

**INTERNATIONAL CIVIL AVIATION ORGANIZATION
SOUTH AMERICAN REGIONAL OFFICE**

**FOURTH INFORMAL MEETING ON THE PLANNING AND
IMPLEMENTATION OF THE SAM DIGITAL NETWORK**

(REDDIG/4)

(Lima, 4 to 8 September 2000)

Agenda Item 2: REDDIG Training program

(Presented by the Secretariat)

Summary

This working paper presents for the meetings discussion, matters regarding the training program considered in the REDDIG implementation project. The plan is aimed at training the technical staff of the States in order that they will be able to carry on efficiently the network operation and maintenance.

1. Introduction

1.1 The present working paper is aimed at presenting to the meeting the training plan considered in the REDDIG implementation project.

1.2 The plan is aimed at training the States technical staff in order that they can assume the installation, operation, maintenance, expansion and management of the network in an efficient way, regarding hardware and software.

1.3 The training plan considers the implementation of three theoretical-practical programs, and the on job training (OJT) in each node, as well as the provision of the necessary material. The section 9.1 of the Technical specifications document details the objectives intended to acquire with the training program. The training programs and another matters in this regard, are detailed below.

2. Theoretical-practical training program

2.1 This program will be developed once in three different places: Lima-Peru and Montevideo-Uruguay both in Spanish language and in Recife-Brazil in English language. The host States should provide the installation for the proper development of the programs.

2.2 Each program to be developed considers 15 participants and 10 fellowships are included which will be distributed with a maximum of two fellowships and 3 participants for each REDDIG node.

2.3 Since the training program is theoretical-practical, the project has considered the beginning of the course whenever the nodes are installed.

2.4 The appendix A of this working paper specifies the details of the training programs as well as the courses that should be included. The section 8.2 of the technical specification document specifies the training documentation that must be provided by the contractor.

3. On job training program (OJT)

3.1 The on job training is aimed at providing to the CAAs technical maintenance staff the required experience and handling on the equipment and systems to be provided.

3.2 The OJT will be developed in each REDDIG node during its installation, and comprises the training of a maximum of five technical experts in each place.

4. Profile of the CAAs technical staff that will participate in the training programs

4.1 The technical staff that should participate in the training programs must be involved with the international and local communications of the ATS speech circuits, the aeronautical fixed telecommunications network AFTN, as well as the recent transmission and switching.

4.2 The REDDIG training program is not oriented to provide the first level knowledge on the abovementioned matters, but the technical staff is supposed have the background about that matters.

4.3 According with the project document RLA/98/019/B/01/15, the participant States will select and nominate candidates for the training program, adopting the measures deemed necessary for their retention in the at service at least during the two years following the training completion. When training is given abroad, the State must provide the round trip air tickets for the participants.

5. **Suggested actions**

5.1 The meeting is invited to discuss the matters presented in this working paper and to consider:

- a) The theoretical-practical program and the on job training included in the Technical specifications document and in the appendix A.
- b) The possibility of developing the courses in the foreseen States according with what is indicated in this working paper.
- c) The selection and the profile of the participants, as well as their nomination.
- d) The supplementary actions that should be taken by the States to get the maximum advantages from the REDDIG training program.

APPENDIX A**COURSE 1 INTRODUCTION TO THE COMMUNICATION DIGITAL
NETWORK OF OPEN ARCHITECTURE**

Length: 16 hours (minimum)

Objective: To provide first and second level of theoretical knowledge, regarding the open architecture of the digital communication network, putting emphasis on ISDN, FRAME RELAY, X.25, ATM and ETHERNET networks, the network synchronization, and communication protocols as TCP/IP, OSI networks, routers and bridges, SNMP and CMIP.

Topics

Primary E1 and T1 multiplex;

- a) physical interfaces;
- b) speeds;
- c) frames;
- d) CRC codes;
- e) synchronization.

