CORE CONCEPT

# Air Navigation CNS Systems Engineering Course: Radar, ILS, VOR/DME, ADS-B and VHF Maintenance

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## Introduction:

Air navigation CNS systems engineering, covering radar, ILS, VOR/DME, ADS-B and VHF maintenance, is a 1-week course for units that keep ground surveillance, navigation aids and air-ground voice in service, ending with a CNS Maintenance and Availability Plan for a case organisation. Providers lose approach minima, separation capability and controller voice paths when monitor alarms, drifting tolerances and single points of failure go unnoticed until an outage. Nominees already test or restore CNS equipment and work through inspection walkthroughs of station records, monitor logs and flight inspection reports. CoreConcept Training Center delivers this CNS systems engineering course.

## Course Objectives:

- Map the ground CNS estate of an aerodrome or approach unit, from VHF voice and navigation aids to radar, ADS-B and multilateration coverage
- Check ILS localiser, glide path, DVOR and DME transmitter parameters against ICAO Annex 10 tolerances during routine ground checks
- Verify primary and secondary surveillance radar, ADS-B ground station and multilateration performance using test targets, coverage plots and track data
- Maintain VHF air-ground radio and voice communication control system channels, including main and standby transmitters, receivers and frequency changeover
- Plan flight inspection support, monitor alarm responses and outage restoration so that equipment returns to service with documented evidence
- Prepare a CNS Maintenance and Availability Plan that sets preventive tasks, spares, redundancy checks and asset replacement priorities

## Target Audience:

- Navigation aid maintenance units responsible for ILS, DVOR and DME stations at aerodromes and en route sites
- Surveillance maintenance units responsible for primary and secondary radar heads, ADS-B ground stations and multilateration sensors
- Communication maintenance units responsible for VHF air-ground radio sites and voice communication control systems
- Technical control and monitoring units that watch CNS equipment status, log alarms and coordinate restoration
- Airport electronics and engineering units that operate CNS equipment on behalf of the aerodrome operator

## Course Outline:

### Day 1: Ground CNS Estate, Service Roles and Current-State Assessment

- CNS Functions Supporting Air Traffic Services on the Ground
- ICAO Annex 10 Structure for Radio Navigation and Surveillance Aids
- CNS Station Inventory From Approach Aids to Radar Heads
- Equipment Availability, Continuity and Integrity Terms in Practice
- Station Logbook and Fault History Review for Baseline Condition

### Day 2: Navigation Aid Principles: ILS, DVOR and DME Signal Architecture

- ILS Localiser DDM, Course Width and Clearance Signals
- ILS Glide Path Angle, Sector Width and Siting Effects
- DVOR Doppler Bearing Principle and 30 Hz Phase Comparison
- DME Interrogation, Reply Delay and VOR Frequency Pairing
- Integral Monitor Alarm Limits, Changeover and Shutdown Logic

### Day 3: Surveillance and Voice Systems: Radar, ADS-B, Multilateration and VHF

- Primary Radar Detection, Clutter Processing and Coverage Checks
- SSR Mode A, Mode C and Mode S Interrogator Performance
- ADS-B Ground Station Reception and Position Cross-Checks
- Multilateration Sensor Timing and Time Difference of Arrival Accuracy
- VHF Transmitter, Receiver and Voice Control System Channel Tests

### Day 4: Flight Inspection, Outage Response, Redundancy and Problem Cases

- Flight Inspection Manual Criteria for Ground Check Planning
- ILS Critical and Sensitive Area Protection Against Signal Reflections
- Main and Standby Equipment Redundancy and Power Supply Resilience
- Outage Restoration Workflow From Alarm to Return to Service
- Recurring Fault Cases Traced With Monitor and Maintenance Logs

### Day 5: Inspection Walkthrough and CNS Maintenance and Availability Plan Build

- Case Organisation CNS Station Records and Alarm Data Pack
- Case Walkthrough Ranking Navaid and Surveillance Defects by Risk
- Case Preventive Task Intervals, Spares and Test Equipment Needs
- Case Asset Ageing Review and Replacement Priority Scoring
- CNS Maintenance and Availability Plan Completion and Peer Challenge

## Skills You Will Gain:

- Navigation Aid Parameter Verification
- ILS Signal Tolerance Checking
- Surveillance Coverage Assessment
- VHF Voice Channel Testing
- Flight Inspection Coordination
- CNS Outage Restoration
- Equipment Redundancy Design Review
- CNS Asset Replacement Planning

## Why Attend This Course:

- Deliver a CNS Maintenance and Availability Plan for a case organisation to the head of CNS engineering and the technical control supervisor
- Judge whether an ILS, DVOR, radar or VHF channel can stay in service, needs adjustment or must be withdrawn after a monitor alarm
- Prevent unplanned approach aid outages, surveillance gaps and lost controller frequencies caused by unchecked tolerances or untested standby equipment
- Share ground check sheets, alarm response steps and asset ranking templates with station technicians and shift engineers

## Conclusion:

Back at work, the participant hands the CNS Maintenance and Availability Plan to the head of CNS engineering, the technical control supervisor and the air traffic services unit that depends on the equipment. They use it to set preventive check intervals, confirm standby and power arrangements, order spares and rank stations for replacement funding. After the first flight inspection or major outage under the plan, the unit should compare availability figures, restoration times and inspection findings with the targets and adjust check intervals or redundancy arrangements.

## Frequently Asked Questions FAQ:

### What should participants know before an air navigation CNS systems engineering course?

Participants should already maintain, test or monitor ground radar, navigation aid or VHF radio equipment and read basic RF measurements and alarm logs. Bringing anonymised station logbooks, ground check sheets or outage reports helps them apply the walkthrough exercises to their own equipment.

## How does air navigation CNS systems engineering differ from aircraft avionics or air traffic management courses?

It covers the ground stations that radiate guidance, detect aircraft and carry controller voice. Avionics courses test the receivers and transponders fitted to aircraft, while air traffic management courses balance airspace, flow and capacity rather than maintain equipment.

## Why do ILS and DVOR monitors shut down a CNS navigation aid instead of letting it run out of tolerance?

An out-of-tolerance signal can guide an aircraft off the intended path without warning the crew. Integral monitors therefore change over to standby or remove the signal within set times, so pilots receive a failure flag rather than misleading guidance.

## What do participants take back from the air navigation CNS systems engineering course?

Participants take back a CNS Maintenance and Availability Plan for a case organisation, with a defect ranking, preventive task intervals, spares and redundancy checks, and an asset replacement priority list they can adapt to their own stations.