

## Dr. Chris Daft

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## SUMMARY

- Award winning, Oxford Educated scientist whose areas of expertise include imaging, electronics, semiconductors, MEMS, medical engineering, sensors, signal processing and image processing.
- Experience in industries/applications including medical devices, imaging, consumer electronics, biometric security, and electrical power delivery.
- Extensive Intellectual Property experience including patent development, analysis, licensing, and strategy. Serial inventor holding 24 U.S. Patents with several pending.
- Diverse industry experience includes multi-nationals such as GE, Medtronic, Fujifilm, Samsung and Siemens as well as several start-ups.
- Well published in peer-reviewed scientific journals.
- Winner of grants from National Institute of Health (NIH) and DARPA. Extensive international consulting experience.
- Three years at University of Illinois teaching electrical and computer engineering.
- IEEE Senior Member since 2004.

## EDUCATION

- D. Phil. (equal to Ph.D.) in Materials Science, Oxford University, UK, 1987. Thesis title: *Acoustic microscopy of biological tissue*.
- M.A. in Physics, Oxford University, UK, 1985.
- B.A. in Physics with 1<sup>st</sup> class honors, Oxford University, UK, 1984.

## HIGHLIGHTS OF RECENT WORK

- Deposition and trial testimony experience in patent litigation (PTAB and ITC), product liability and medical malpractice matters.
- Deposition and trial testimony experience in the Superior Court of California, County of Santa Clara.
- Advising start-ups on patent strategy, product positioning and business strategy.

- System design for a wearable cancer monitoring device.
- Portable point-of-care imaging (research supported by a grant to River Sonic Solutions from the National Institutes of Health).
- Design of beam formation and image reconstruction techniques for transcranial imaging and treatment (with the University of Arizona).
- Acoustics and transducer design for medical and industrial applications.
- Design of MEMS (micro-electro-mechanical systems) transducers, signal processing and front-end electronics for pediatric otitis diagnosis.

## HONORS AND AWARDS

- *Senior Key Expert*, Siemens AG, February 2009: Siemens defines the Key Expert position as “a career path for key technology experts analogous to that for our top managerial talents.”
- *Willis R. Whitney Technical Achievement Award*, GE Global Research, August 2000: For participating in the development of a Six-Sigma software toolkit, which was widely deployed within GE.
- *Six-Sigma Certified Green Belt*, GE Global Research, April 1998: A certified Green Belt at GE has taken classes and completed several projects resulting in cost savings for the company. In my case these involved Design for Six-Sigma (DFSS).
- *Dushman Award*, GE Global Research, June 1994: Highest-ranking team award for contributions to the introduction of GE’s first premium ultrasound product, the LOGIQ 700.

## VOLUNTEER WORK

- *Member of the Board of Directors*, IEEE-CNSV (Consultants' Network of Silicon Valley), 2017-2019. IEEE-CNSV is the Silicon Valley chapter of the IEEE-USA Consultants' Network. It brings together consultants, clients and other interested parties to exchange ideas about electrical, electronic and software engineering. I served as the Secretary of this organization for two years.
- *Project Manager*, Keizai Silicon Valley, May 2013-present. KSV is a non-profit business and professional networking organization. It provides a venue for showcasing specialists with expertise on issues critical to the success of entrepreneurs and companies doing business with Japan and the U.S.
- *Member of Technical Program Committee*, IEEE International Ultrasonics Symposium. This committee is responsible for the technical content of the IEEE International Ultrasonics Symposium.

