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# Michael Kobold, P.E.

## Education

June 2011 Naval Postgraduate School (Anti-Sub. Warfare Cert) The Presidio  
M. S., Electrical Engineering, Air Force Institute of Technology, WPAFB, Ohio  
Thesis: *Laser Covariance Vibrometry for Unsymmetrical Mode Detection*, September 2006  
M. S., Physics The University of Michigan, Ann Arbor, Michigan May 1994  
B. S., Physics and Math University of Texas, Arlington, Magna Cum Laude December 1984

## Licensure Clearance

**Professional Engineer (Mechanical Engineering). License Number 6201043854 (Michigan)**  
**Currently Secret.** Top Secret information & granted access to sensitive compartmented information based on single scope background investigation completed 14Jan05. Debriefed to Secret 30Mar09.

## Patents

**US # 9197822** "Array Augmented Parallax Image Enhancement System & Method" 24Nov15  
**US # 9208386** "Crowd State Characterization System and Method" 8 December 2015

## Skills and Expertise

Underwater Acoustic communication, Structural vibration. Automated Target Recognition Sensors: EO/IR/LADAR/RADAR, Laser Vibrometry and optics, vehicle intent, adaptive optics thermal blooming, image parallel processing through turbulence, hydrodynamic protuberance analysis, and expression of proteins. Acoustic modems and adaptive acoustic comms; parallel processing of ATR and simulation; P&L management, earned value S/W; system Integration, structural analysis, impact, sonic fatigue, dynamics, acoustics; **Matlab**, LaTeX, MathCad, Mathematica, NASTRAN, Patran, I-DEAS, ABAQUS, DYNA –commercially used codes only. [Interest in & some work with: xMidas, OPNET, LabView, vxWorks, FPGA's, Basic Local Alignment Search Tool (proteins) LEEDR, ANCHOR & HELEEOS]

## Work Experience



The UW work resides in these yellow "fish."

Aug. 2009 – present US Navy civil service optics scientist & structural vibration engineer  
**NSWC PCD Code X-12** Panama City, Florida  
Laser vibrometry and other sensors picking up seismic responses. Automated target recognition (ATR). Underwater (UW) acoustic communications (comms) to estimate range and throughput through naturally inhomogeneous sound speed profile (SSPs statistics using tech from atmosphere-based optical comms that is part of MODTRAN, LEEDR or HELEEOS for UW acoustic communication. Produced structure functions and acoustic coherence widths for acoustical comms forecasting and other results, showed the relationship of the latter to coherence break-up range. Discovered that *random* SSPs over-estimate range compared to natural (tidal) variations. Remote sensing and ATR using polarimeters, UV, IR and EO as well as parallel target recognition using the FX imaging ATR algorithm with success identifying aged buried objects. Synthetic aperture sonar beamforming and ATR. Signal processing applications included shader functions related to persistent surveillance and plenoptic depth of field issues. Patent for crowd characterization with privacy preserving algorithms using Sakur-Tetrode entropy. Patent for image processing enhancements for detritus corrupted viewing. Technology evaluation. Technical reports include atmospheric imaging at low height for shallow depression angle laser vibrometry of the ground, simulation of soil vibration above buried objects, and seismic spectral-based attenuation calculations based on geophysics methods – the use of the log of ratios of PSD's with respect to wavespeed and range differences. Signal-processing issues related to laser line scan and other methods to image further into seawater and systems engineering on a particular instance of Bluefin-type sensor systems. Defense Threat Reduction Agency (DTRA) passive and semi-active sensing in 2013. A-comms work used spectral efficiency (compares systems via baseband normalization) to identify potential protocol improvement. Showed target spectral elimination in laser vibrometry is not an ID problem for vibration of manufactured (realistic) vehicles. Produced tool for hydrodynamics of simulated biological coatings. Provided Raman frequencies and mode shapes for impurities of sintered/HIP'd powered sensor windows, and electron affinities of primary element.  
April 2009 – July 2009 UCF CREOL OSE 6525 & sabbatical: Optical & Quantum Coherence  
**Univ. of Central Florida, Center for Research in Electro-Optics and Lasers** Orlando, FL  
June 2008 – Mar 2009 BAE Systems - Technology Solutions & Services (AFTAC)  
**Remote Sensing Research, Modelling & Simulation, Data Analysis** PAFB, FL  
DSP engineer for multidisciplinary signal processing at PAFB/AFTAC; Liaison for South American installations; Generated two BAE technical papers for crowd statistical mechanics / remote sensing and optical communication research.

