William Stamps Howard, PhD

President

Stability Technology, Inc.

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HIGHLIGHTS

- A Specialist in the design and development of industrial machines, equipment, robotics, and automation. With a background in Mechanical Engineering, Electrical Engineering, and Software Development, as well as 30+ years of experience working with machines and automation equipment, Dr. Howard is a specialist in electro-mechanical equipment -- any type of machine, equipment, or automation.

- As president of Stability Technology, Dr. Howard has spearheaded the projects to design and develop over $100,000,000 of industrial machinery, machines, robotics, electro-mechanical equipment and devices operating in 30+ countries around the world.

- Well-versed, experienced, and knowledgeable in all aspects of machine, automation, electro-mechanical equipment development, including Estimated Costs, Efficiency, Performance, and Reliability.

- 20+ years as an Expert Consultant and Witness. Routinely qualified by Federal and State courts. He has testified in a wide variety of trials (14+) and depositions (45+), in cases that involve Intellectual Property, Patent, Trade Secret, Tort, and Contract cases.

- Routinely hired by OSHA and the US Department of Labor as an expert in machines and equipment. I wrote and developed the OSHA Safety iPad and iPhone app, which was the #1 top-downloaded OSHA iPad app on the Apple App Store, with over 125,000 total downloads.

EDUCATION, LICENSES & PATENTS

- Doctor of Philosophy, Department of Mechanical Engineering and Applied Mechanics, *University of Pennsylvania*, Philadelphia, PA, 1995. Field of Study: Robotics & Grasping. Doctoral Thesis: *Stability of Grasped Objects: Beyond Force Closure*.
- Master of Science, Department of Mechanical Engineering and Applied Mechanics, *University of Pennsylvania*, Philadelphia, PA, 1994. Field of Study: Robotics & Grasping.
- Master of Business Administration, School of Business Administration, *Monmouth University*, Monmouth, NJ, 1991.
- Bachelor of Science**,** Department of Electrical Engineering, *Cum Laude*, Field of Study: Computer and Systems Engineering, *Rensselaer Polytechnic Institute*, Troy, NY, 1986.
- Bachelor of Science, Department of Mechanical Engineering, *Cum Laude*, Field of Study: Mechanical Engineering, *Rensselaer Polytechnic Institute*, Troy, NY, 1986.
- Professional Engineer, States of Georgia, New Jersey and Alabama.
- 6 United States Patents (three in mechanical design, and three in software). 3 International patents.

WORK HISTORY

7/02 – Present President, *Stability Technology, Inc*. Charleston, SC

A consulting company specializing in Manufacturing, including the design and development of new industrial machines. Stability Technology is a company that provides specialized design and engineering services to Manufacturing companies in the area of manufacturing, equipment, machinery, software development, packaging equipment, electro-mechanical equipment and devices, and industrial automation.

- Mechanical Design and Electrical Design for many different machines and equipment in numerous companies.
- Developed the software and electrical control systems for many various machines, devices and equipment for numerous different companies.
- 15+ years of Legal Services as an Expert Consultant and Witness (Intellectual Property, Tort and Contract) related to the design and development of machines and equipment, based on patents and/or trade secrets, safety engineering, machine guarding, contractual performance, and software control system design.
- Teach advanced seminars in the OSHA safety, EU safety, and guarding of machinery. Topics include ANSI regulations, CE Standards, OSHA standards, lockout/tagout, PPE, risk assessment, electrical safety, light curtains, area scanners, interlocks, and E-Stops. See www.ManufacturingSafety.com for more details on available seminars.
- Clients of Stability Technology include (partial list):

Pepperidge Farms, Inc.	Solo Cups
Exxon-Mobile	Aggressive Tooling
Sunoco	Sara Lee
L'Oreal Cosmetics	Simmons Bedding Co.
Kellogg's	Welding Services Inc.
Rock-Tenn Co.	Toledo Blade
Wrigley's Gum	Harris Waste
Siemens	Atlanta Attachment
Multicell	Payless Décor
MTS – Medication Technology	GripNails, Inc.
The Southern Illinoisan	Shamrock Forrest Products
OPTI Medical	McKenney's Inc.
Industrial Manufacturing, Inc.	Automatic Handling, Inc.
National Cement	PrimeForm Building Systems.
Alliance Machinery	Hydrochem
Atlanta Journal Constitution	Aumund Corp.
Trane	Coastal Automation
Sinclair International	Filet of Chicken
International Paper Company	CSU Industries
Albany Door	Container Automation Systems
Nike	Frito Lay
Transition Optics	Apache Mills
AEP Industries, Inc.`	TPI Composites
Astec Industries	Material Handling Systems
Santa Rosa Systems	Newpark Mats
HP Hood, LLC	Wirtz, USA