ISDN

- a) theory of operation;
- b) PCM codification and voice comprehension algorithms;
- c) ISDN channels;
- d) number 7 and EURO-ISDN signaling system;
- e) QSIG signaling system;
- f) 3B+D and 6B+D mapping;
- g) ISDN interfaces; and
- h) standards.

FRAME RELAY

- a) operation theory;
- b) frame relay components;
- c) virtual circuits;
- d) UNI and NNI interfaces;
- e) access devices; and
- f) congestion handling.

X.25

- a) concepts;
- b) physical , link and network layers;
- c) PVC and SVC circuits;
- d) X.121 numeration plan; and
- e) PAD.

APPENDIX A (Cont)

ATM

- a) concepts;
- b) layers structure;
- c) adaptation layers functions;
- d) cells structure;
- e) physical layer; and
- f) native and frame relay access interfaces.

ETHERNET

- a) Theory of operation;
- b) components;
- c) frames;
- d) scheme and routing; and
- e) 10 base T interface.

OSI NETWORKS

- a) model;
- b) model layers;
- c) connection less network protocols (CLNP);
- d) OSI routers; and
- e) CMIP protocol.

TCP/IP

- a) model;
- b) model layers;
- c) protocol;
- d) address resolution protocols (ARP);
- e) bridges;
- f) routers; and
- g) SNMP

APPENDIX A (Cont)

**COURSE 2 INTRODUCTION TO SATELLITE
COMMUNICATIONS**

Length: 10 hours (minimum).

Objective: To provide the first and second level of knowledge in satellite communications, inter-operation with earth networks and measures that must be done.

Topics

Introduction

- a) satellite communication systems;
- b) space segment;
- c) earth segment; and
- d) earth network connections.

Space segment

- a) orbits;
- b) stabilization;
- c) position;
- d) frequency bands;
- e) transponders;
- f) frequency reuse;
- g) delay;
- h) type of beams and satellite footprint;
- i) geographical advantage;
- j) sun interferences; and
- k) troposphere variations (scintillation).

Earth segment

- a) block diagram of a typical station;
- b) thermal noise, noise figure, equivalent temperature noise;
- c) Antenna systems, antennas, feeders, OMT, filters and its required parameters;
- d) selection of site;
- e) measurement of the satellite pointing angles;
- f) LNA, down converters;
- g) Up converters, HPA and
- h) Monitoring.

APPENDIX A (Cont)

Base band communication systems

- a) PSK modulation;
- b) FSK modulation;
- c) modulation efficiency;
- d) error rate probabilities;
- e) convolution codes (FEC);
- f) calculation of the bandwidth;
- g) typical modems;
- h) doppler buffer; and
- i) synchronization with terrestrial networks.

Media access techniques

- a) access techniques: FDMA, TDMA and CDMA;
- b) algorithms: alfa and its variations.

Earth station design

- a) objectives of the design;
- b) free space losses;
- c) additional losses in the atmosphere;
- d) interferences, cross polarization;
- e) C/N and Eb/No relations; and
- f) link budgets;

VSAT networks

- a) description;
- b) components;
- c) type of services;
- d) type of access;
- e) network configuration; and
- f) interconnection to the terrestrial networks; IDSN, Frame Relay and ATM.

Measurements techniques

- a) Power;
- b) Frequency;
- c) spectrum;
- d) I/Q modulation; and
- e) BER.

APPENDIX A (Cont)

**COURSE 3 INTRODUCTION TO REDDIG ARCHITECTURE,
INTEGRATION WITH THE CURRENT NETWORKS, AND TESTS**

Length: 4 hours (minimum)

Objective: To provide a detailed version of the architecture, function, installation, commission, operation and maintenance of the supply.