## Michael C. Kobold

One patent uses enthalpy-entropy states.



High-Gain Antenna Gimbal verification on the Mars Explorer Rovers Spirit & Op.



Structural and radar work on Joint STARS antenna integration into the E-8C.

2001 – June 2008 General Dynamics – Advanced Info. Systems (USAF/NASIC, AFRL/SN)

### Remote Sensing Research, Modelling & Simulation, CID systems

WPAFB, Ohio

RF signal processing (ambiguity), radar, EO, IR, & laser return phenomenology; GPS transmission  $4\pi$  sr radiation patterns (using data from Thomas.D.Powell@aero.org); AFOSR remotely sensed vehicle dynamics; DARPA IXO SASO SPEYES acoustics, vibration signatures & crowd behavior using statistical mechanics (figure at left) prior to Navy work on entropy that led to patent. 9208386; Cooperative ID integration; Vehicle Intent analysis using remote sensing & structural dynamics; Radiometry for anti-aircraft missile plume threat warning analysis using *Matlab*; Multi-spectral, optical flow, & spectrum assessments, IR calibration; Image processing algorithms, SIMD parallel processing, Requirements Eng. Algorithms: Workflow, wireless communications simulation (Matlab based on OPNET), Warfare Modeling & Simulation software development, ATR; MASINT Sys. Engineering – Space-Based Infrared System, NASIC (subcontracted to Ball Aerospace and Technologies Corp.); Acoustic and Laser cross-spectral covariance for target ID and acoustic time lags. Research involves alternative hardware and algorithms.

2000 - 2001

Ball Aerospace & Technologies Corp.

### Senior Structural Engineer

Boulder, Colorado

NASA satellite imaging programs, NPOESS and JPL's Mars Explorer Rover (MER photo is the watermark of this résumé). SDRC I-DEAS simulation, including random vibration, MSC/NASTRAN and Matlab, Satellite instruments space physics and optics. Both Spirit and Opportunity HGAG worked well. Program Manager was Satish.A.Krishnan @ gmail.com, a manager at Raytheon. Satish worked for JVacchio @ jpl.nasa.gov (Joe). NPOESS SESS magnetometer and Langmuir probe Space Physics, system analysis; National Polar-orbiting Operational Environmental Satellite System (NPOESS) Cross-tracking infrared sounder (CrIS) Vibration, MER High Gain Antenna (watermark) and Gimbal shock. This photo of the MER is the watermark used for this resume.

1997 - 2000

Northrop Grumman Corporation (Joint STARS)

### Senior Structural Engineer

Melbourne, Florida

USAF Joint STARS. Stress, Sonic Fatigue analysis (NASTRAN, PATRAN, "C", UNIX shell post-processors for NASTRAN, MathCad, Matlab). SGI IRIX, Shell scripts for Finite Element Analysis Systems integration; aerodynamic effects including sonic fatigue, vibration, noise; Stress, design changes, BOLD, FEA, corrosion, damage tolerance, crack propagation; Familiar with FAA procedures, military specs, Boeing stress reports, SEI4, Configuration Management (CM) system maintenance; Radar Systems software, problem tracking, metrics; BCWP, ACWP, effects on earned value, CM – build process issues; Joint STARS class library definition and build process documentation (CM); Conformal load-bearing RF, radiation patterns, selection, and location of slot antenna.