Mitchell Ellis Products, Inc.	Oki Electric Industry Company
Integrated DNA Technologies	Phillip Morris International
Siemens Corp.	Sinclair International
Pepsi Co.	Adrian Steel Company
EBox	Low & Bonar
Biax FiberFilms	ECI (Rego)
Atlas Pacific Engineering Co.	Brown International Corp.
Ryeco	Elsner Engineering
AeroSpec	FujiFilms Dimatix
Eaglestone Conveyor Equipment	Eiken Chemical Co.
Intuitive	Aggressive Tooling
Burr Oak Tool, Inc.	Oak Press Systems, Inc.
Tensile Mills CNC	

12/10 – 1/15 President, *Wildlife Technology, a trade name of Stability Technology, Inc.* Buford, GA

The pro bono portion of Stability Technology focused on applying innovative technology to wildlife protection and sustainable eco-development. Projects include:

- Managed the pilot software project for the Asian Development Bank to collect the wildlife protection laws for the Asian Judges Network on the Environment, the roundtable network of ASEAN supreme court justices.
- Developed an experimental solar-powered hydroponics project in Chinandega, with results far exceeding expectations.
- Designed twelve large renewable water projects in rural Nicaragua, to supply fresh water to twelve communities without clean running fresh water.
- Designed the prototype ultra-low cost ($600) solar-powered home project, and installed the first two systems for rural houses, and a school, in Nicaragua.

9/00 – 7/02 R&D Director *Kliklok Corporation*, Decatur, GA

Responsible for the design, development, and creation of all new Kliklok-branded and Woodman-branded machinery and equipment (Kliklok is one of the largest US manufactures of carton closers, carton erecting machines, end-loaders, top load closers, over-wrappers, and associated cartoning equipment). Responsible for the software, mechanical and electrical design of all new equipment, and often visited the factories to ensure the new machinery operated properly. Developed the safeguarding, interlocks, and warning labels.

- While at Kliklok, I had supervisory responsibility over the Quality Assurance Department. The Quality Assurance Department was staffed with technicians, and included a small laboratory with numerous types of inspection, measurement, and test equipment. One of the primary roles of the Quality Assurance Department was to perform testing of all parts manufactured or purchased by Kliklok. As the engineering & technical supervisor for the department, I worked with the QA Department to ensure they were able to perform accurate tests.

7/95 – 9/00 Engineering Manager, *Woodman Division of Kliklok Corp*., Decatur, GA

Responsible for the design, development, and creation of new Woodman-branded packaging machinery (Woodman is one of the largest US manufacturers of vertical bagmaking machinery, as well as weighers, volumetric scales, conveyors, casers, infeed equipment, and associated mezzanines and support structures). Oversaw the production and manufacture of all Woodman machinery and equipment. Responsible for the successful operation of the machinery in plants

and factories, and often visited the factories to ensure proper operation. Developed the machine guards, interlocks, and warning labels for new machinery.

9/91 – 7/95 Lead Research Engineer, *GRASP Robotics Laboratory,* Philadelphia, PA
Responsible for the research, operation, and testing of various robotic systems in an applied research facility.

6/86 – 9/91 Member of the Technical Staff, Mechanisms Group, *General Electric*, Princeton, NJ
Developed various robotic end-effectors, tooling, and other mechanisms for use in the International Space Station.

Former Affiliations

- ASSE, The American Society of Safety Engineers, Professional Member
- IOPP, The Institute of Packaging Professionals, Member
- IEEE. The Institute of Electrical and Electronics Engineers, Member
- ASME, The American Society of Mechanical Engineers, Member

List of Publications

- William S. Howard, *Small Packaging OEMs: The Benefits of Formalized Safety Processes*, Siemens Totally Integrated Automation Newsletter, December 3, 2013
- William S. Howard, *A New, Free OSHA Safety App,* Siemens Totally Integrated Automation Newsletter, August 28, 2013
- Kala Mulqueeny and Stamps Howard, *Sharks Win at CITES – But What Now?* Ocean Geographic, June 30, 2013
- Stamps Howard and Guy Stevens, *Thailand Can Offer a Ray of Light to an Endangered Species*, The Nation, Thailand, March 12, 2013
- Stamps Howard, *Manta Rays and CITES*, The Bangkok Post, Thailand, March 11, 2013
- Stamps Howard and Kala Mulqueeny, *Majestic Maduwa*, Ceylon Today, Sri Lanka, March 7, 2013
- Stamps Howard and Kala Mulqueeny, *CITES and Indonesia: So Why Care About a Fish?* The Jakarta Post, Indonesia, March 6, 2013
- W. S. Howard, *Stability of Grasped Objects*, UMI, Ann Arbor, MI, 175 pp, 1995
- J. Donahue, W. S. Howard, and V. Kumar, *Stable Workpiece Fixturing*, ASME Conference - Advances in Design Automation, 1994.
- W. S. Howard and V. Kumar, *On the Stability of Grasped Objects*, IEEE Transactions on robotics and Automation, 1995.
- W. S. Howard, and V. Kumar, *Modeling and Analysis of the Compliance and Stability of Enveloping Grasps*, IEEE Conference on Robotics and Automation, 1367-1372, 1995.
- W. Stamps Howard, Vijay Kumar: *A Minimum Principle for the Dynamic Analysis of Systems with Frictional Contacts*. ICRA (3) 1993: 437-442
- W. Stamps Howard, Vijay Kumar: *Stability of Planar Grasps*. ICRA 1994: 2822-2827
- Stamps Howard, Milos Zefran, Vijay Kumar *On The 6x6 Cartesian Stiffness Matrix For Three-Dimensional Motion* Mech. Mach. Theory Vol.33, No.4, pp. 389-408, 1998
- William Stamps Howard, *Trends in Electrical Safety of Machines*, IDS Packaging Conference, 17 January - 4 February, 2005.

