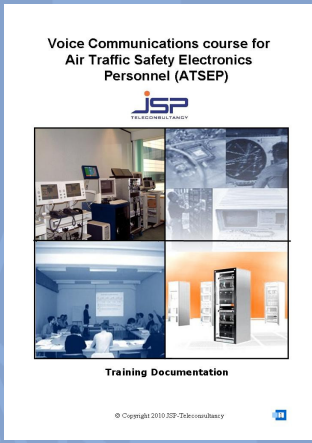
Course code: JSP-EU220

John Palmer has been a communications consultant to Eurocontrol in Brussels for more than 6 years followed by 8 years with a role of external consultant. He also has over 15 years of experience in the private telecoms industry working for a number of large and medium sized telecoms companies in the UK, Italy and Belgium.

John Palmer has over 10 years of experience of delivering Voice Communication courses to Air Navigation Service Providers, Civil Aviation Authorities and Private companies in Europe, North America and the Middle East.



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Communications course for Air Traffic Safety Electronics Personnel (ATSEP)

Course Background

With the scope of training the technical personnel of Air Navigation Service Providers to uniform requirements on a worldwide basis, ICAO developed the ICAO Training Manual that addresses the training requirements for Air Traffic Safety Electronic Personnel (ATSEP).

This course has been developed following requirements defined by the ICAO training manual Part E-2 for Air Traffic Safety Electronics Personnel (ATSEP). It provides fundamental knowledge required for ICAO Phase 1 Basic Training and Phase 2 Qualification Training relating to the discipline of Communication Systems within a CNS/ATM environment which are not site specific. Following the steps defined by the Progression of ATSEP training programme (below), the Basic and Qualification training are needed in order to prepare for the ICAO Phase 3 System/Equipment rating training

While Basic Training is designed to give an overview of communication systems within an operational environment, the Qualification Training provides the ATSEP with an in-depth knowledge needed for Voice Communication systems with the CNS/ATM discipline.

The course contains 8 modules that follow the ICAO requirements for content definition, starting from the fundamentals required for Basic training, but expanding each topic to reach the more in-depth level required for Qualification Training.

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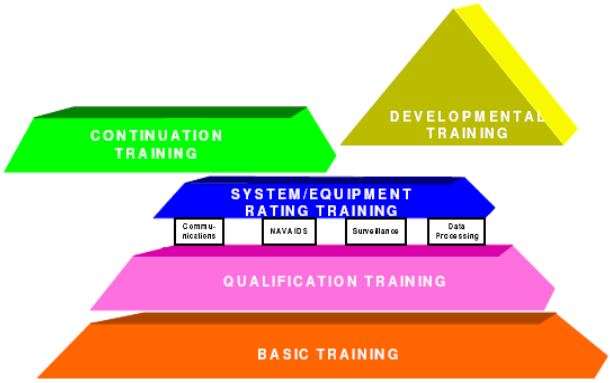
Progression of ATSEP Training



www.jsp-teleconsultancy.com.

JSP-Teleconsultancy Via Gorizia, 11 Folignano 63040 Ascoli Piceno Italy

Course code: JSP-EU220

Course duration:
6 hours per day with 10 or 20 minute breaks every hour as defined below:

HOUR 1	09.00 - 10.00
BREAK	10.00 - 10.20
HOUR 2	10.20 - 11.20
BREAK	11.20 - 11.30
HOUR 3	11.30 - 12.30
LUNCH	12.30 - 13.30
HOUR 4	13.30 - 14.30
BREAK	14.30 - 14.40
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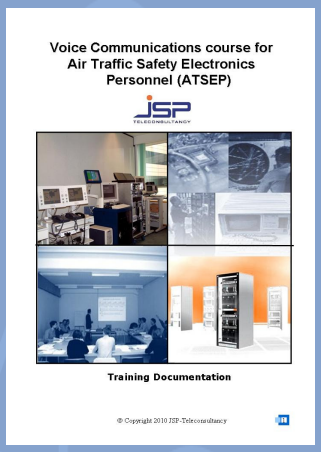
BREAK	15.40 - 16.00
HOUR 6	16.00 - 17.00



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Course Description

Detailed outline of 4.5 day course

A typical day starts at 09h00 and finishes at 17h00.

