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# CHAPTER 9

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## ELECTRONIC COUNTER-COUNTERMEASURES

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### 9.1 INTRODUCTION

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Since World War II both radar and electronic warfare (EW) have achieved a very high state of performance.<sup>1,2</sup> Modern military forces depend heavily on electromagnetic systems for surveillance, weapon control, communication, and navigation. Electronic countermeasures (ECM) are likely to be taken by hostile forces to degrade the effectiveness of electromagnetic systems. As a direct consequence, electromagnetic systems are more and more frequently equipped with so-called electronic counter-countermeasures (ECCM) to ensure effective use of the electromagnetic spectrum despite an enemy's use of EW actions.

This chapter is devoted to the description of the ECCM techniques and design principles to be used in radar systems when they are subject to an ECM threat. Section 9.2 starts with a recall of the definitions pertaining to EW and ECCM. The topic of radar signals interception by EW devices is introduced in Sec. 9.3; the first strategy to be adopted by radar designers is to try to avoid interception by the opponent electronic devices. Section 9.4 is dedicated entirely to the analysis of the major ECM techniques and strategies. It is important to understand the ECM threat to a radar system in order to be able to efficiently react to it. To facilitate the description of the crowded family of ECCM techniques (Secs. 9.6 through 9.10), a classification is attempted in Sec. 9.5. Then, the techniques are introduced according to their use in the various sections of radar, namely, antenna, transmitter, receiver, and signal processing. A key role is also played by those ECCM techniques which cannot be classified as electronic, such as human factors, methods of radar operation, and radar deployment tactics (Sec. 9.10).

The ensuing Sec. 9.11 shows the application of the aforementioned techniques to the two most common radar families, namely, surveillance and tracking radars. The main design principles (e.g., selection of transmitter power, frequency, and antenna gain) as dictated by the ECM threat are also discussed in some detail.

The chapter ends with an approach to the problem of evaluating the efficacy of ECCM and ECM techniques (Sec. 9.12). There is a lack of theory to properly

# Radar Electronic Countercountermeasures

**Fernando Mendoza**



## **Radar Electronic Countercountermeasures:**

**Radar Electronic Counter-countermeasures** Stephen L. Johnston, 1979      **Radar Electronic Countermeasures (ECM) and Electronic Counter-countermeasures (ECCM)** Fernando Mendoza, 1991      **Radar Electronic Warfare** August Golden, 1987 This text provides students engineers and officers with a solid foundation for understanding electronic countermeasures It defines common terms and principles used in the fields of radar and electronic warfare and describes the response of radar systems to electronic countermeasures In depth analyses of the effects that various electronic countermeasure emissions have on classes of radar systems follows Mathematical models are used to describe these effects although minimal mathematical sophistication is required      **Electronic Counter-countermeasures Considerations in Radar Systems Acquisition** , 1987      *Electronic Counter Countermeasures/Advanced Radar Test Bed (ECCM/ARTB)* T. King, 1992      *Introduction to Electronic Defense Systems* Filippo Neri, 2006 This revised edition surveys sophisticated electronic warfare systems with the latest technological advances New material covers current radar techniques with the latest in IR techniques and EW weapons systems and defense equipment It also includes an introduction to Information Operations and Information Warfare      **Synthetic Aperture Radar Electronic Counter-countermeasures Techniques** Marvin Neal Cohen, Georgia Tech Research Institute (1984- ). Project no. A-9303, 1992      **Fundamentals of Strategic Weapons** James N. Constant, 2013-12-01 The purpose of this book is to provide graduate students professional engineers military officers and weapons systems planners with a comprehensive grounding in the technology evolution functions costs impacts on society utility and limitations of modern strategic weapons systems Since the subject is often left to the specialists this work should introduce the general reader to the fundamentals of such systems in an informed manner Nowadays the intense interaction of means and ends symbolized by strategic weapons has stimulated a changing discipline in which new missile systems and the intricate logic of nuclear force and counterforce hold the stage alongside the truths of conflict alliances fears games and subtle gains and losses Many readers with new personal interest or public responsibility in this complex field will require an overall guide to it This book will not prepare the reader to become an expert in the vast subject of strategic weapons systems It will however enable him to understand evaluate and form reasonable opinions about these systems their capabilities and effectiveness The subject is dealt with more from the viewpoint of the user investor rather than the architect systems engineer and builder design engineer While the user will be concerned with both political as well as technical options which may be available to solve a problem the systems and design engineers are concerned with analyzing and building technological weapons devices once their requirements are generally known      **Modern Radar Techniques** M. J. B. Scanlan, 1987      *DDC Retrieval and Indexing Terminology* Defense Documentation Center (U.S.), 1975      **The Electronics Handbook** Jerry C. Whitaker, 1996-12-23 The superb organization of The Electronics Handbook means that it is not only a comprehensive and fascinating reference but also a pleasure to use Some of these organizational features

include **An Introduction to Electronic Warfare; from the First Jamming to Machine Learning Techniques** Chi-Hao Cheng, James Tsui, 2022-09-01 Since its creation at the beginning of World II radars have forever transformed the practice of modern warfare The evolution of countermeasure conducted by electronic warfare systems against radars and radars corresponding counter countermeasures is an intriguing technical subject This book provides a very accessible introduction to a broad range of radar and electronic warfare technologies The subjects covered in this book range from early radar development to later technologies such as stealthy techniques low probability of intercept radar and machine learning Historical events are used to illustrate the principles of electronic warfare and to help readers to apprehend contexts under which radars and corresponding electronic warfare techniques were developed **The Navigator** ,1961