OSHA Background

- Developed, designed and programmed the iPad/iPhone app, OSHA Safety:
    - #1 ranked OSHA iPad app on the Apple App Store (and the #2 ranked iPhone App).
    - Over 125,000 downloads
- Hired by OSHA, and the US Department of Labor, on multiple occasions as an expert for OSHA in machinery and industrial automation.
- Holder of an OSHA 30-Hour Card.

Machinery & Manufacturing Seminars Taught

- I teach a wide variety of seminars in the field of machinery and equipment, focused mostly on the design and development of machines and equipment, and how to meet the relevant government regulations and standards (OSHA, ANSI, ISO, and EU standards). These seminars are taught both to the public, and privately to companies such as Nike, Siemen's, and Transitions Optics.

- Public Seminars include the following:
    - William Stamps Howard, *OSHA Subpart O: Machinery and Machine Guarding*, Siemens Factory Automation Webinar Series, February 28, 2014
    - William Stamps Howard, *How Can Risk Assessments Help My Bottom Line*, Siemens Factory Automation Webinar Series, August 28, 2013
    - William Stamps Howard, *Manufacturing Risk Management*, Georgia Center of Innovation for Manufacturing Excellence, Lanier Technical College, April 18, 2008.
    - William Stamps Howard, *Manufacturing Risk Management*, Advantage Industrial Automation, September 26, 2007.

- The private training seminars cover the OSHA, International Standards Organization ("ISO") and American National Standards Institute ("ANSI") requirements to properly design machines and equipment – focused specifically on the applicable US and EU regulations for machinery. These seminars are customized to the specific machinery used by my clients.

- As part of these seminars and training provided to manufacturers, I cover the following OSHA regulations, ISO standards and ANSI standards:

  <u>OSHA Regulations for Machinery</u>
    - Subpart I - Personal Protective Equipment.
    - Section O - Machine Guarding
    - Subpart S - Electrical equipment and Electrical hazards.
    - Section 147 - The Control of Hazardous Energy (Lockout/Tagout)
    - Section 146 - Permit Required Confined Spaces
    - Section 145 - Specification for Accident Prevention Sign and Tags

  <u>ANSI and ISO Standards for Machinery</u>
    - ANSI B11.0 (2015) - Safety of Machinery – General Requirements and Risk Assessment
    - ANSI B11.19 (2010) – Safety of Machinery – Performance Standard for Safeguarding
    - ANSI Z535.4 (2011) - Product Safety Signs and Labels
    - ANSI B20.1 (2012) - Safety Standard for Conveyors and Related Equipment
    - ANSI/RIA R15.06 (2012) - Safety Requirements for Industrial Robots
    - NEC (2014) - The National Electric Code (also known as ANSI/NFPA 70)
    - ANSI/NFPA 79 (2015) - Electrical Standards for Industrial Machinery

- ANSI/ASSE Z224.1 (2016) - Control of Hazardous Energy, Lockout/Tag out and Alternative Methods
- ANSI/ISO 12100 (2012) - Safety of machinery. Basic concepts, general principles for design.
- ANSI/NFPA 70E (2015) - Standard for Electrical Safety in the Workplace
- ISO 13849-1 (2015) – Safety of Machines: Safety-related Parts of the Control System