## ISSUED PATENTS AND PUBLISHED APPLICATIONS

1. Receive-side beam forming for an ultrasonic image sensor: United States Patent 10,067,229

2. Ultrasonic device and operation method therefor: United States Published Application US2018185011
3. Piezoelectric transducer device for configuring a sequence of operational modes: United States Patent 10,022,751
4. Redistribution layer in an ultrasound diagnostic imaging transducer: United States Patent 9,274,088
5. Switch for aperture control in medical diagnostic ultrasound imaging: United States Patent 8,795,182
6. Volume mechanical transducer for medical diagnostic ultrasound: United States Patent 8,647,279
7. Aperture synthesis using cMUTs: United States Patent 8,641,628
8. Multi-dimensional CMUT array with integrated beam formation: United States Patent 8,465,431
9. Piezoelectric and CMUT layered ultrasound transducer array: United States Patent 8,277,380
10. Ultrasound imaging transducer array for synthetic aperture: United States Patent 7,963,919
11. Apparatus for two-dimensional transducers used in three-dimensional ultrasonic imaging: United States Patent 7,824,338
12. Method and apparatus for improving the performance of capacitive acoustic transducers using bias polarity control and multiple firings: United States Patent 7,780,597
13. Apparatus for two-dimensional transducer used in three-dimensional ultrasonic imaging: United States Patents 7,719,166 & 7,679,263
14. Electric circuit for tuning a capacitive electrostatic transducer: United States Patent 7,670,290
15. Microfabricated ultrasonic transducer array for 3-D imaging and method of operating the same: United States Patent 7,618,373
16. Apparatus for two-dimensional transducers used in three-dimensional ultrasonic imaging: United States Patent 7,508,113
17. Microfabricated ultrasonic transducers with bias polarity beam profile control and method of operating the same: United States Patent 7,087,023
18. System and method for statistical design of ultrasound probe and imaging system: United States Patent 7,006,955
19. Method and system for conducting medical imaging transactions: United States Patent 6,931,270
20. Ultrasound imaging system having post-beamformer signal processing using deconvolution algorithm: United States Patent 6,245,016
21. Ultrasound imaging system with dynamic window function generator: United States Patent 5,817,023
22. Focused ultrasound surgery system guided by ultrasound imaging: United States Patent 5,769,790
23. Method for adaptively filtering doppler signals using a complex time domain filter: United States Patent 5,445,156

24. Color flow imaging system utilizing a time domain adaptive wall filter: United States Patent 5,349,524
25. Ultrasound imaging system with dynamic window function: United States Patent 5,345,939

## ACADEMIC PUBLICATIONS

### *Invited Papers*

1. Daft, C.M.W., "Conformable transducers for large-volume, operator-independent imaging," Ultrasonics Symposium, 2010 IEEE, pp.798-808, 11-14 Oct. 2010
2. Daft, C.; Wagner, P.; Bymaster, B.; Panda, S.; Patel, K.; Ladabaum, I., "cMUTs and electronics for 2D and 3D imaging: monolithic integration, in-handle chip sets and system implications," Ultrasonics Symposium, 2005 IEEE, vol.1, pp.463-474, 18-21 Sept. 2005
3. Daft, C.M.W., "Neural networks for image analysis," Ultrasonics Symposium, 1990. Proceedings., IEEE 1990, pp.1425-1433 vol.3, 4-7 Dec 1990

### *Other Papers*

4. Reznik, S.; Sanguinetti, J.; Tyler, W.; Daft, C.; Allen, J., "A Double-Blind Pilot Study of Transcranial Ultrasound (TUS) as a Five-Day Intervention: TUS Mitigates Worry among Depressed Participants," *Neurology, Psychiatry and Brain Research* 37C, 60-66 (2020)
5. Sanguinetti, J.; Hameroff, S.; Smith, E.; Sato, T.; Daft, C.; Tyler, W.; Allen, J., "Transcranial Focused Ultrasound to the Right Prefrontal Cortex Improves Mood and Alters Functional Connectivity in Humans," *Frontiers in Human Neuroscience*, vol. 14, 52 (2020)
6. Nistorica, C.; Latev, D.; Gardner, D.; Imai, D. and Daft, C., "Characterization of a 3D-MEMS piezoelectric transducer for portable imaging systems," 2015 IEEE International Ultrasonics Symposium (IUS), Taipei, 2015, pp. 1-4
7. Daft, C.; Brueske, D.; Wagner, P.; Liu, D., "A Matrix Transducer Design with Improved Image Quality and Acquisition Rate," Ultrasonics Symposium, 2007 IEEE, pp.411-415, 28-31 Oct. 2007
8. Daft, C.; Panda, S.; Wagner, P.; Ladabaum, I., "Two Approaches to Electronically Scanned 3D Imaging Using cMUTs," Ultrasonics Symposium, 2006. IEEE, pp.685-688, 2-6 Oct. 2006
9. Liu, D.; Brueske, D.; Willis, T.; Daft, C., "Sigma-delta dynamic receive beamforming," Ultrasonics Symposium, 2008. IUS 2008. IEEE, pp.1270-1273, 2-5 Nov. 2008
10. Daft, C.; Wagner, P.; Bymaster, B.; Panda, S.; Patel, K.; Ladabaum, I., "cMUTs and electronics for 2D and 3D imaging: monolithic integration, in-handle chip sets