**ECM/ECCM/ESM (electronic Countermeasures/electronic Counter Countermeasures/electronic Support Measure Systems) for Radar Systems, Communication Systems, Electro-optical Systems, and Millimeter-wave Systems** ,1986 **Defense Technical Information Center Thesaurus** Defense Technical Information Center (U.S.),1990

Handbook of Defence Electronics and Optronics Anil K. Maini,2018-07-23 Handbook of Defence Electronics and Optronics Anil K Maini Former Director Laser Science and Technology Centre India First complete reference on defence electronics and optronics Fundamentals Technologies and Systems This book provides a complete account of defence electronics and optronics The content is broadly divided into three categories topics specific to defence electronics topics relevant to defence optronics and topics that have both electronics and optronics counterparts The book covers each of the topics in their entirety from fundamentals to advanced concepts military systems in use and related technologies thereby leading the reader logically from the operational basics of military systems to involved technologies and battlefield deployment and applications Key features Covers fundamentals operational aspects involved technologies and application potential of a large cross section of military systems Discusses emerging technology trends and development and deployment status of next generation military systems wherever applicable in each category of military systems Amply illustrated with approximately 1000 diagrams and photographs and around 30 tables Includes salient features technologies and deployment aspects of hundreds of military systems including military radios ground and surveillance radars laser range finder and target designators night visions devices EW and EO jammers laser guided munitions and military communications equipment and satellites Handbook of Defence Electronics and Optronics is an essential guide for graduate students R D scientists engineers engaged in manufacturing defence equipment and professionals handling the operation and maintenance of these systems in the Armed Forces *Self-protective measures to enhance airlift operations in hostile environments* ,

**Technical Abstract Bulletin** ,1964 **bk. 2 Research and development title II** United States. Congress. House. Committee on Armed Services,1978 *Hearings on Military Posture and H.R. 10929* United States. Congress. House. Committee on Armed Services,1978

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## **Table of Contents Radar Electronic Countercountermeasures**

1. Understanding the eBook Radar Electronic Countercountermeasures
  - The Rise of Digital Reading Radar Electronic Countercountermeasures
  - Advantages of eBooks Over Traditional Books
2. Identifying Radar Electronic Countercountermeasures
  - Exploring Different Genres
  - Considering Fiction vs. Non-Fiction
  - Determining Your Reading Goals
3. Choosing the Right eBook Platform
  - Popular eBook Platforms
  - Features to Look for in an Radar Electronic Countercountermeasures
  - User-Friendly Interface
4. Exploring eBook Recommendations from Radar Electronic Countercountermeasures
  - Personalized Recommendations
  - Radar Electronic Countercountermeasures User Reviews and Ratings
  - Radar Electronic Countercountermeasures and Bestseller Lists

5. Accessing Radar Electronic Countercountermeasures Free and Paid eBooks
  - Radar Electronic Countercountermeasures Public Domain eBooks
  - Radar Electronic Countercountermeasures eBook Subscription Services
  - Radar Electronic Countercountermeasures Budget-Friendly Options
6. Navigating Radar Electronic Countercountermeasures eBook Formats
  - ePub, PDF, MOBI, and More
  - Radar Electronic Countercountermeasures Compatibility with Devices
  - Radar Electronic Countercountermeasures Enhanced eBook Features
7. Enhancing Your Reading Experience
  - Adjustable Fonts and Text Sizes of Radar Electronic Countercountermeasures
  - Highlighting and Note-Taking Radar Electronic Countercountermeasures
  - Interactive Elements Radar Electronic Countercountermeasures
8. Staying Engaged with Radar Electronic Countercountermeasures
  - Joining Online Reading Communities
  - Participating in Virtual Book Clubs
  - Following Authors and Publishers Radar Electronic Countercountermeasures
9. Balancing eBooks and Physical Books Radar Electronic Countercountermeasures
  - Benefits of a Digital Library
  - Creating a Diverse Reading Collection Radar Electronic Countercountermeasures
10. Overcoming Reading Challenges
  - Dealing with Digital Eye Strain
  - Minimizing Distractions
  - Managing Screen Time
11. Cultivating a Reading Routine Radar Electronic Countercountermeasures
  - Setting Reading Goals Radar Electronic Countercountermeasures
  - Carving Out Dedicated Reading Time
12. Sourcing Reliable Information of Radar Electronic Countercountermeasures
  - Fact-Checking eBook Content of Radar Electronic Countercountermeasures
  - Distinguishing Credible Sources
13. Promoting Lifelong Learning

- Utilizing eBooks for Skill Development
- Exploring Educational eBooks

#### 14. Embracing eBook Trends

- Integration of Multimedia Elements
- Interactive and Gamified eBooks

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