1. Life Members and **Aerospace and Electronic Systems Society** – 4:00PM, Wednesday, 23 March
   **Breakthroughs in Phased-Arrays and Radars – An Update.** Dr. Eli Brookner. Raytheon Co. (retired)

2. Education Society and co-sponsoring Women In Engineering and **Aerospace and Electronic Systems Society**
   - 6:00PM, Thursday, 20 October - **Singing Whales, Deep-Rumbling Elephants** - Doctor Katy Payne is affiliated with the Cornell Lab of Ornithology’s Bioacoustics Research Program, founder of the lab’s Elephant Listening Project, and author of *Silent Thunder: in the Presence of Elephants*.


4. Photonics Society and co-sponsoring **Aerospace and Electronic Systems Society** – 6:00PM, Thursday, 8 December, **Building the First Microprocessor that Communicates using Light** - Prof. Miloš A. Popović - Department of Electrical and Computer Engineering, Boston University

5. Reliability Society – 5:30PM, Wednesday, 14 December
   **Microwave and Millimeter Wave Power Amplifiers: Technology, Applications, Benchmarks, and Future Trends** - James J. Komiak, Ph.D. of BAE Systems, IEEE Distinguished Lecturer*

*AESS was not an official cosponsor. They indicated they do not get full credit if they cosponsor it. Only get credit for half a meeting. We did publicize it with our AESS membership email list. I attended as did some of our AESS members.*
BOSTON IEEE AESS
SPONSORED COURSES
AND TUTORIALS FOR 2016
LOCALLY GIVEN TEN SESSION EVENING COURSES BOSTON AESS CO-SPONSORED WITH BOSTON IEEE*

1. RADAR BASICS AND AMAZING RECENT ADVANCES, OCT. 26, 2015 TO JAN. 11, 2016. TEN 3 HR SESSION ON MONDAY NIGHTS

2. PHASED - ARRAY AND ADAPTIVE-ARRAY FUNDAMENTALS AND THEIR RECENT ADVANCES, FEB. 27, 2016 TO MAY 15, 2016. TEN 3 HR SESSION ON MONDAY NIGHTS

3. RADAR BASICS AND AMAZING RECENT ADVANCES, OCT. 24, 2016 TO JAN. 9, 2017. TEN 3 HR SESSION ON MONDAY NIGHTS

*ALL THE PROFITS GO TO SUPPORTING THE BOSTON IEEE SECTION OFFICE. FLIERS FOR THESE 3 COURSES PROVIDED. DR. ELI BROOKNER LECTURER.
TUTORIALS BOSTON AESS SPONSORED

1. BASICS AND ADVANCES OF PHASED-ARRAYS AND MIMO RADARS, MICROWAVE JOURNAL EDI CON 2006, BEIJING, CHINA, APRIL 21, 2016, 3 HRS.

2. BASICS AND ADVANCES OF PHASED-ARRAYS AND MIMO RADARS, MICROWAVE JOURNAL EDI CON 2006, BOSTON, SEPT. 22, 2016, 3 HRS.

3. PHASED-ARRAYS, RADARS, MIMO AND METAMATERIALS: BASICS, PAST ACCOMPLISHMENTS, AMAZING BREAKTHROUGHS AND FUTURE TRENDS, CIE RADAR 2016, GUANGZHOU, CHINA, OCT. 10, 2016. 4 HRS.

4. PHASED-ARRAYS, RADARS, MIMO AN METAMATERIALS: BASICS, PAST ACCOMPLISHMENTS, AMAZING BREAKTHROUGHS AND FUTURE TRENDS, IEEE INTERNATIONAL ARRAY-2016 SYMP., BOSTON, OCT. 21, 2016. 4 HRS.