Topics

Systems integration

- a) architecture and configuration of the REDDIG;
- b) technical description of the system function;
- c) network synchronization;
- d) installation techniques and procedures;
- e) provision commissioning (tests);
- f) network expansion and its systems;
- g) hardware and software platform of the elements programming;
- h) network operation under technical and user perspective;
- i) remote control and monitoring of the network;
- j) human-machine interface;
- k) commands and basic reports of the platform;
- l) platform diagnostic and trouble shooting;
- m) maintenance procedures;
- n) emergency procedures; and
- o) technical documentation handling.

APPENDIX A (Cont)

COURSE 4 MULTIPLEXING AND SWITCH SYSTEM

Length: 2 hours (minimum)

Objective: To provide first, second and third level of knowledge, regarding the operation, installation, tests, maintenance, diagnostic, management, SDCM operation. Explain the multiplexing and switching techniques of packages and circuits, and the personnel be familiar with the own installation.

Topics

Hardware

- a) Introduction
 - a.1) description of the packages switching subsystem;
 - a.2) description of the ISDN subsystem; and
 - a.3) description of the multiplexing subsystem (FRAD);
- b) control panels, tests, adjustments and measurements,
- c) installation, configuration, expansion and programming;
- d) included tests (BITE);
- e) drop/insert techniques to monitor and test aggregate voice and data circuits;
- f) techniques for measurement of voice and data user circuits;
- g) use of specialized instruments (protocol analyzers, measurements of bite error rate, decibel-meter, generators, etc.);
- h) maintenance program;
- i) diagnostic and search of failures, alarm interpretation and emergency procedures; and
- j) components replacement.

Operation

- a) operational description;
- b) use of the facilities; and
- c) operation in degraded and normal way.

APPENDIX A (Cont)

Software

- a) Introduction
 - a.1) description of the software modules;
 - a.2) local and remote operation;
- b) commands, human-machine interface language;
- c) configuration, supervision, control and programming;
- d) identification, location, diagnostic, solution of failures and alarm interpretation;
- e) emergency procedures, cold and hot start, and automatic restart;
- f) Data bases:
 - f.1) routing tables;
 - f.2) service class tables;
 - f.3) close group of users;
 - f.4) search group;
 - f.5) type of circuits, signalling, compression;
 - f.6) number tables of directory/equipment number;
 - f.7) doors statement, interfaces, protocols;
 - f.8) definition of PVC circuits; and
 - f.9) programming of DLCI, CIR Bc, Be, traffic priorities;
- g) call segments;
- h) analysis of statistics, reports, log-book;
- i) definition of PVCS, SVCS, DLCI, enrouting, etc.
- j) measurement of traffic, occupation, length of band, bite error rate, etc.; and native equipment commands.

Hardware and software exercises

- a) Practical exercises over equipments;
 - a.1) a commutation and multiplex system;
 - a.2) a protocol analyzer;
 - a.3) a drop insert; and
 - a.4) generator, decibelmeter, frequencymeter, etc.

APPENDIX A (Cont)

COURSE 5 VSAT SYSTEM

Length: 12 hours (minimum)

Objective: To provide first, second and third level of knowledge on operation, installation, tests, maintenance, diagnostic, to explain the techniques of the digital transmission ways by radio, satellite, fiber, etc. and let the personnel be familiar with the provision installation.

Topics

Hardware

- a) introduction;
- b) installation;
- c) configuration, expansion and programming;
- d) tests, adjustments, measurements, BITE and control panels;
- e) antennas, appointment and maintenance;
- f) measurement techniques;
- g) use of specialized instruments (measures of BER rate, spectrum analyzer, constellation analyzer, decibel-meter, generators, wati-meter, etc.);
- h) maintenance program;
- i) identification, diagnostic, location and solution of failures, alarm interpretation and emergency procedures; and
- j) replacement of components and adjustments.

Operational description.

Software

- a) introduction;
- b) description of software modules;
- c) local and remote management;
- d) commands, language human-machine;
- e) configuration, supervision, control, programming and measurements;
- f) identification, diagnostic, location, solution of failures and alarm interpretations;
- g) emergency proceedings, cold and hot start, automatic restart;
- h) data base;
- i) analysis of the statistics, reports, log-book; and
- j) native equipment commands.