1	Voice Communication System (General)	2	Controller Working Position Functionality	3	Voice overview	4	Air Traffic Services Ground Telephone Network
	300 minutes		240 minutes		120 minutes		180 minutes
5	Voice Communication System - Telephone Functionality	6	Air Traffic Services Ground Radio Network	7	Voice Communication System- Radio Functionality	8	Voice Communication System-Recording Functionality
	300 minutes		150 minutes		210 minutes		90 minutes

Benefits for course participants

After completing the course, participants will have acquired a good understanding of Voice Communication System, Ground Radio Station and Recorder functionality together with the networks over which they are used, to the level that satisfies the Non-site specific requirements defined for ATSEP Basic and Qualification training objectives for Communication systems as defined in the ICAO Training manual for Air Traffic Safety Electronics Personnel. In particular it will cover:

- Voice Communication System (General)
- Controller Working Position functionality
- Voice Overview
- Air Traffic Services Ground Telephone network
- Voice Communication System- Telephone functionality
- Air Traffic Services Ground Radio network
- Voice Communication System – Radio functionality
- Voice Communication System – Recorder functionality

Course suitable for

This course is designed for those wishing to follow a career which involves operational safety related tasks in ATM and those seeking to complete a part of the minimum training requirement for ATSEP Basic training and /or the theoretical, Non-site related part of the qualification training.

Course code: JSP-EU220

Course duration:
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BREAK	11.20 - 11.30
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BREAK	14.30 - 14.40
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BREAK	15.40 - 16.00
HOUR 6	16.00 - 17.00

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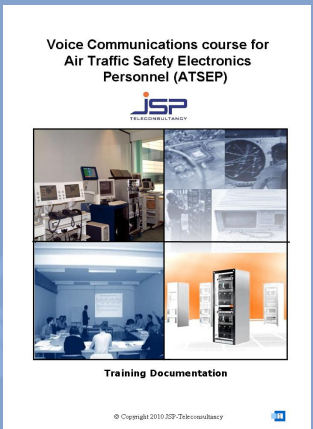

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Detailed outline DAY 1

A typical day starts at 09h00 and finishes at 17h00.

1	**Voice Communications general**	2	**Controller Working Position functionality**
	300 minutes		**60 minutes**

Module 1: Voice Communications general

- ✓ How is Airspace divided?
- ✓ What is a sector? Collapsing sectors, Expanding Sectors
- ✓ What is a handover?
- ✓ Purpose of Voice Communication System for G/G (e.g. DA, IA, IDA, Priority etc)
- ✓ Purpose of Voice Communication System for A/G
- ✓ Location of Voice Communication Systems – TWR, APP, ACC.
- ✓ Fundamental elements for Communication-CWP, VCS, RCE, Radio
- ✓ Component parts of a Voice Communication System (i.e. VCS, CWP, Legal Recorders, VCS Control and Monitoring System (VCMS)
- ✓ Typical Voice message exchange used during a G/G handover and A/G communication
- ✓ Image of different VCS's
- ✓ Network-Network Interface (Line Side)- User-Network Interface (Desk side)
- ✓ VCS Architectures
- ✓ Main/Standby component- Dual processing architectures
- ✓ What is Switching? Switch Matrix ?
- ✓ Non-blocking switch principle
- ✓ What is a Line Interface?
- ✓ Spectrum
- ✓ Civil Aviation Aeronautical Bands - use, characteristics and limitations
- ✓ Frequency Bands: VHF, UHF and HF ATC communications-Number of frequencies
- ✓ Military Aviation Aeronautical bands
- ✓ Frequency Management
- ✓ Sector frequency
- ✓ Principles of radio: Frequencies, phase, power, period, pulsation, wavelength, Dipole antenna
- ✓ Characteristics of radio waves: E-Field, M-Field, polarisation
- ✓ Principles of electromagnetic propagation
- ✓ Factors that can affect propagation of radio waves: Reflection, Absorption, Refraction, Diffraction
- ✓ Frequency Interference Sources
- ✓ Coverage area of Radio transmission - Earth Spherical form, Mountains
- ✓ Efficient Utilisation of frequency bands
- ✓ Frequency Congestion: 25kHz & 8.33kHz Channel Spacing
- ✓ Purpose and Principle of 8.33kHz channel spacing
- ✓ Principles of a transmitting and receiving system
- ✓ Radio Transmitter/Receiver System block diagram
- ✓ ICAO Legal Recording requirements
- ✓ Automatic terminal Information Services (ATIS)