NOTE: DR. ELI BROOKNER LECTURER.
1. PHASED - ARRAY AND ADAPTIVE-ARRAY FUNDAMENTALS AND THEIR RECENT ADVANCES, BEIJING INSTITUTE OF TECHNOLOGY, BEIJING, CHINA, APRIL 11-14, 201 DR. ELI BROOKNER LECTURER.
The following book plus over ten paper reprints are provided FREE with your registration:
1. “Aspects of Modern Radar”, Dr. Eli Brookner (Editor), Artech House, Hardcover, 432 pages, 1988, List price: $159. The 1st chapter gives the best easy to read introduction to radar. It covers all aspects of radar: transmitters, receiver, antennas, signal processing, tracking, clutter derivation of radar equation in easy terms and definition of dB. The 2nd chapter gives detailed descriptions of different radar systems like: Cobra Dane, Pave Paws, BMESWS, Series 320 3D radar, OTH radars and dome antenna. The book has a catalog giving the detailed parameters for over 200 radars from around the world. The remaining chapters cover AEGIS SPY-1, Hybrid and MMIC circuits, ultra low sidelobe antennas (ULSA), mmw, radar cross section and Doppler weather radars. The material in the book is easy to access and as a result the text serves as a handy reference book.

This course is an updated version of the Radar Technology course given previously. Those who have taken the Radar Technology previously should find it worthwhile taking this revised version. New material includes determination of radar height-range coverage diagram using the powerful SPWAR’s AREPS program. AREPS provides coverage for arbitrary propagation conditions (ducts / evaporation, surface, or elevated), sub-refraction and superrefraction) and terrain conditions based on DTED data. AREPS now accounts for surface roughness scattering and evaluates sea and land clutter backscatter versus range. Attendees will be told how to obtain AREPS FREE. Valued at over $7,000. Also new is coverage of Anomalous Propagation and what to do about it; the latest on surface solid state devices and transmitters including GaN, SiC, SiGe; Breakthroughs in Radar — $10 T/R module, Digital Beam Forming (DBF), MIMO, Packaging, Disruptive Technology, Metamaterials, Memristors, Graphene, Tubes. Also covered are STAP, AMTI, DPCA, System Temperature.

For the beginner, basics such as the radar equation, MTI (Moving Target Indicator) and pulse doppler processing, antenna-scanning techniques, pulse compression, CFAR, RAC and SAW devices are explained in simple terms. Dome antenna, CCDs, BBDs, SAW pulse doppler processing, antenna-scanning techniques, pulse compression, CFAR, RAC reprints by Dr. Brookner. Updated course is framed around FREE book described above. Also given out free are supplementary notes consisting of copies of ~800 vugraphs plus over 15 paper reprints by Dr. Brookner.
Electron spin: For memory; Atomic Memory: 12 iron atoms for 1 bit of memory; could provide hard drive with 100X density; Revolutionary 3-D Micromachining: integrated circuitry for microwave components, like 16 element Ka-band array with Butler beamformer on 13X2 cm2 chip; Superconductivity: We may still achieve superconductivity at room temperature; Superconductivity recently obtained for first time with iron compounds; DARPA UHPC (Ubiquitous High Performance Computing) Program: Goal: Reduce signal processing power consumption by factor of 75; Biodegradable Array of Transistors or LEDs: Embedded for detecting cancer or low glucose; can then dispense chemotherapy or insulin. New Symmetry Breaking Theory: Could allow in future placing small low frequency antennas on a chip; Quantum Radar: See stealth targets; New polarizations: OAMs, (Orbital Angular Momentum) unlimited data rate over finite band using new polarizations??
Phased - Array and Adaptive-Array Fundamentals and their Recent Advances

This course is based on the book entitled Practical Phased Array Antenna Systems by Dr. Eli Brookner. The book covers array basics and fundamentals which do not change with time. The course, the book and the notes will provide an ideal introduction to the principles of phased array antenna design and adaptive arrays. The course material and notes cover in addition recent developments in phased arrays updated to 2016.