APPENDIX A (Cont)

Hardware and software practices:

- a) Practice equipment;
- a.1) VSAT terminal;
- a.2) adjustable frequency transponder;
- a.3) adjustable attenuators;
- a.4) wati-meter;
- a.5) spectrum and constellation analyzer;
- a.6) bit error rate measurements device;
- a.7) generators;
- a.8) protocol analyzers; and
- a.9) measurers of distortion, modulation, S/N (E_b/N_o).

APPENDIX A (Cont)

COURSE 06 UNINTERRUPTED ENERGY SYSTEM

Length: 4 hours (minimum)

Objective: To provide first, second and third level of knowledge on the operation, installation, tests, maintenance and diagnostic of the uninterrupted energy system.

Topics

Hardware:

- a) Introduction:
 - a.1) system description;
 - a.2) rectifier subsystem description;
 - a.3) batteries subsystem description;
 - a.4) energy distribution subsystem description;
- b) Dimension, expansion, installation and connection;
- c) cold and hot start, tests and adjustments,
- d) measurements of electric parameters and control panels;
- e) periodic maintenance program;
- f) trouble solutions, components replacement and adjustments;
- g) emergency procedures;
- h) incorporated BITE tests;

Software

- a) diagnostic and failure search at local level;
- b) diagnostic and failure search at remote level;
- c) alarm interpretation and log-book handle;
- d) adjustments, meters;
- e) configuration and programming;
- f) periodical and statistical records;
- g) emergency procedures and cold and hot start.

Hardware and software practices

- a) Practice equipment;
 - a.1) Rectification subsystem;
 - a.2) batteries bank; and
 - a.3) instruments.

APPENDIX A (Cont)

COURSE 7 NETWORK MANAGEMENT SYSTEM (NMS)

Length: 12 hours (minimum)

Objective: To provide the first, second and third level of knowledge, in operation, installation and in the correct use of the NMS, to carry out the configuration, telesupervision, telecontrol, telemaintenance, remote diagnostic, report broadcasting, etc.

Topics

Hardware

- a) NMS architecture;
- b) Hardware description in each one of the nodes;
- c) BITE built-in tests;
- d) Functional description of the system operation;
- e) Work stations and other NMS elements;
- f) Standing, installation, commission and expansion;
- g) cold and hot start;
- h) emergency mode; and
- i) periodical maintenance program.

Software

- a) software and data base architecture;
- b) protocols;
- c) software operation description;
- d) cold and hot start, emergency procedures;
- e) tests, adjustments, measurements of parameters and control panels;
- f) operative system, commands and utilities;
- g) initialization, and system cold and hot recharge; emergency procedures;
- h) human-machine interface language;
- i) modifications, module additions, compilation, and executable build;
- j) programming, configuration, control and supervision;
- k) maintenance procedures and management of the data base and its commands;
- l) alarm handling: reports, interpretation and proceedings;
- m) identification, diagnostic, failure search, supervision points and software traps; and
- n) periodical and corrective maintenance procedures.

APPENDIX A (Cont)

Hardware and software practical exercises

- a) Practical exercises
 - a.1) one job station; and
 - a.2) REDDIG systems and equipment.

On job training (OJT)

The OJT is aimed at permitting that the technical maintenance staff of the CAAs gets experience and practice in the systems supplied.

The OJT must be developed in each REDDIG node during the installation process, systems and equipment start. The interoperation of the systems, the VSAT antennas pointing and the preliminary tests with the satellite communication service provider.

The OJT must complete the theoretical-practical training subprograms, regarding RF systems on the VSAT terminal (tests, measurements, fault analysis, etc.).

The training during the OJT must be made with the local technical staff who are present during the installation process in a number not bigger than five (5).

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