1985 – 1997

General Motors Corporation (GM Truck)

### Senior Structural Analyst

Pontiac, Michigan

Stress, Vibration and Noise Lead Structural Analyst for NASTRAN FEA for Delphi on GM Corporate structural analysis and acoustics committees, I-DEAS, PATRAN, "C", UNIX, MSC/NASTRAN, HKS/ABAQUS, LST/DYNA, Comet/Acoustics, calculations per Roark. Simulation, structural analysis, hiring, supervision, mostly nonlinear analysis, acoustics analysis test (B&K) and boundary element analysis for acoustics, hand calculations, optimization, design sensitivity, mfg. design direction, Crash-worthiness, occupant simulation, side-impact air bag deployment door, CAE integration. Structural modification of body-in-white for mobility targets (noise and vibration); Suspension component FE modeling and analysis, UNIX, "C", NASTRAN. **FROM 1986 TO 1990: Engineering Systems Engineer, Electronic Data Systems (division of GM), Engineering Analysis Support.** Program Management, \$5M P&L, computer (NASTRAN, FEM, storage). Doubled goals by mid-year; services for GM design groups on a contractual basis; I-DEAS; MSC/NASTRAN Structural analysis support: FEA, FEM, and consulting; Automated Electrical Engineering Systems, welding transformer, kick-less cable selection; Image processing coding for Automated Intelligence P5000 inspection system.

1990 – 1991 (between GM assignments)

Computer Sciences Corp., Falls Church, VA

### Structural Analyst/Supercomputer Consultant

Warren, Michigan

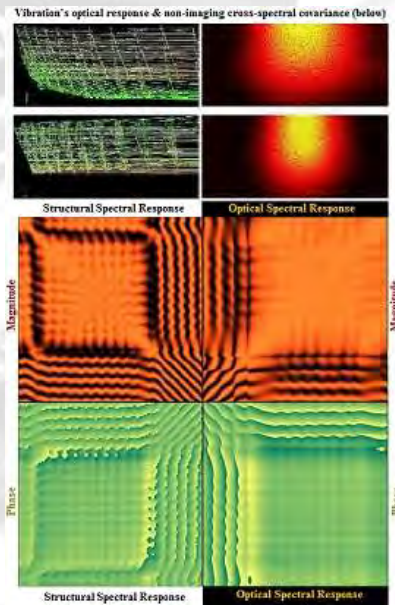
Technology Assessment for Army engineering applications at the US Army Tank Automotive Research, Development and Engineering Center (TARDEC), Warren Michigan, using Cray2 and Connection Machine technology (UNIX, "C", FORTRAN90, PATRAN ABAQUS, internal Army code for metal fatigue, DADS multi-body, UNICOS, calculations per Roark); UNIX/FEA services: M1A2, Track and Chassis Group, ABAQUS stress and dynamics; Thermal ( $\text{CO}_2$  laser) photo-acoustic imaging theory and simulation.

**Member, Navy League. Engineering and scientific associations via employer.**

Affiliations



## Technical Publications



Tank armor nonlinear clattering sensed by laser imaging. Time evolution of modes analyzed for covariance of the spectra, structural vs. optical.