With the explicitly tutorial approach the course and book offers a concise, introductory-level survey of the fundamentals without dwelling on extensive mathematical derivations or abstruse theory. Instead a physical feel will be given. The book provides extensive curves, tables and illustrative examples.

Covered in easy terms will be sidelobe cancellation, full adaptive array processing without suffering its computation complexity (through the use of adaptive-adaptive array processing also called beam-space processing and eigenbeam processing). Finally, Space-Time Adaptive Array (STAP) for airborne platforms will be explained and related to the displaced phase center antenna (DPCA).

This course is intended for the engineer or scientist not familiar with phased-array antennas as well as the antenna specialist who wants to learn about other aspects of phased-array antenna systems. The major emphasis will be on the system aspects of phased-array systems.

Lecture #1. Monday March 14; Phased Array Fundamentals: Fundamental Principles of Electronically Scanned Array (ESA) explained with tube COBRA DANE used as example. Covered will be: Near and Far Field Definitions, Phased Steering, Switched-Line Phase Steering; Time Delay Steering, Subarraying, Array Weighting, Monopulse, Duplexing, Array Thinning, Embedded Element, dual polarized, loaded-line; ferrite phase-shifters: non-reciprocal, reciprocal latching; diode vs ferrite; MEMS (Micro-Electromechanical); microwave integrated circuits (MMIC). 09/30...

Lecture #2. Monday March 21; Linear Array Fundamentals: Conditions for no grating lobes; beamwidth vs scan angle; sine space; Array Factor; sidelobe level vs antenna beamwidth; directivity; antenna efficiency factors; array weightings; array frequency scanning; array bandwidth.

Lecture #3. Monday March 28; Planar Arrays: Array Factor; array separability; sine space (sina-sina space, T-space); grating lobes location for triangular and rectangular lattice; directivity; very useful bell curve approximation; array thinning system issues.

Lecture #4. Monday April 4; Array Errors: Effects of element phase and amplitude element errors and element failures; simple physical derivation of error effects; paired echo theory; subarray errors; quantization errors; examples.

Lecture #5. Monday April 25; Radiating Elements: Waveguide; dipole; slotted waveguide; microstrip patch; stacked patch; notch (wideband); spiral; matching (wide-angle); waveguide simulator; practical limitations, mutual coupling and array blindness; scattering matrix; design procedure, polarization mismatch loss.

Lecture #6. Monday May 9; Active Phased Arrays: 2nd generation solid state hybrid active electronically scanned array (AESAs) covered using PAVE PAWS as example, T/R Module Introduced, Cross Bent Dipole Element. Multiport blindness; notch (wideband); T/R Module of PAVE PAWS (6 stories) via color slides. 3rd Generation AESAs; THAAD, SPY-3, IRIDIUM, F-15 APO-61 V/2, APG-79, XBR, AMDR and upgraded Patriot GaAs and GaN microwave integrated circuits (Monolithic Microwave Integrated Circuit, MMIC). 06/07...

Lecture #7. Monday May 16; Array Feeds: Corporate and space fed; Reactive (lossless) and matched (Wilkinson); even/odd node analysis. Serial; Ladder; Lopez; Blass; Radial, Butler matrix; microstrip/stripline; Rotman Lens; SLG-32; PATRIOT space-fed array; reflectarray. System Considerations: sequential detection, beam shape loss; receiver and A/D dynamic range; polarization miss-match loss; array noise figure and system temperature taking into account array mismatch. Phase Shifters: Diode switched-line, hybrid-coupled, loaded-line; ferrite phase-shifters: non-reciprocal latching; diode vs ferrite; MEMS (Micro-Electro-Mechanical Systems) and its potential for a low cost ESA.