Module 2: Controller Working Position Functionality

- ✓ What is a CWP ?
- ✓ Image of different CWPs
- ✓ What is a Dynamic Display (DD)?
- ✓ General Layout of a DD – Combined-Split Telephone/Radio parts
- ✓ Dynamic Display Sub-areas
- ✓ 4 letter ICAO codes
- ✓ Calling and Called Parties
- ✓ DA Panel, DA Keys, DA Call operation
- ✓ IA Panel, IA keys, IA Call operation
- ✓ IDA Dial Pad, IDA Call Queue

Summary of first day- Questions and Answers session

Course code: JSP-EU220

Course duration:
6 hours per day with 10 or 20 minute breaks every hour as defined below:

HOUR 1	09.00 - 10.00
BREAK	10.00 - 10.20
HOUR 2	10.20 - 11.20
BREAK	11.20 - 11.30
HOUR 3	11.30 - 12.30
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BREAK	14.30 - 14.40
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BREAK	15.40 - 16.00
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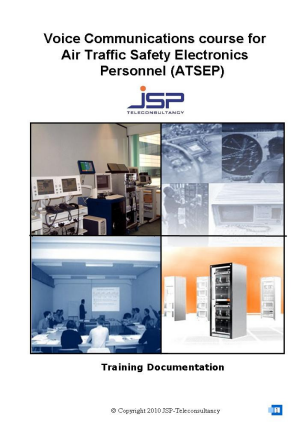

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TELECONSULTANCY

Detailed outline DAY 2

A typical day starts at 09h00 and finishes at 17h00.

2	Controller Working Position Functionality (Continued)	3	Voice Overview	4	Air Traffic Services Ground Telephone network
	180 minutes		120 minutes		60 minutes

Module 2: Controller Working Position Functionality (continued)

- ✓ Priority (Emergency) Calls
- ✓ Call Release, End key
- ✓ Telephone Feature Keys (Priority, Call Transfer, Call Forwarding, Call Hold, Conference, Redial etc)
- ✓ Audio Devices Plug Panel- Handset, Headset, Loudspeaker, Microphone, Coach Handset/Headset
- ✓ Audio Level Control Panel
- ✓ Headset types and quality- Split working, Noise Cancelling, Cordless headsets
- ✓ Radio Frequency Panel
- ✓ Frequency key assignment- Silent, Rx-only, Traffic, Coupling
- ✓ Frequency Key symbols – PTT, Squelch, Coupled etc
- ✓ Push-To-Talk (PTT) key – Lapel, Handset, Footswitch
- ✓ Aircraft Call/Squelch indication
- ✓ When are frequencies cross-coupled?
- ✓ Configuring a Cross-coupled group of frequencies (Retransmission)
- ✓ Duplex/Simplex Cross-coupled frequency
- ✓ Automatic & Manual -Best Signal Selection (Rx Voting)
- ✓ Climax operation- Multicarrier Offset Transmission
- ✓ Main/Standby Radio switchover
- ✓ Position Monitoring
- ✓ What are Roles, Missions, Scenarios, Sector suites
- ✓ Long term recording (Legal recording)
- ✓ Short term recording (Non-legal recording)

Module 3: Voice overview

- ✓ Analogue Voice
- ✓ Digital Voice
- ✓ Converting Analogue Voice to PCM
- ✓ What is clarity?
- ✓ What are Codecs? – Waveform, Hybrid, Vocoders
- ✓ What is Voice Compression?
- ✓ Audio bandwidth- Narrowband, Wideband.
- ✓ End-to-End Voice Delay (Processing-Network delay)
- ✓ End-to-End Voice Delay for Telephone/Radio
- ✓ Voice Quality- MOS, PESQ-LQO, Measurement equipment
- ✓ Voice Transcoding rules
- ✓ Voice Echo
- ✓ Voice Levels
- ✓ Voice Buffer Slips
- ✓ Voice Encryption
- ✓ Transporting Voice over IP network
- ✓ Audio/RTP/UDP/IP
- ✓ Foreseen migration towards SIP Telephone interfaces