Partial List of Machinery Designed, Interfaced and/or Analyzed

Conveyors	Vibration Feeders	End Loaders
Top Loaders	Carton Feeders	Carton Former
Continuous Bagmakers	Draw-bar bagmakers	Intermittent machines
Weighers	Formers (bags)	Augers
Blow-Molding Machines	Mezzanines	Platforms
Pack-Off Conveyors	Volumetric Feeders	Labelers
Vision Systems	Code Daters	Auto-caser
Film Handling Systems	Automatic Splicers	Printing Press
Stacking & Sorting Machines	Corrugated Machinery	Newspaper Machinery
Textile Machinery	Packaging Machinery	Pharmaceutical Machinery
Robotic Machinery	Recycling Machinery	Gantry Robots
Condom Machinery	Duct-Forming Machines	Wire Forming Machines
Pharmaceutical Machinery	Tube-Cleaning Machines	Pattern-cutting Machines
Automatic Puncher	Thermoforming Equipment	Hydroponic Systems
Grid-Tied Solar Power Systems	Solar Water Supply Systems	Inspection Robots
Material Handling Machines	Waffle-Stacking Machines	Hydraulic Presses
Potting Agriculture Machinery	Injection Molding Machines	Eye-glass machines
Sneaker-making Equipment	Composite Molding Machines	Dairy Machinery
Robotic Sorting Equipment	Plastic Molding Machines	Battery Manufacturing Equipment
Potting Machinery	ATMs	Quilting Machines
Non-woven Fiber Machines	Valves & Gas Equipment	Fruit Processing Equipment
Chicken Processing Machines	Film Marking Euipment	

US Patents

US 5,736,683 - Multiple Hopper Weighing and Transfer System
US 5,959,258 - Multiple Hopper Weighing and Transfer System
US 6,138,442 - Packaging Machine with Continuous Sealing Jaw Movement
US 8,057,607 - Automated heat exchanger tube cleaning assembly and system
US 8,308,869 - Automated heat exchanger tube cleaning assembly and system
US 8,524,011 - Automated heat exchanger tube cleaning assembly and system

System Controls and Software Clients:

Woodman Company: Polaris Bagmaker, Gemini Bagmakers, Compak Bagmaker, Spectra Weigher, Cyclone Bagmaker, P2/G2 Bagmaker, P3/G3 Bagmakers.

Kliklok Corporation: Vari-Right, Vari-Straight, Servo SFR endloader, CELOX endloader.

Wrigley's Gum: Extra Gum labeling machine, and an inspection robot for Wrigley's Spearmint gum.

Solo Cups: Thermoforming forming machine for red solo cups.

Atlanta Attachment: Silver Eagle quilter, Golden Eagle Quilter, Platinum Eagle Quilter, Laser Panel Cutter machine,
Multicell: Cardboard divider machines, Automated puncher machines, Paperboard divider machines.
Kellogg's: Eggo waffle baking machine, Eggo waffle stacker.
Rock-Tenn Co., Sunoco: Paperboard divider machine
Welding Services Inc.: Remote robotic welding machines
Simmons Bedding: Bed cycle-testing machine.
Hydrochem, Shell Oil: STARS robotic machine.
Hydrochem, ExxonMobile: STARS II robotic machine.
Grip-Nails, McKenney's Inc.: Tack-welding machine for sheet metal
TMSI, AJC: Newspaper stacking machine.
Coastal Automation, Toledo Blade: Newspaper stacking machine.
Gillette: Razor packaging line.
Rich Sea Pack: Vari-Right machine
The Southern Illinoisan: Newspaper stacking machine
Albany Door Systems: Processing machinery for the doors.
Frito Lay: "Ship Less Air" bagmaker project.

Programming Languages

APL
Basic
C++
Cobol
Fortran
Javascript
Lisp / Common Lisp (CL)
Maple
Pascal
Prolog
SNOBOL
Assembler, various versions
C (both Lattice C and K&R C)
CSS
Objective-C
Java
Ladder, various versions
HTML / HTML-5
MATLAB
PL/I
Punchcards (IBM)
Wolfram Language (Mathematica)

IEC 61131 Programming Languages:
- Ladder diagram (LD)
- Function Block Diagram (FBD)
- Structure Text (ST)
- Instruction List (IL)
- Sequential Function Chart (SFC)

Programming Development Environments

Adobe Flash
Adobe Dreamweaver
Apple Xcode
B&R Automation – Automation Studio
Coffeecup HTML Editor
Digi – Dynamic C
Intellution iFix
Maplesoft Maple V
Proface Pro-Designer
Rockwell Automation RSLogix5
Rockwell Automation RSLogix 500
Rockwell Automation RSLogix 5000
Rockwell Automation RSLinx
Rockwell Automation RSView32
Schneider Electric SoMachine
Schneider Electric Viejo Designer

Mathworks MATLAB
Microsoft C
Microsoft Excel
Microsoft Visual Basic
Microsoft Visual C++
Mitsubishi GX Developer
Phoenix Contact – SteepleChase VLC
Proface GP-Pro
WATFOR / WATFIV Fortran
Wind River VxWorks
Wolfram Mathematica
Yaskawa MotionWorks 5
Yaskawa MotionWorks 6
Yaskawa MotionWorks IEC