Lecture #8. Monday May 23; Limited Scan (Limited Field of View [LFOV]) Arrays: Ex-...
over Washington DC; 3, 4, 6 faced “Aegis” radar systems developed by China, Japan, Australia, Netherlands, USA. Low Cost, Low Power Extreme MMIC (Moore’s law at Mi-crowave and mm-waves); 4 T/R modules on single chip at X-band costing ~$10 per T/R module; Intel single chip 32-El-ement 60 GHz Tx/Rx Phased Array, full phased array on wafer at 110 GHz; on-chip self-test (BIST), will be used in the internet-of-things and in cell phones which by 2020 is expected to number 50 billion, expect such single chip arrays to cost only a few dollars in future; All the RF circuitry for mm-wave automobile radars at 25 GHz and 77 GHz are being put on a chip. Now some believing that such ar-ray and radars will soon be produced for just a few dollars; Valeo Raytheon (now Valeo Radar) developed low cost, $100s, 25 GHz 7 beam phased array radar; about 2 million sold already, more than all the radars ever built up to a very few years ago. Digital Beam Forming (DBF): Israel, Thales and Australia AESAs have under develop-ment array with an A/D for every element channel; Raytheon developing mixer-less direct RF A/D having >400 MHz instantaneous bandwidth, reconfigurable between S and X-band; Radio Astronomers looking at using arrays with DBF. Materials: GaN can now put 5X to 10X the power of GaAs in same footprint, 38% less costly, 100 million hr MTBF. Raytheon invested $150 million to develop GaN, SiGe for backend, GaN for front end of T/R module. MIMO (Multiple Input Multiple Output). Where it makes sense: contrary to what is claimed MIMO array radars do not provide 1, 2 or 3 orders of magnitude better resolution and accuracy than conventional array radars; MIMO does not provide better barrage-noise-jammer, repeater-jammer or hot-clutter rejection than conventional array radars; contrary to claims MIMO should not provide better minimum detectable velocity for airborne radars.

Sidelobe Cancellers (SLC): The single simple-loop, feed-forward canceller is introduced in easy terms. This is followed by a discussion of the simple single-loop feedback canceller with and without hard limiting. The normalized feedback SLC will also be covered. Presented will be their performance; transient response and cancellation ratio. Next the multiple-loop SLC (MSLC) will be covered. Applied to the MSLC will be the Gram-Schmidt, Givens and Householder orthonormal transformation methods. Systolic array implementations will be given.

Lecture #10. Monday June 13; Fully Adaptive Arrays: The optimum weight for a fully adaptive array is developed using a very simple derivation. Methods for calculating this optimum weight are given using the Sample Matrix Inversion (SMI) algorithm, the Applebaum-Howells adapt-ive feedback loop method, a recursive method, and Gram-Schmidt, Givens and Householder orthonormal transforma-tions developed for the tracking problem and for the MSLC. The use of eigenvector beams and a whitening filter will also be developed. It will be shown how the latter reduces the transient response. Methods for obtaining the benefits of a fully adapt-ive array without its high computation and large transient time disadvantages are given. These are the adaptive-adaptive array, systolic processing procedures, the use of eigen-beam space, and the method of finding the largest eigenvalues and in turn their eigenvectors. The STAP algorithm will be introduced.

Phased Array Amazing Advances and Breakthroughs -- Part 2: Metamaterials: Material custom made (not found in nature): using synaptic transistors and/or memristors, remember the brain only weighs about 2-3 kilograms. Thus we compensate for it to provide focused ISAR image. Technology and Algorithms: A dual polarized, low profile, (1/40), wideband (1/20) antenna can be built using tightly coupled dipole antennas (TCDA). Lincoln Lab increases spurious free dynamic range of receiver plus A/D by 40 dB; MEMS: reliability reaches 300 billion cycles without failure; Has potential to reduce the T/R module count in an array by a factor of 2 to 4; Can provide microwave filters 200 MHz wide tunable from 6-12 GHz; MEMS Piezoelectric Material = piezMEMS: Enables flying insect robots; Printed Electronics: Low cost 1.6 GHz (goal 2.4 GHz) diodes printed with Si and NbSi2 particles; Electrical and Optical Signals on Same Chip: IR beams could be used for transmitting on computer chips digital information at the speed of light; COSMOS: DARPA revolutionary MMIC program: Allows integration of III-V, CMOS and opto-electronics on one chip without bonded wires leading to higher performance, lower power, smaller size, components; Graphene and Carbon Nanotube (CNT); potential also for non volatile memory, flexible displays and camouflage clothing, self-cooling, IBM producing 200 mm wafers with RF devices; Superconductivity: We may still achieve superconductivity at high temperature; Superconductivity recently obtained for first time with iron compounds; Biodegradable Array of Transistors or LEDs: Imbedded for detecting cancer or low glucose, can then dispense chemotherapy or insulin. Can now grow functioning non-rejecting kidney and heart for rats.
The following book plus over ten paper reprints are provided FREE with your registration:

