

Advanced Technology Education Program

معهد الأمير سلطان
لأبحاث التقنيات المتقدمة

Prince Sultan Advanced
Tech. Research Institute


www.psatri.org.sa



PSATRI

Advanced Radar EW Technology

(ATEP 04) 17 Apr. - 21 Apr. 2016



Training Course Information:
**Advanced Radar EW
Technology (ATEP 04)**
17 Apr. - 21 Apr. 2016

COURSE AIMS

This course aims to impart an appreciation of the capabilities, techniques and applications of modern radar electronic warfare. It provides an advanced level of analysis of radar EW techniques appropriate to today's radar EW systems.

PRE-REQUISITES

This course assumes that students have attended "Introduction to Radar / Modern Radar Systems" and "Introduction to Radar Electronic Warfare / Radar Electronic Warfare Technology" or have an equivalent background in radar. It is recommended that students have a strong background in maths. Advanced Radar EW Technology is pitched at master's degree level.

WHO SHOULD ATTEND

- Engineering officers seeking an in-depth knowledge of modern radar EW techniques,
- Defence personal involved in the procurement or specification of radar EW systems,
- Radar and Radar EW equipment design engineers and other defence industry senior engineers with a background in radar EW,
- Master's and doctorate level students in mathematics, science or engineering subjects,
- University academic staff seeking an in-depth knowledge of modern radar EW techniques.

COURSE CONTENT

Introduction to Advanced Radar EW Techniques (1 hr) EJH

- Systems and Sensors: Importance of Data and Information
- Surveillance, Defence and Attack Concepts
- The radar electromagnetic environment

Intercept Receivers (1hr) CMA

- Swept superheterodyne receiver
- Channelised superheterodyne receiver
- Instantaneous frequency measurement (IFM)
- Bragg cell

Beamforming Techniques for Advanced Cancellation & Direction Finding (3 hrs) EJH

- High Speed Spinning Antenna
- Monopulse Techniques
- Multi-Port Direction Finding
- Interferometry
- Spatial Frequency Theory and the DFT beamformer

- Advanced Beamformers (Bartlett, Capon, Music)
- Adaptive Jammer / Sidelobe Cancellation

ESM Deinterleaving (2 hrs) EJH

- Pulse Deinterleaving Concepts
- Separability
- Clustering approaches
- Pulse Train Association
- PRI Identification
- Emitter Scan Analysis
- Emitter Identification
- Template Matching

LPI: Statistical Approach to Intercept Probability (2 hrs) CMA

- Probability of Intercept vs. Probability of detection,
- Window Functions,
- Coincidence of Two Window Functions,
- Coincidence of Three Window Functions,
- Generalisation to N Window Functions,
- Statistical Approach to Continuous Time.

LPI Radar Waveforms (2 hrs) CMA

- Applications
- ESM Interception
- Low Probability of Intercept
- Power Management
- FM waveforms
- Polyphase codes (PSK)
- Polytime coding

- Frequency Shift Keying (FSK)
- Hybrid methods
- Examples

Receiver Channelisation Using FFT Techniques (2 hrs) EJH

- Key areas of Commercial development that can be applied to Electronic Warfare
- Time & Frequency Domain DSP Methods
- FFT Channelisation
- Hilbert Transform for Analytic Signals
- Software Superhet
- Zoom FFT for ESM analysis

Stealthy Materials (2 hrs) CMA

- RCS Control,
- Transmission and Reflection Coefficients,
- Space Cloth,
- Salisbury Screen,
- Jaumann Screen,
- Radar Absorbent Materials (RAM),
- Metamaterials,
- Frequency Selective Surfaces,
- Antenna Scattering Aperture,
- Low RCS Antennas.

Jamming of SAR Systems (1.5 hrs) CMA

- Area Affected by Noise Jamming
- Signal to Jamming Noise Ratio
- Signal to Clutter Ratio

- Noise Jamming Against Swath Mode SAR
- Losses in Noise Jamming
- Repeater Jamming
- False Targets, masking, difficulties
- SAR Vulnerability & contour plots
- SAR Based Automatic Target Recognition
- Electronic Defence Against SAR Jamming

Case Study 1: Reverse Engineering of Radar Waveforms (3.5 hr) EJJ

- Uses of waveform reconstruction information
- Common Waveform structures and their properties/application
- Parameter Measurement Accuracy
- Estimators and Knowledge Systems for Real-Time Analysis
- Time / Frequency analysis (Short Term Fourier Transform, Wigner-Ville analysis)
- Examples of waveform reverse engineering
- Impact of waveform application ambiguity on decision making

