycle and fatigue testing for lift controls and energy chains. Experience reading and analyzing crane black box data.

## **Drill Rigs and Mining**

Designed, reverse engineered, and tested drill pipe wrenches and clamps as well as heavy mining equipment including simulation rooms, centrifuge mounts, drill rig structures, and more. Experience in accident reconstruction involving drill pipe handling and storage.

## **Trailers**

Designed trailers in multiple form factors including beer dispensary trailers, multi-cart carrying trailers, and pneumatic trailers. Selected towing hitches and testing hitches. Testing was done in accordance with SAE standards.

## Consumer Products

Designed and/or analyzed various consumer products including consumer grade printing presses, racing seat simulation bases, basketball standards, electric lawnmowers, refuse receptacles, trampoline frames, urinal screens, construction hardware, and blenders/blender jars. Work included reverse engineering and re-design, motor testing, instrumentation, data collection/processing, statistical analysis, prototyping, structural calculations and simulation.

## CERTIFICATION AND LICENSURE

- Licensed Professional Engineer (license no. 11829303-2202)
- Certified Safety Professional (CSP-38229)
- Certified forklift operator
- Certified scissor lift operator
- Certified trainer for counterbalance forklifts, telehandlers, and MEWP's (IVES #26107)
- Certified Commercial Building Inspector (Cert. No. 9679028)

## EDUCATION

### **Bachelors of Science, *Brigham Young University***

Mechanical Engineering

Academic Scholarship, multiple semesters.

## PATENTS AND PRODUCT LIABILITY

Extensive experience providing expert witness support for lawsuits involving patents and product liability. Work experience involved drafting of reports, including validity, infringement, anticipation and obviousness, motivations to combine arguments, claim construction, claim charts, prior art searching and review, and more. Also included accident reconstruction, simulation, deposition review, foreseeable misuse analysis, safer alternative design, hazard analysis, and warning labels review. Written multiple patent specifications for complex controls systems, exercise equipment, and massage equipment.