

1. Module details**Module name****Secondary Radar and Related Systems****Module duration**

It is expected that students with the appropriate entry knowledge and skills will successfully complete this module in 36 – 40 hours.

Module code

NUE175

Discipline code

0703501 Communications Engineering – General.

2. Module purpose

To provide knowledge and skills in Secondary Radar and related systems and to apply these to service systems and related equipment.

3. Prerequisites

Nil.

4. Relationship to competency standards

This module provides part of the underpinning knowledge and skills in the ‘Evidence Guide’ of specific units of competency in the National Electrotechnology Training Package and provides similar support, where mapped, to equivalent units in the National Metals and Engineering Competency Standards. For details refer to the module to unit maps, available from NUEITAB.

5. Content**Secondary radar principles**

Transponder operation

Definition of secondary radar

Operating principles

Signal processing

Pulse generation, transmission and detection

Mode generation, detection and response

Display symbol generation

Synchronisation with primary radar

Advantages over primary radar with respect to: clutter; signal/noise ratio; transmit power required for operation

Interfaces to other systems providing information for transmission of mode data

Slaving/synchronisation to primary radar

Clutter reduction/elimination

Defruiting

Degarbling

Interfaces to other systems

Range/ducting effects

Advantages over primary radar

Power supplies and UPS

International standards

Hot standby, cold standby

Application of secondary radar systems

- Traffic Collision Avoidance System (TCAS)
- Selective Identification System (SIF)
- Air Traffic Control Radar Beacon System (ATCRBS)
- Instrument Landing System (ILS)
- Tactical Air Navigation (TACAN)
- Navigation Systems (VOR, GPS, DME)
- Radar Altimeter
- Jamming
- Electronic warfare
- Second Time Round Returns (STRR)
- Identification –friend or foe radar (IFF)

6. Assessment strategy

Assessment methods

Assessment should be progressive reflecting a holistic approach to ensure the module purpose is met. To assist in ensuring validity, reliability and fairness assessment instruments should include practical exercises, assignments and written tests consisting of a number of item types, such as multiple choice, short answer and problem solving.

Conditions of assessment

Learning and assessment will take place in a classroom / laboratory environment.

7. Learning outcome details

Learning outcome 1

Describe the functions of secondary radar.

Assessment criteria

- 1.1 Compare the functions and role of a secondary radar system with those of a primary radar system.
- 1.2 Describe the basic principles of operation of a secondary radar system, including pulse generation, transmission and detection requirements.
- 1.3 Explain the meaning of mode generation, detection and response.
- 1.4 Describe the characteristics of typical transponder interrogation modes used by air traffic control centres.
- 1.4 Describe radar display symbol generation.
- 1.5 Describe techniques commonly used to synchronise secondary radar systems with primary radar systems.

Learning outcome 2

Assessment criteria

- 1.6 Explain the advantages of a secondary radar system over a primary radar system with respect to signal/noise ratio and transmit power required for operation.
- 1.7 List the typical operating specifications of an Uninterruptable Power Supply (UPS) used for secondary radar systems.
- 1.8 Draw a block diagram of a secondary radar system showing how it interacts with aircraft transponders.
- 1.9 List the typical functions of a transponder.

Operating principles of secondary radar.

- 2.1 Describe the process of beacon interrogation and identification.
- 2.2 Describe interfaces to other systems providing information for transmission of mode data.
- 2.3 Describe the process of 'slaving' and 'synchronisation' to primary radar.
- 2.4 Describe signal-processing techniques used for clutter reduction/elimination.
- 2.5 Describe different types of interfaces used with radar systems.
- 2.6 Describe the meaning of 'range' and 'ducting' effects.
- 2.7 Identify the International Standards that apply to secondary radar.
- 2.8 Describe applications of hot standby and cold standby equipment.

Learning outcome 3

Assessment criteria

Application of secondary radar systems.

- 3.1 Describe the application and principles of operation of a range of radar systems that include:
 - Traffic Collision Avoidance System (TCAS)
 - Selective Identification System (SIF)
 - Air Traffic Control Radar Beacon System (ATCRBS)
 - Instrument Landing System (ILS)
 - Microwave landing system (MLS)
 - Navigation Systems (VOR, GPS, DME)
 - Radar Altimeter.

Learning outcome 4

Military applications of secondary radar.

Assessment criteria

- 4.1 Describe the typical effects of 'jamming' on radar systems.
- 4.2 List a range of recent developments in electronic warfare affecting secondary radar systems.
- 4.3 Explain the meaning of the terminology 'Second Time Round Returns' (STRR).
- 4.4 Describe Tactical Air Navigation (TACAN) and list its advantage over Very High Frequency Omni-Directional (radio) Range (VOR) method of navigation.
- 4.5 Describe target identification techniques such as Identification – friend or foe radar (IFF).
- 4.6 Explain the meaning of the following IFF target related terminology: 'defruiting', 'degarbling', code validation.

8. Delivery of the module

Delivery strategy

Delivery strategies must be suitable for learning both theoretical and practical aspects described in the module purpose. It is considered that the most effective method to achieve this is by integration of theory and practice where students learn by experimentation, research and reports. It is recommended that learning and assessment be facilitated in a holistic manner that may require learning outcome sequence other than that indicated in the module.

Resource requirements

Occupational health and safety requirements

A safe and healthy environment will be provided for students and teachers as well as the particular safety procedures followed as part of the learning / teaching activity and content.