- and system implications," Ultrasonics Symposium, 2005 IEEE, vol.1, no., pp.463-474, 18-21 Sept. 2005
11. Daft, C.; Calmes, S.; da Graca, D.; Patel, K.; Wagner, P.; Ladabaum, I., "Microfabricated ultrasonic transducers monolithically integrated with high voltage electronics," Ultrasonics Symposium, 2004 IEEE, vol.1, no., pp.493-496 Vol.1, 23-27 Aug. 2004
  12. Daft, C.; Wagner, P.; Panda, S.; Ladabaum, I., "Elevation beam profile control with bias polarity patterns applied to microfabricated ultrasound transducers," Ultrasonics, 2003 IEEE Symposium on, vol.2, no., pp.1578-1581 Vol.2, 5-8 Oct. 2003
  13. Daft, C.M.W.; Leue, W.M.; Thomenius, K.E.; Macdonald, M.C.; Odegaard, L.A., "Comprehensive imager simulation for improved acoustic power control," Ultrasonics Symposium, 1999. Proceedings. 1999 IEEE, vol.2, no., pp.1571-1575 vol.2, 1999
  14. Wildes, D.G.; Chiao, R.Y.; Daft, C.M.W.; Rigby, K.W.; Smith, L.S.; Thomenius, K.E., "Elevation performance of 1.25D and 1.5D transducer arrays," Ultrasonics, Ferroelectrics, and Frequency Control, IEEE Transactions on, vol.44, no.5, pp.1027-1037, Sept. 1997
  15. Daft, C.M.W.; Engeler, W.E., "Windowing of wide-band ultrasound transducers," Ultrasonics Symposium, 1996. Proceedings., 1996 IEEE, vol.2, no., pp.1541-1544 vol.2, 3-6 Nov 1996
  16. Daft, C.M.W.; Wildes, D.G.; Thomas, L.J.; Smith, L.S.; Lewandowski, R.S.; Leue, W.M.; Rigby, K.W.; Chalek, C.L.; Hatfield, W.T., "A 1.5D transducer for medical ultrasound," Ultrasonics Symposium, 1994. Proceedings., 1994 IEEE, vol.3, no., pp.1491-1495 vol.3, Oct. 31 1994-Nov. 3 1994
  17. Daft, C.M.W.; Siddiqi, T.A.; Fitting, D.W.; Meyer, R.A.; O'Brien, W.D., Jr., "In-vivo fetal ultrasound exposimetry," Ultrasonics, Ferroelectrics, and Frequency Control, IEEE Transactions on, vol.37, no.6, pp.501-505, Nov. 1990
  18. Daft, C.M.W.; Smith, L.S.; O'Donnell, M., "Beam profiles and images from two-dimensional arrays," Ultrasonics Symposium, 1990. Proceedings., IEEE 1990, pp.775-779 vol.2, 4-7 Dec 1990
  19. Conrath, B.C.; Daft, C.M.W.; O'Brien, W.D., Jr., "Applications of neural networks to ultrasound tomography," Ultrasonics Symposium, 1989. Proceedings., IEEE 1989, pp.1007-1010 vol.2, 3-6 Oct 1989
  20. Daft, C.M.W.; Siddiqi, T.A.; Fitting, D.W.; Meyer, R.A.; O'Brien, W.D., Jr., "In-vivo fetal ultrasound exposimetry," Ultrasonics Symposium, 1989. Proceedings., IEEE 1989, pp.1053-1056 vol.2, 3-6 Oct 1989
  21. Weaver, J.M.R.; Daft, C.M.W.; Briggs, G.A.D., "A quantitative acoustic microscope with multiple detection modes," Ultrasonics, Ferroelectrics, and Frequency Control, IEEE Transactions on, vol.36, no.5, pp.554-560, Sept. 1989
  22. Daft, C.M.W.; Briggs, G.A.D., "Wideband acoustic microscopy of tissue," Ultrasonics, Ferroelectrics, and Frequency Control, IEEE Transactions on, vol.36, no.2, pp.258-263, March 1989

23. Daft, C. M. W.; Briggs, G. A. D., "The elastic microstructure of various tissues," The Journal of the Acoustical Society of America, 85, 416-422 (1989)
24. Daft, C. M. W.; Briggs, G. A. D.; O'Brien, W. D., Jr. "Frequency dependence of tissue attenuation measured by acoustic microscopy" The Journal of the Acoustical Society of America, 85, 2194-2201 (1989)
25. Daft, C.M.W.; Briggs, G.A.D.; O'Brien, W.D., Jr., "Frequency dependence of tissue attenuation measured by acoustic microscopy," Ultrasonics Symposium, 1988 Proceedings., IEEE 1988, pp.971-974 vol.2, 2-5 Oct 1988
26. Daft, Christopher M. W.; Briggs, G. A. D., "Wideband acoustic microscopy of tissue," The Journal of the Acoustical Society of America, 83, S110-S110 (1988)
27. Bamber, J.C.; Daft, C., "Adaptive filtering for reduction of speckle in ultrasonic pulse-echo images," Ultrasonics 24(1), 41-44 (1986)

## PROFESSIONAL MEMBERSHIPS

- *IEEE Consultants Network of Silicon Valley*: member from 2012 to Present.
- *IEEE Senior Member*: September 1987 to Present. The Institute of Electrical and Electronic Engineers is the world's largest professional association dedicated to advancing technological innovation and excellence for the benefit of humanity.
- *Associate Member, American Bar Association*, July 2016 to Present. Member of Intellectual Property Law section.

