NICHOLAS B. WETTELS, PHD

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329 N. Van Ness Ave, Los Angeles, CA 90004 (213) 477-0710 (C)

- Skilled in industrial robotic and gripper systems, reach and grasp algorithms and machine learning
- Sensor expert: Cross discipline knowledge of sensing systems from tactile to 3D vision
- Commander in U.S. Navy Reserve; has led various teams of 4 to 20 in scientific and warfare environments (from start-ups to government labs to military vessels)
- Active TS/ SCI U.S. Government security clearance

EDUCATION and CERTIFICATIONS:

PhD Biomedical Engineering University of Southern California – 2011 (Los Angeles, CA)
Dissertation: Biomimetic Tactile Sensor for Grip Control and Object Identification
M.S. Biomedical Engineering University of Southern California
Medical Device and Diagnostics Engineering – 2008 (Los Angeles, CA)
M.S. Engineering Management Old Dominion University – 2005 (Norfolk, VA)
B.S. Physics (Minor Mathematics) Tulane University – 2000 (New Orleans, LA)

Joint Professional Military Education Phase I U.S. Naval War College – 2015 (Newport, RI)
Graduate Certificate: Technology Commercialization
University of Southern California – 2010 (Los Angeles, CA)
Nuclear Engineer Certification U.S. Department of Energy, Office of Naval Reactors - 2003

Research Funding (totaling ~$5 M):

- PI: NASA SBIR Phase I/II/IIE: Industrial Electrostatic Gecko Gripper; 2015-2019
- PI: NSF SBIR Phase I/ II: Object Pose Est. System for Pick and Place Robots; 2014-2018
- PI: NASA SBIR Phase I: Polymeric Pressure Sensor for Space Suits: 2017
- PI: NASA-JPL Center Innovation Fund Award: Optical Range & Force Sensor 2013
- PI: DARPA SBIR Phase I/II: Tactile Robotic Hand Detection System: 2009 – 2012
- Co-PI: NIH SBIR Phase I/II: Biomimetic Tactile Sensor for Prosthetics: 2009 – 2012

Technical and Computing Skills:

Computer Languages and Programs:
C (Adv), C++ (Adv), Matlab (Adv), Python (Int), LabVIEW (Int); **Libraries:** OpenCV, TensorFlow

Equipment: 6-DoF Load Cells, Tactile Sensors, National Instruments DAQ boards, Servo and Stepper Motors & Drivers, Stereo Cameras, Proximity Sensors

EXPERIENCE:

OnRobot / Perception Robotics – Los Angeles, CA *January 2012 to June 2020*
Founder, CEO for technical start-up company making bio-inspired robotic grippers for industrial automation

- Grew company from employee #1 to 20 people when it merged with OptoForce and On Robot to form new OnRobot to create one-stop for robot peripherals – raised ~$20 M
- Supervised commercial development of 4 industrial robotic grippers (tactile-based, 2 gecko-inspired, magnetic)
- Lead project manager and software developer (scientific computing and firmware) for company

University of Southern California – Los Angeles, CA *January 2013, 2019, 2021*
Adjunct Assistant Professor in Biomedical Engineering and Entrepreneurship

- Instructor for BME-650: Measurement and Instrumentation, BME-101: Introduction to Biomedical Engineering and BAEP-551 Introduction to New Business

NASA Jet Propulsion Laboratory – Pasadena, CA *February 2013 to February 2014*
Post-Doctoral Researcher for Robotic Hardware Systems Group

- Team member to develop novel gecko-inspired adhesive for grippers and feet of maintenance robots for Space Station and satellite maintenance
- Team member to develop velocity path planning and COLREGS compliance for autonomous Navy surface ship

SynTouch – Los Angeles, CA *June 2008 to January 2012*
Co-Founder, Scientist and COO for technical start-up company.

- PI on several SBIRs, latest project to develop novel tactile control and object identification algorithms using BioTac sensor and Shadow Robot C6M hand and arm
- Grant writer; develop and execute research plan for tri-axial impedance-based force and thermal sensing effort of biomimetic tactile sensor for LLC of 8 personnel.
- Execute strategic and daily operations and financial plan for company.

NASA – Johnson Space Center – ER4 Robonaut 2 Lab, Houston, TX *June 2010 to August 2010*
Researcher for Dr. Ron Diftler as part of NASA GSRP Fellowship.