Module 4: ATS Ground Telephone Network

- ✓ Telephone network infrastructure overview
- ✓ Complete signalling path between Controllers during a handover
- ✓ Secure G/G voice communication requirements
- ✓ Analogue Lines M.1030
- ✓ Difference between Dedicated Point to Point lines and Circuit/Channel Switching
- ✓ ITU-T G.703 Interface
- ✓ D64U -Digital Line EN 300 288/289 with Octet Integrity
- ✓ What is TDM?
- ✓ 2048 E1 digital line characteristics

Summary of 2nd day-
Questions and Answers session

Course duration:
6 hours per day with 10 or 20 minute breaks every hour as defined below:

HOUR 1	09.00 - 10.00
BREAK	10.00 - 10.20
HOUR 2	10.20 - 11.20
BREAK	11.20 - 11.30
HOUR 3	11.30 - 12.30
LUNCH	12.30 - 13.30
HOUR 4	13.30 - 14.30
BREAK	14.30 - 14.40
HOUR 5	14.40 - 15.40
BREAK	15.40 - 16.00
HOUR 6	16.00 - 17.00

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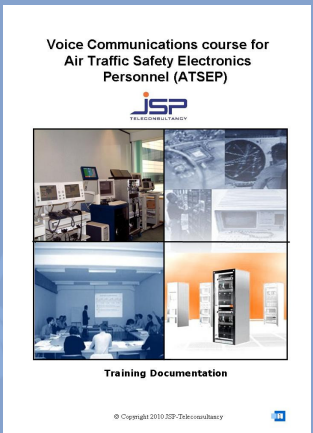

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Course code: JSP-EU220

JSP TELECONSULTANCY

Detailed outline DAY 3

A typical day starts at 09h00 and finishes at 17h00.

4	**Air Traffic Services Ground Telephone network (Cont.)**	5	**Voice Communication System Telephone Functionality**
	120 minutes		**240 minutes**

Module 4: ATS Ground Telephone Network (Continued)

- ✓ What is a Multiplexer and Multiplexing technique?
- ✓ Line Diversification policy
- ✓ Quantity of line/channels etc proportional to traffic- Traffic Stats.
- ✓ What are routing tables?
- ✓ Direct Routes and Detour Routes for Direct Access
- ✓ ICAO Performance for DA/IA calls
- ✓ Closed loop prevention
- ✓ What are permission tables?
- ✓ Through Switching
- ✓ Line Checking method for Analogue/Digital- Test Numbers
- ✓ Cross-border agreements for routing
- ✓ Availability – Mean time to Restore service- Element/Component replacement
- ✓ Sunset dates for analogue & digital leased lines
- ✓ Functional Airspace Blocks (FABs)
- ✓ Dynamic Resectorisation applied to Telephone
- ✓ Moving Sector control between ACCs
- ✓ PENS Network
- ✓ Next Generation Networks (NGN) & Benefits

Module 5: Voice Communication System – Telephone functionality

- ✓ ICAO 9804- Ground Voice Switching and Signalling Manual
- ✓ What is Degraded operation?
- ✓ What are redundant system elements/components?
- ✓ Purpose of a Backup/Standby VCS
- ✓ What is a fallback system?
- ✓ What is a VCS Test System?
- ✓ What is a Main Distribution Frame (MDF) ?
- ✓ Telephone Line interface cards- LB (2w & 4w), E&M, Loop Disconnect (LD), DTMF, ATS-R2, ATS-No5, ATS-QSIG, E1 CAS, E1 CCS, SIP UA
- ✓ A Typical Analogue Telephone Network
- ✓ What is Signalling? Line/Register/User signals
- ✓ ATS Ground Voice Network Numbering Plan
- ✓ Inband and Out-of band signalling
- ✓ Forwards and Backwards Direction
- ✓ What is Compelled and Non-Compelled Signalling?
- ✓ Link-to-link signalling and End-to-end Signalling
- ✓ Call collision – Double Seizure
- ✓ What is an A and B side?
- ✓ What is Busy, Free, Out-of-Service and Congestion?
- ✓ Automatic Call repeat on busy
- ✓ Audible Tones – Dial, Busy, Congestion, Out-of-service.
- ✓ What is Line/Channel Interruption?
- ✓ What is Call Intrusion?
- ✓ VCS Synchronization (to Telco, ANSP reference clock, GPS
- ✓ VCS Security aspects
- ✓ VCS Re-configuration Policy
- ✓ ATS-R2 analogue signalling protocol functionality using animated graphics -(free, busy, out of service, congestion)