1. “Aspects of Modern Radar”, Dr. Eli Brookner (Editor), Artech House, Hardcover, 432 pages, 1988, List price: $159. The 1st chapter gives the best easy to read introduction to radar. It covers all aspects of radar: transmitters, receiver, antennas, signal processing, tracking, clutter derivation of radar equation in easy terms and definition of dB. The 2nd chapter gives detailed descriptions of different radar systems like: Cobra Dane, Pave Paws, EMEWS, Series 320 3D radar, OTH radars and dome antenna. The book has a catalog giving the detailed parameters for over 200 radars from around the world. The remaining chapters cover AEGIS SPY-1, Hybrid and MMIC circuits, ultra low sidelobe antennas (ULSA), mmw, radar cross section around the world. The material in the book is easy to access and as a result the text serves as a handy reference book.

This course is an updated version of the Radar Technology course given previously. Those who have taken the Radar Technology previously should find it worthwhile taking this revised version. New material includes latest on solid state devices and transmitters including GaN, SiC, SiGe; Breakthroughs in Radar — $10 T/R module, Digital Beam Forming (DBF), Packaging, Disruptive Technology, Metamaterials, radar on a chip, 32 element phased array on a chip, Memristors, Graphene. Also covered are radar height-range coverage diagram using the powerful SPAWAR’S AREPS program. AREPS provides coverage for arbitrary propagation conditions (ducts [evaporation, surface, or elevated], subrefraction and superrefraction) and terrain conditions based on DTED map data. AREPS now accounts for surface roughness scattering and evaluates sea and land clutter backscatter versus range. Attendees will be told how to obtain AREPS FREE. Valued at over $7,000. Also new is coverage of Anomalous Propagation and what to do about it. Finally also covered is the new Multiple-Input Multiple-Output (MIMO) explained in simple physical terms.

Updated course is framed around FREE book described above. Also given of free are supplementary notes consisting of copies of >800 vugraphs plus over 15 paper reprints by Dr. Brookner.

For the beginner, basics such as the radar equation, MTI (Moving Target Indicator), pulse doppler processing, antenna-scanning techniques, pulse compression, CFAR, RAC and SAW devices, dome antenna, CCDs, BBDs, SAW, SAW monolithic convolvers, microstrip antennas, ultra-low antenna sidelobes (<-40 dB), stacked beam and phased array systems, (1-D, 2-D, 3-D Limited Field of View [LFOV]), Moving Target Detection (MTD) are all explained in simple terms. For both the novice and experienced covered are tracking, prediction and smoothing in simple terms (mystery taken out of GH, GHK and Kalman filters); the latest developments and future trend in solid state, tube and digital processing technologies; synthetic aperture radar (SAR); Displaced Phase Center Antenna (DPCA); Space-Time Adaptive Processing (STAP) ; digital beam forming (DBF); Adaptive-Adaptive Array Processing for jammer suppression with orders of magnitude reduction in computation; RECENT AMAZING RADAR BREAKTHROUGHS.