- M.C. Kobold, "Vibration and Noise Response of Panels with Coatings and Laminates," Technical Report TR-2020-003, Naval Surface Warfare Center Panama City Division, 2020.
- M.C. Kobold, "Remote vibrometry recognition of nonlinear eigen-states, for object coverage of randomly large size," remote vibration sensing, Journal of Vibroengineering, 2020, <https://jvejournal.com/article/29591> (delphi .web .runbox .net) Remove spaces to activate.
- M.C. Kobold, "Observations of nonlinear eigenstates, localized v. non-imaging modal response of contact structures," remote vibration sensing, Cornell U Lib, [arxiv.org/abs/1711.04217](https://arxiv.org/abs/1711.04217), 2018
- M. Kobold, "Numerical Rationale to Choose Throughput over BER," Naval Surface Warfare Center, Panama City Division, Panama City, FL, Unclassified, Internal report 2017. (This extends the rate-distortion theory.)
- Michael C. Kobold, "Parallel Target Recognition performance metrics using FX," Naval Surface Warfare Center Panama City Division, TR16-001, Technical Library, Code 1033, NSWC PCD Code X-12, 110 Vernon Ave, BL 110, Panama City, FL, USA 32407-7001, September 2017. This 94 page 47 figure report may be available through DTIC in 2019.
- Michael C. Kobold and Keith M. Aliberti, "Littoral Acoustic Modem Protocol Statistics," Naval Surface Warfare Center Panama City Division, TR16-006, Technical Library, Code 1033, NSWC PCD Code X-12, 110 Vernon Ave, BL 110, Panama City, FL, USA 32407-7001, September 2017. This 221 page 71 figure report might be available through DTIC in 2019.
- M. C. Kobold, "Modal insensitivity limits for laser vibrometry, spectral reduction requires supersymmetry," physics-optics, Cornell University Library, [arXiv .org/pdf/1408.2267.pdf](https://arxiv.org/pdf/1408.2267.pdf), Aug 2014
- M. C. Kobold, and H R Suiter, "Seismic attenuation estimate using linearity in frequency of spectral ratios at different ranges," NSWC PCD Tech. Note TR-13/016, Sep 2013. ADB406167
- M. C. Kobold, "Optics detection, classification, and identification of soil surface vibration above buried objects" NSWC PCD Technical Note TR-13/013, 2013-09-01 DTIC: ADB399579
- M. C. Kobold, "Scintillation response sensitivities; effects of turbulence on laser sensing of soil surface vibration," NSWC PCD Technical Report, TR13/012, September 2013.
- M. C. Kobold, "Shear deflection estimate of Soil vibration above a buried object," NSWC PCD Technical Note TN-13-004, September 2013.
- M. C. Kobold, "Large spot size laser vibrometry insensitivity occurs in 1-D vibrations only," SPIE Defense and Security Symposium Paper 6968-58 Orlando 19 Mar 2008
- M. C. Kobold, "Laser Covariance Vibrometry for Unsymmetrical Mode Detection," Air Force Institute of Technology, WPAFB, Ohio, M. S., Electrical Engineering, Sep 2006 (Remove spaces to activate.) [www.dtic.mil/dtic/tr/fulltext/u2/a456716.pdf](http://www.dtic.mil/dtic/tr/fulltext/u2/a456716.pdf) [www.dtic.mil/docs/citations/ADA456716](http://www.dtic.mil/docs/citations/ADA456716)
- Atindra K. Mitra, M. C. Kobold, Tom Lewis, & Rob Williams, "Theoretical radar-Doppler models for pivoting mechanical and biological objects-of-interest," SPIE Proc., Vol. 6237, 17 May 2006
- M. C. Kobold, "videst.m based on NATO data in the 2003 Swedish dissertation the Andreas Olsson," AFRL SNAT report, WPAFB, OH, 2005. (Unclassified Matlab ROC code used to propose laser vibrometry to DARPA, videst.m shows that simple application of high error modes (fundamental) provide highest  $P_d$  and lowest  $P_{fa}$ .)
- M. C. Kobold, "Laser and Acoustic Exploitation Concept for Unconventional Target Covariance," Internal Conference, WPAFB, OH, 2005.
- M. C. Kobold, "Image and Acoustic Crowd Characterization," AFRL STAR Conference, WPAFB, OH, 2005.
- M. C. Kobold, "Ocean Wave Earth Diffraction Antenna, post processing in 'n' time," IMAC XIX, Orlando, FL, April 2001.
- M. C. Kobold, "Stability, Stabilizability, and Stabilization, using state variable linear systems approach to 'move' a structural design to desired vibration response," IMAC XIX, Orlando, Apr '01.
- M. C. Kobold, "Ocean Wave Earth Diffraction Antenna, post processing in 'n' time," SPIE AEROSENSE, July 2000.
- M. C. Kobold, "Stability, Stabilizability, and Stabilization, using state variable linear systems approach to 'move' a structural design to desired vibration response," AEROSENSE, July 2000.
- M. C. Kobold, "Linear Correction of Buckled Panels using Optimization," MSC User's Conference, CA, 1998.
- Named participant: K. W. Chen (director), "Investigation of Acceleration and Densification of Electrons Utilizing Travelling Magnetic Waves," AFOSR-83-0368, AD-A197 700, AFOSR-TR-88-0706, 18 August 1988. Ref. page 5 of [www.dtic.mil/dtic/tr/fulltext/u2/a197700.pdf](http://www.dtic.mil/dtic/tr/fulltext/u2/a197700.pdf).

## Personal

US Navy Vet. Fluent in Spanish and French, some Thai and American Sign Language. Desire to learn more. Social Salsa dancer. Open Water Diver certified (scuba), Wright-Patterson AFB Air Club ground school June – Aug 07. (delphi .web .runbox .net) Remove spaces to activate.