- Tested B robot's phalange sensors for drift, hysteresis, repeatability, and calibration prior to ISS launch; generated particle filters for object and force tracking with tactile data
- Assisted team in integrating SwissRange finder data into machine vision system

U.S. Navy Submarine Officer – Rank: Commander

Reserve Duty *November 2006 – August 2017*
Space and Naval Warfare Systems Command

- Deputy Director for Autonomous Systems: Design stereo vision-based guidance system for HAMMER UAS/UUV/USV, liaison to UK Royal Navy during UK Unmanned Warrior 2016

Office of Naval Research

- Deputy for Autonomous Systems of ONR Reserve Component and Training Officer for local unit and taps national assets (Naval Postgraduate School, Naval Research Lab) to solve real-world Navy needs in reserve community. Founded 4 ONR-RC research projects: Submarine launched unmanned aerial vehicles for anti-submarine warfare, robotic pallet handler and corporate strategic communications; joint autonomous meteorology system

Task Force 74 Anti-Submarine Warfare Group & Pacific Strike Group Operations Detachment E

- Served as Reserve Staff Group Watch Officer for TF-74; Training and Administration Officer for reserve unit Liaison for Submarine Advisory Team providing guidance to aircraft carrier and theater leadership on submarine operations in Western Pacific Theater; Manage and develop navigation water space to prevent mutual submarine collision and friendly weapons fire (4 national and international exercises)

Active Duty *May 2000 - September 2006*

Navy Recruiting District, Los Angeles, CA

- Served as Engineering and Chaplain Officer Recruiter; supervised all non-medical Navy officer recruiting efforts in nine southern California counties

U.S.S. Topeka, Pearl Harbor, HI

- Served as a junior officer and Assistant Engineering Department Head aboard nuclear submarine through a 16-month maintenance overhaul to a Western Pacific deployment. Scheduled and monitored quality assurance level maintenance on fifty million dollars of electrical, main propulsion, auxiliary and damage control systems without incident

Publications, Awards and Honors:

- Senior Member IEEE: 2020
- IEEE/ IFR Innovation and Entrepreneurship Award 2018: *Gecko Gripper – 1st Place*
- Popular Mechanics Breakthrough Innovator Award 2013: *BioTac Sensor*
- USC New Venture Seed Competition, April 2012 – *1st Place*
- Best paper award IEEE/RAS ROBIO Conference, Phuket, Thailand, December 2011
- Best student paper award: "Biomimetic Tactile Sensor," 2nd Frontiers in Biomedical Engineering conference, Irvine, CA 2007
- 3 Navy Commendation Medals, 3 Navy and Marine Corps Achievement Medals
- NASA Graduate Student Researcher Fellowship (Johnson Space Center)
- Tulane University NROTC Scholarship, Navy Graduate Education Voucher Scholarship
- Tenor 2 – Los Angeles Metropolitan Opera – 2012

Patents

J. McAuley, J.A. Fortus, **N. Wettels**, "Systems and Methods for Magnetic Gripping," U.S. Patent 63/033503, filed 2020

N. Wettels, S.P. Marshall, A Nanayakkara, "Dual Electrode Electroadhesion and Dust Mitigation / Cleaning System," U.S. Patent 62/898225, filed 2019

N. Wettels, M. Gamage, K. Dade, "System, Devices, and Methods for Sensing Locations and Forces" U.S. Patent 62/520469, filed 2017

M. Tehrani, **N. Wettels**, "Systems and Methods for Post-Treating Dry Adhesive Structures," U.S. Patent 10S155S318 B2, issued 2018

N. Wettels, "Systems and Methods for Sensing Objects," U.S. Patent US9579801B2, issued 2017

G.E. Loeb, J.A Fishel, **N. Wettels**, V.J. Santos, R.A. Peck, "Robust Measurement of Sliding-Friction Induced Vibrations for Biomimetic Tactile Sensing," US4186108P, issued 2013

G.E. Loeb, **N. Wettels**, J.A Fishel, C.H. Lin, V.J. Santos, R.A. Peck, "Enhancements to Improve

the Function of a Biomimetic Tactile Sensor," US8272278B2, issued 2012

R.S. Johansson, G.E. Loeb, **N. Wettels**, D.J. Popovic, V.J. Santos, "Biomimetic Tactile Sensor for Control of Grip," U.S. patent US7878075B2, issued 2011

Peer-reviewed Conference Proceedings Articles (full-length articles)

Wettels, N., Mahmoudzadeh, J, Marshall P., Peters, B "Polymer-Fabric Pressure Sensor for Space Suits," *International Conference on Environmental Systems,* Albuquerque, NM, USA, 2018

Mohammad Dadkhah M., Zhao Z., **Wettels N**., Spenko M., "A Self-Aligning Gripper Using an Electrostatic/Gecko-Like Adhesive," *IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS),* Daejeon, Korea, 2016

Wettels N., Parness A. "Advances in Fibrillar On-Off Polymer Adhesive: Sensing and Engagement Speed." *IEEE/RSJ International Conference on Intelligent Robots and Systems*, Chicago, IL, USA. 2014.