### Lecture 1, Oct. 24

**Fundamentals of Radar: Part 1**


### Lecture 2, Oct. 31

**Fundamentals of Radar: Part 2**

- Coverage: Search vs Track, Range and Doppler Ambiguities, Detection in Clutter. Blind Velocity region, range eclipsing, Environmental Factors, Dependence of clutter model https://mail.google.com/mail/u/0/#inbox/15724914852016160
- n grazing angle and size radar resolution cell discussed,
- Weibull clutter: Polarization Choice, Detection of Low Flying Low Cross-Section Targets, Antenna Pattern Lobing in Elevation due to multopath, Ground Multipath Elevation Angle Error Problem and ways to cope with it, e.g., use of an even difference pattern Off-Axis Monopulse, Complex Monopulse Two Frequency Radar Systems: Marconi L- and S-band S631, Signaal/Thales (Holland),Flycatcher X and Ka System; Tube and Solid State. EMI/RFID Radars

### Lecture 3, Nov. 7

**Fundamentals of Radar: Part 3**


### Lecture 4, Nov. 14

**Fundamentals of Radar: Part 4**

- ULTRA LOW ANTENNA SIDELOBS (40 dB down or more).
- MOVING TARGET INDICATORS (MTI): Two-Pulse Canceller, Pulse Doppler Processing; MOVING TARGET DETECTOR (MTD); Optimum Clutter Canceller, STAP, AMTI, DPCA.

### Lecture 5, Nov. 21

**Signal Processing: Part 1**

- What is PULSE COMPRESSION? Matched Filters; Chip Waveform Defined; ANALOG PROCESSING: Surface Acoustic Wave (SAW) Devices: Reflective Array Compresor (RAC), Delay Lines, Bandpass Filters, Oscillators, Resonators; IMCON
Devices; Analog Programmable Monolithic SAW Convolver; BBD/CCD. What are they?

**Lecture 6, Nov. 28**

**SIGNAL PROCESSING: Part 2: DIGITAL PROCESSING**

Fast Fourier Transform (FFT); Butterfly, Pipeline, and In-Place Computation explain in simple terms; Maximum Entropy Method (MEM) Spectral Estimation; State-of-the-art of A/Ds, FPGAs and Memory; Signal Processor Architectures: Pipeline FFT, Distributed, Systolic; Digital Beam Forming (DBF). Future Trends.

**Lecture 7, Dec. 5**

**SYNTHETIC APERTURE RADAR (SAR):** Strip and Spotlight SAR explained in simple terms. TUBES: Basics given of Magnetron, Cross Field Amplifiers, Klystrons, Traveling Wave Tubes, Gyro Tubes. TREND TOWARD SOLID STATE PHASED-ARRAY

TRANSMITTERS: Discrete All Solid State PAVE PAWS and BMESW radars; advantages over tube radars; MMIC (Monolithic Microwave Integrated Circuitry; integrated circuitry applied to microwave components): THAAD, SPY-3, IRIDIUM, XBR, JLENS. Solid State Bottle Transmiters: ASR -11/DASR, ASR 23SS, ASDE-X. Extreme MMIC.