## EMPLOYMENT EXPERIENCE

### **RIVER SONIC SOLUTIONS, LLC (2012 – present)**

*Principal*

Technical Consulting and Expert witness practice in: Imaging, especially Medical Imaging; Patents; Ultrasound; Electronics; Transducers; Application Specific Integrated Circuits (ASIC); Micro-electro-mechanical systems (MEMS); FDA approval of medical devices; Signal Processing; Design for Six-Sigma (DFSS); Semiconductors/ICs; Biometric security; Surgical Tissue Ablation; Tomography; Parallel Computing; Minimally Invasive Surgical Guidance; Wearables and Hearables.

### **CEPHASONICS, INC. (previously Samplify)**

*Chief Scientist, Santa Clara, CA: 2011-2013*

- Responsible for technical direction of a start-up seeking to commoditize front-end and beam formation electronics.
- Advised CEO on all technical matters; also deeply involved in angel and VC fundraising.

- Extensive customer interaction: marketed products to imaging and non-traditional customers.

## **SIEMENS HEALTHCARE, ULTRASOUND DIVISION**

*Senior Manager, Engineering, Mountain View, CA: 2005-2011*

- Delivered 3 ASICs on tight schedule to support new Silicon Ultrasound product line.
- Managed team of eight engineers to design, test and manufacture all electronics needed for introduction of Silicon Ultrasound transducers.
- Technology evangelist presenting weekly to customers at Siemens' Innovation Center.

## **SENSANT CORPORATION**

*Manager, Research and Development, San Leandro, CA: 2003-2005*

- Managed group which created electronics for first 2D and 3D images using silicon ultrasound transducer.
- Co-authored successful grant proposal to DARPA on battlefield ultrasound imaging and surgery. \$7.5 M was awarded to Sensant and its collaborator.

*Senior Staff Engineer, San Leandro, CA: 2000-2003*

- Design of new types of imaging systems using capacitive micro-fabricated ultrasound transducers (cMUTs, also known as Silicon Ultrasound.)
- Co-authored several successful SBIR grant proposals.

## **GENERAL ELECTRIC COMPANY**

*Physicist, Corporate R&D, Niskayuna, NY: 1990-2000*

- Designed algorithms for IC implementation; resulting beamforming IC was the heart of GE's successful entry into the premium ultrasound market.
- Developed statistical methods (now patented) for robust simultaneous design of transducer and imaging system to six-sigma quality standards.
- Much transducer design, acoustic field simulation and measurement.
- Research in signal processing for improved image quality and blood flow estimation. Several of these signal processing innovations are used in current GE products.

## **UNIVERSITY OF ILLINOIS AT URBANA-CHAMPAIGN**

*Assistant Professor of Electrical and Computer Engineering, Urbana, IL: 1987-1990*

- Research in scanning laser acoustic microscopy to characterize tissue, and applications of neural networks to ultrasonic imaging.
- Taught undergraduate courses in circuit theory, medical imaging and acoustics.
- Thesis Advisor for Masters' students and undergraduate senior projects.

## TESTIMONY EXPERIENCE

- Hologic v. Fujifilm, *Certain X-ray Breast Imaging Devices and Components Thereof*, ITC Investigation No. 337-TA-1063. Deposition: Feb. 8, 2018; trial testimony: Apr. 11, 2018.
- Fujifilm v. Hologic, Patent Trial and Appeal Board, Case IPR2018-00595, patent number 7,688,940. Deposition: Nov. 27, 2018.
- Superior Court of California, County of Santa Clara, Case 17CV311668, Lobo v. Intel Mobile. Deposition: Sep. 19, 2019; trial testimony Feb. 26-27, 2020.
- Philips v. Garmin, Fitbit and others, *Certain Wearable Monitoring Devices, Systems and Components Thereof*, ITC Investigation No. 337-TA-1190. Deposition: Aug. 14, 2020; trial testimony: Oct. 23, 2020.