Parness A., Heverly M., Hilgemann E., **Wettels N**., Hilgendorf T., White V., Kennedy B., "ON-OFF Adhesive Grippers for Earth-Orbit," *in Proc. of American Institute of Aeronautics and Astronautics Conference*, San Diego, CA USA, 2013

N. Wettels, B. Pletner, "Integrated Dynamic and Static Tactile Sensor: Focus on Static Force Sensing," *in Proc. of SPIE Smart Structures NDE Conf.* San Diego, CA USA, 2012

B. Pletner, L. Swan, **N. Wettels,** A. Joseph, "Large-Scale Self-Tuning Solid-State Kinetic Energy Harvester," *in Proc. of SPIE Smart Structures NDE Conf.* San Diego, CA USA, 2012

N. Wettels, G.E. Loeb, "Haptic Feature Extraction from a Biomimetic Tactile Sensor: Force, Contact Location and Curvature," *in Proc. of IEEE/RAS Int'l Conf on Robotics and Biomimetics,* Phuket Thailand, 2011

C.H. Lin, T. W. Erickson, J. A. Fishel, **N. Wettels**, G.E. Loeb, "Signal Processing and Fabrication of a Biomimetic Tactile Sensor Array with Thermal, Force and Microvibration Modalities, in Proc. of *IEEE International Conference on Robotics and Biomimetics,* Gulin, China, 2009

N. Wettels, L.M. Smith, V.J. Santos, and Loeb G. E., Deformable Skin Design to Enhance Response of a Biomimetic Tactile Sensor, in Proc. of I*nternational Conference on Biomedical Robotics and Biomechatronics,* Scottsdale, Arizona, 2008

N. Wettels, D. Popovic, V. J. Santos, R. S. Johansson, G. E. Loeb, "Biomimetic Tactile Sensor for Control of Grip", in *Proc. of International Conference on Rehabilitation Robotics*, Noordwijk, Netherlands, 2007

N. Wettels, D. Popovic, G. E. Loeb, "Biomimetic Tactile Sensor", in *Proc. of ASME 2nd Frontiers in Biomedical Devices Conference*, Irvine, CA, USA, 2007 – Oral Presentation

Peer-reviewed Journal Articles/ Book Chapters

Wettels, N., Fishel, J.A., Loeb, G.E., "Multimodal Tactile Sensor: in The Human Hand as an Inspiration for Robot Hand Development*," Springer Tracts in Advanced Robotics (STAR) series*, Balasubramanian, R. and Santos, V.J., Eds., Springer, Heidelberg. 2014.

D. Roy, **N. Wettels**, G. E Loeb, "Selection of an Elastomeric Skin for an Artificial Fluid Filled Fingertip" *Applied Polymer Science* 127: 4624–4633, 2013

Loeb, G.E., Tsianos, G.A., Fishel, J.A., **Wettels, N**. Schaal, S, "Understanding haptics by evolving mechatronic systems". *Progress in Brain Research,* Vol. 192, Ch 9: 129-144 – 2011

N. Wettels, A.R. Parnandi, J.H. Moon, G.E. Loeb, G.S. Sukhatme, "Grip Control Using Biomimetic Tactile Sensing Systems," *ASME/IEEE Transactions on Mechatronics* Vol 14, No. 6, pp. 718-723, December 2009.

N. Wettels, V. J. Santos, R. S. Johansson, G. E Loeb, "Biomimetic Tactile Sensor Array", *Advanced Robotics*, vol. 22, no. 7, June 2008

Peer-reviewed Conference Proceedings and Workshop Abstracts

Wettels N., Weichman A., Hargrave B., "Visual-Tactile 3D Random Bin Picking: A Low-Cost Solution," *Southern California Robotics Symposium*, Los Angeles, CA USA 2017

N. Wettels, J.A. Fishel, Z. Su, C.H. Lin, and G.E. Loeb, "Multi-modal Synergistic Tactile Sensing ." Tactile Sensing in Humanoids – Tactile Sensors and Beyond Workshop *9th IEEE/RAS International Conference on Humanoid Robots.* Paris, France, 2009 – Oral Presentation

N. Wettels, V. J. Santos, R. S. Johansson, G. E Loeb, "Biomimetic Tactile Sensor for Grip Control", in *International Conference on Robotics and Automation,* Pasadena, CA, USA 2008 – Workshop Session

N. Wettels, V. J. Santos, R. S. Johansson, G. E Loeb, "Biomimetic Tactile Sensing," in *Proc. of Biomedical Engineering Society Annual Meeting,* Los Angeles, CA, USA, 2007 – Oral Presentation