Summary of 3rd day-
Questions and Answers session

Course duration:
6 hours per day with 10 or 20 minute breaks every hour as defined below:

HOUR 1	09.00 - 10.00
BREAK	10.00 - 10.20
HOUR 2	10.20 - 11.20
BREAK	11.20 - 11.30
HOUR 3	11.30 - 12.30
LUNCH	12.30 - 13.30
HOUR 4	13.30 - 14.30
BREAK	14.30 - 14.40
HOUR 5	14.40 - 15.40
BREAK	15.40 - 16.00
HOUR 6	16.00 - 17.00

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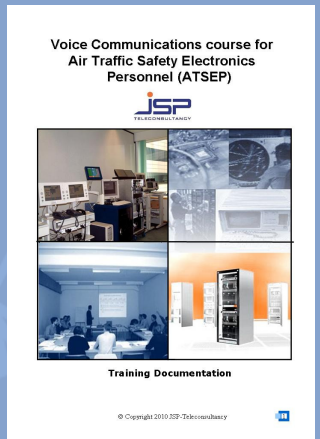

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JSP TELECONSULTANCY

Detailed outline DAY 4

A typical day starts at 09h00 and finishes at 17h00.

5	Voice Communication System -Telephone Functionality (Cont.)	6	Air Traffic Services Ground Radio network	7	Voice Communication System -Radio Functionality
	60 minutes		150 minutes		150 minutes

Module 5: Voice Communication System – Telephone functionality (Continued)

- ✓ ATS-R2 Call Priorities for Direct and Detour route
- ✓ ATS-R2 call interruption & intrusion
- ✓ Examples of ATS-R2 Printouts
- ✓ Examples of ATS-R2 test equipment
- ✓ Overview of ATS-QSIG Signalling Protocol
- ✓ Layer 2 frames, Layer 3 messages, Features etc
- ✓ ATS-QSIG signalling protocol functionality using animated graphics
- ✓ Examples of ATS-QSIG printouts
- ✓ Example of ATS-QSIG test equipment
- ✓ Overview of future SIP signalling- SIP/SDP etc
- ✓ Examples of SIP/SDP printouts
- ✓ Example of SIP/SDP test equipment
- ✓ What are gateways? Incoming and Outgoing Gateways
- ✓ Example of Incoming Gateway
- ✓ Example of Outgoing Gateway

Module 6: ATS Ground Radio Network

- ✓ Radio network infrastructure overview
- ✓ Complete Signalling path between Controller to Pilot
- ✓ Radio Transmitter, Receiver, Transceiver-Tx/Rx separation
- ✓ Tx and Rx Station and Antenna System – Tx location, Rx location, antenna switching & filtering, no. of Rx per antenna, No. of Tx per antenna, polarisation ….
- ✓ Standby Radios – VHF, UHF.
- ✓ Multi-mode tuneable radios
- ✓ Local/ remote switchover between Main/Standby Radios- Link redundancy
- ✓ Radio Control Equipment (RCE)
- ✓ Tools for testing radio equipment- Power Meter, Spectrum Analyser.
- ✓ Analogue Lines M.1030
- ✓ E&M 4, 6 or 8 wire Interface;
- ✓ E1 CAS- Channel 16 line signals, Audio channels digitized tones
- ✓ Point-to-Point lines- No Switched Lines- Redundant lines to Standby radios
- ✓ Performance for PTT delay
- ✓ Performance for A/C call indication delay
- ✓ Performance for Audio delay
- ✓ Future- Radio Addresses, VoIP Radios with SIP interfaces, Multiple sessions between VCSs and Radio possible
- ✓ Dynamic Resectorisation applied to Radios
- ✓ Access to Radio Stations in Functional Airspace Blocks
- ✓ Access to Radio Stations for Last Resort Communications
- ✓ Prevention of Cross-coupling chains between VCS's
- ✓ Foreseen migration towards SIP Radio interfaces