**Lecture 8, Dec. 12**

Breakthroughs and Trends in Phased-Arrays and Radars Systems: 3, 4, 6 face “Aegis” systems developed by China, Japan, Australia, Netherlands, USA; Patriot now has GaN AESA providing 3600 coverage without having to rotate; SIX-band AMDR provides 30 times the sensitivity and number of tracks as SPY-1D(V). Low Cost Packaging: Raytheon funding development of low cost flat panel X-band array using COTS type printed circuit boards (PCBs); Lincoln-Lab./MA-COM developing low cost S-band flat panel arrays using PCBs, overlapped subarrays and a T/R switch instead of a circulator; Extreme MMIC: 4 T/R modules on single chip at X-band costing ~$10 per T/R module; full phased array on wafer at 110 GHz; on-chip built-in-self-test (BIST); Digital Beam Forming (DBF): Israel, Thales and Australia AESAs have an A/D for every element channel; Raytheon developing mixer-less direct RF A/D having >400 MHz instantaneous bandwidth, reconfigurable between S and X-band; Lincoln Lab increases spurious free dynamic range of receiver plus A/D by 40 dB; Radio Astronomers looking at using arrays with DBF. Materials: GaN can now put 5X to 10X the power of GaAs in same footprint, 38% less costly, 100 million hr MTBF; SiGe for backend, GaN for front end of T/R module. Metamaterials: Material custom made not found in nature: electronically steered antenna at 20 and 30 GHz demonstrated (with goal of $1K per antenna) remains to prove low cost and reliability); 2-20GHz stealthening by absorption simulated using <1 mm coating; target made invisible over 50% band-layer 2D MoS2, could be a step towards transporting on computer chips digital particles; Electrical and Optical Signals on Same Chip: Electricity and light can be simultaneously transmitted over a silver nanowire combined with single layer 2D MoS2, could be a step towards transporting on computer chips digital information at the speed of light; COSMOS: DARPA revolutionary program: Allow integration of III-V, CMOS and opto-electronics on one chip without bonded wires leading to higher performance, lower power, smaller size, components; MIMO (Multiple Input Multiple Output): Where it makes sense; contrary to what is claimed MIMO array radars do not provide 1, 2 or 3 orders of magnitude better resolution and accuracy than conventional array radars; MIMO does not provide better barrage-noise-jammer, repeater-jammer or hot-clutter rejection than conventional array radars; should not be better for detecting low velocity targets in airborne STAP radar; Graphene and Carbon Nanotube (CNT): Potential for Terahertz transistor clock speeds, manufacture on CMOS demo’d, could allow Moore’s law to march forward using present day manufacturing techniques; potential for non-volatile memory, flexible displays and camouflage clothing, self-cooling, IBM producing 200 mm wafers with RF devices; Electron Spot: For memory; Atomic Memory: 12 iron atoms for 1 bit of memory; could provide hard drive with 100X density; Revolutionary 3-D Micromachining: integrated circuitry for microwave components, like 16 element Ka-band array with Butler beamformer on 13X2 cm2 chip; Superconductivity: We may still achieve superconductivity at room temperature; Superconductivity recently obtained for first time with iron compounds; DARPA UHPC (Ubiquitous High Performance Computing) Program: Goal: Reduce signal processing power consumption by factor of 75; Biodegradable Array of Transistors or LEDs: Imbedded for detecting cancer or low glucose; can then dispense chemotherapy or insulin; Quantum Radar: See stealth targets; New polarizations: OAMs, (Orbital Angular Momentum) unlimited data rate over finite band using new polarizations??
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*1. BREAKTHROUGHS IN RADAR AND PHASED-ARRAYS (THIS BREAKTHROUGH DL TALK CONTINUALLY UPDATED)
**2. MIMO RADAR DEMYSTIFIED AND WHERE THEY MAKE SENSE TO USE (THIS TALK ALSO UPDATED CONTINUALLY)
***3. AROUND WORLD IN 60 MINUTES - EXOTIC PLACES WITH A TWIST, THE TWIST IS INCLUSION OF SHORT TALK ENTITLED "SNOOPY ON RADAR"

# ARCHIVED

# OVER 600 REGISTERED

ACRONYMS:
AESS = AEROSPACE AND ELECTRONICS SYSTEMS SOCIETY
MIT LL = MASSACHUSETTS INSTITUTE OF TECHNOLOGY LINCOLN LAB.
BIT = BEIJING INSTITUTE OF TECHNOLOGY
AOL = ASSOCIATION OF OLD CROWS
MJ = MICROWAVE JOURNAL
AP = ANTENNAS AND PROPAGATION
MTT = MICROWAVE THEORY AND TECHNIQUES
IWRS = IRAN WORKSHOP ON RADAR SYSTEMS
EDI CON = ELECTRONIC DESIGN INNOVATION CONF.
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