Case Study 2: Active Radar Missile Seekers (2 hr) CMA

- Air-Launched Anti-Armour Guided Weapons (e.g. RF Hellfire, Brimstone)
- Anti-Ballistic Missiles (e.g. Patriot PAC-3)
- Air to Air Guided Weapons
- Anti-Ship Missiles (ASM)
- Fuses

Countering the Threat from Active Radar Missile Seekers (1 hr) EJH

- Information Requirements for Guidance
- Properties of Monopulse and High Resolution Pulse Doppler processing
- Noise Jamming Effects
- Repeater Jamming Effects
- Influence of Passive Decoys

Anti-Radiation Missile Seekers (1 hr) EJH

- Methods of Operation
- Seeker Structures
- Emitter Detection and Tracking Issues
- Multi-Sensor System Issues
- Effect of decoys

Demonstration of PSATRI DRFM Jammer (1hr) PSATRI

(or WHR CW Doppler radar and swept spot noise jammer demonstration)

Biographies

Sami M. Alhumaidi, Ph.D.

Dr. Sami Alhumaidi is currently the Managing Director of Prince Sultan Advanced Research Institute (PSATRI), an applied research institute at King Saud University (Riyadh, Saudi Arabia) established by the Ministry of Defense and jointly managed by KSU and the Royal Saudi Air Force. Dr. Alhumaidi has obtained his Ph.D. Degree in Electrical Engineering from Florida Institute of Technology in 1996 and his MSEE from the California State University, Northridge, CA, in 1993. He has numerous publications in the areas of radar and electronic warfare and serves on a number of national committees on electronic defense and unmanned aerial vehicles.



Clive M. Alabaster, Ph.D.

Dr. Clive M. Alabaster received his BSc degree in Physics with Microelectronics from University College Swansea, Wales, in 1985 and his PhD from Cranfield University, Shrivensham in 2004. From 1985 to 1992 he worked as a microwave design and development engineer on airborne radar systems with GEC Marconi, Milton Keynes, England. From 1992 to 1998 he worked as a lecturer in radar techniques at Arborfield Garrison, near Reading, England. From 1998 to 2012 he was a Senior Lecturer at Cranfield University, Shrivensham, UK in the Sensors group within the Department of Informatics and Sensors. His research interests include pulse Doppler radar, radar waveform design and the dielectric properties of materials, particularly in the millimetre wave band. He is a member of the Institute of Physics and is a Chartered Engineer.



Evan J. Hughes, Ph.D.

Dr. Evan J. Hughes received his BEng and MEng degrees in Electrical and Electronic Engineering from the University of Bradford, England, in 1993 and 1994 respectively. He received his Ph.D. in 1998 from Cranfield University, Shrivensham. From 1993 to 1995 he worked as a design engineer with GEC Marconi, Leicester. From 1998 to 2012 he was a Senior Lecturer at Cranfield University, Shrivensham, UK in the Sensors group within the Department of Informatics and Sensors. His primary research interests include Radar signal processing, Evolutionary Many-Objective Optimisation, swarm guidance and data fusion. He is a member of the IET, is a Chartered Engineer and chaired the IET Radar, Sonar and Navigation Professional Network from 2006 to 2010 and was the Technical co-chair for RADAR 2012 in Glasgow.



Advanced Radar EW Technology Pre-registration Form

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Name :

Rank / Job title :

Tel. : Mobile :

Employer Name :

Employer Address :

E-Mail Address :

Employer Tel. : Fax :

Course Name: **Advanced Radar EW Technology Course**

Course Dates: **17 Apr. - 21 Apr. 2016**

Course Reference: **ATEP 04**

Course Fees: **SAR 13,000**

I hereby certify that I would like to pre-register for the above course. I understand that to confirm my registration, I must complete the payment by 03 Apr 2016 otherwise my registration may be cancelled.

Name :

Signature : Date :

Method of Payment

Account No.: 2680741005

Beneficiary Name:

Prince Sultan Advanced Technology Research Institute

Bank Name: Samba

Swift Code: SAMBSARI

IBAN Number : SA594000000002680741005

Pre-registration:

Send a completed Pre-registration form via email or Fax prior to **03 Apr 2016** to:

atep.training@psatri.org.sa, Fax: +966 11 2742841

For further information, please visit or send email:

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