Module 7: Voice Communication System-Radio functionality

- ✓ Radio Access Modes of Operation- Silent, Rx-only, Traffic, Coupling
- ✓ Push-To-Talk functionality
- ✓ Transmission timeout on no PTT
- ✓ Stuck Mic
- ✓ Purpose of a Backup/Standby Radio VCS
- ✓ Emergency frequencies (121.5kHz VHF and 243MHz UHF)
- ✓ PTT override – PTT level hierarchy
- ✓ Incoming Aircraft Call Detection/Squelch
- ✓ Radio Features – Cross-coupling (Retransmission) Simplex and Duplex Cross-coupling
- ✓ Communication path from Pilot to Controller to Pilot – Cross Coupling
- ✓ Cross-coupling chains
- ✓ Best Signal Selection (Rx Voting) operation
- ✓ Best Transmitter Selection (BTS)
- ✓ Multicarrier Offset Transmission (Climax) operation
- ✓ Problems with Climax- Echo and Fading
- ✓ Criteria to safely use same frequency at different ATS units- minimum distance between two Tx radios on same frequency.
- ✓ What are Stepped-on radio transmissions?
- ✓ Solutions -Controller PTT inhibited on frequency while squelch signal detected-PTT activation override possible- prevents controller not hearing A/C call
- ✓ Telephone-Radio channel Cross connect
- ✓ Off-air sidetone/Local sidetone (Radio Loop Check)
- ✓ Automatic Terminal Information Services (ATIS) functionality
- ✓ VOLMET functionality

Summary of 4th day-
Questions and Answers session

Course duration:
6 hours per day with 10 or 20 minute breaks every hour as defined below:

HOUR 1	09.00 - 10.00
BREAK	10.00 - 10.20
HOUR 2	10.20 - 11.20
BREAK	11.20 - 11.30
HOUR 3	11.30 - 12.30
LUNCH	12.30 - 13.30
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BREAK	14.30 - 14.40
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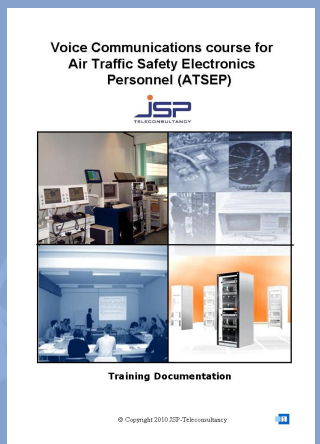

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Course code: JSP-EU220

TELECONSULTANCY

Detailed outline DAY 5

The final day starts at 09h00 and finishes at 12h30.

7	**Voice Communication System - Radio Functionality (Cont.)**	8	**Voice Communication System - Recorder Functionality**
	60 minutes		**90 minutes**

Module 7: Voice Communication System- Radio functionality (Continued)

- ✓ Describe the automatic data link service to ATIS, METAR and VOLMET
- ✓ Remote Monitoring and Control of radios- Parameters controlled & monitored
- ✓ On-board Voice communication systems
- ✓ Images of cockpit communications systems
- ✓ On-board Antenna Systems with images
- ✓ Examples of typical airborne transceivers
- ✓ Future impacts on ATS Voice Communications- G/G link (VoIP Radios), A/G link (VDL Mode 2/4)
- ✓ Overview of future SIP/SDP– RTP signalling etc
- ✓ Examples of SIP/SDP/RTP printouts

Module 8: Voice Communication System- Recorder functionality

- ✓ Legal voice recording requirements - ICAO SARP Annex 10, Volume II, Chapter 3.5: "General Procedures for Recording and retention of ATC communications".
- ✓ What is recorded? DA, IA, IDA, Radio, Ambient Microphone, Call logging
- ✓ Long Term recording
- ✓ Short Term Recording
- ✓ UTC Time stamped
- ✓ Incident recording
- ✓ Playback
- ✓ Redundant Voice recorder
- ✓ Locations to record voice
- ✓ Analogue/Digital Voice recorders
- ✓ Call logging requirements
- ✓ Foreseen migration towards SIP Recorder interfaces

Summary of course-
Course Evaluation
Certificates