ATNP/WG1 IP
ATNP/WG2 WP503
ATNP/WG3 IP 15-06

AERONAUTICAL TELECOMMUNICATION NETWORK PANEL (ATNP)

Working Group 1,2,3

(Honolulu, 18-29 January, 1999)

Agenda Item:4.2

Japanese ATN Development and Implementation Plan

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INFORMATION PAPER

Summary

Japan plans to carry out full scale ATN implementation commencing in 2005. In preparation for this implementation, development and evaluation research has been in progress at the Ministry of Transport's Electronic Navigation Research Institute (ENRI) since 1996.
Japan has also launched the ATN Application Development and Evaluation (A^2DeE) Project, as part of which the ENRI ATN Simulation Testbed (EAST) is being prepared. The development of original components of EAST for the Japanese environment, such as the ATN router, CM and CPDLC, has been completed while applications such as AIDC and ADS are being developed gradually. A2-DeEP incorporates the International Connection Experiment plan, and a connection experiment with Eurocontrol was successfully conducted at router level in December 1998.

1. Introduction

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This paper introduces the ATN Development and Implementation Plan, the EAST configuration, the Eurocontrol connection experiment plan, which is part of the International Connection Experiment, and the result of a connection experiment at router level.

2. Outline of ATN Development and Implementation in Japan

2.1. ATN Implementation Draft Plan

ATN implementation is planned to proceed as follows.

For air/ground operation, preparations will be made between 2000 and 2004 to be ready for the start of operations in 2005. NOPAC will be the first area to be covered. AMSS (MTSAT, INMARSAT) and VDL will be utilized, if possible, as the air/ground sub-network.

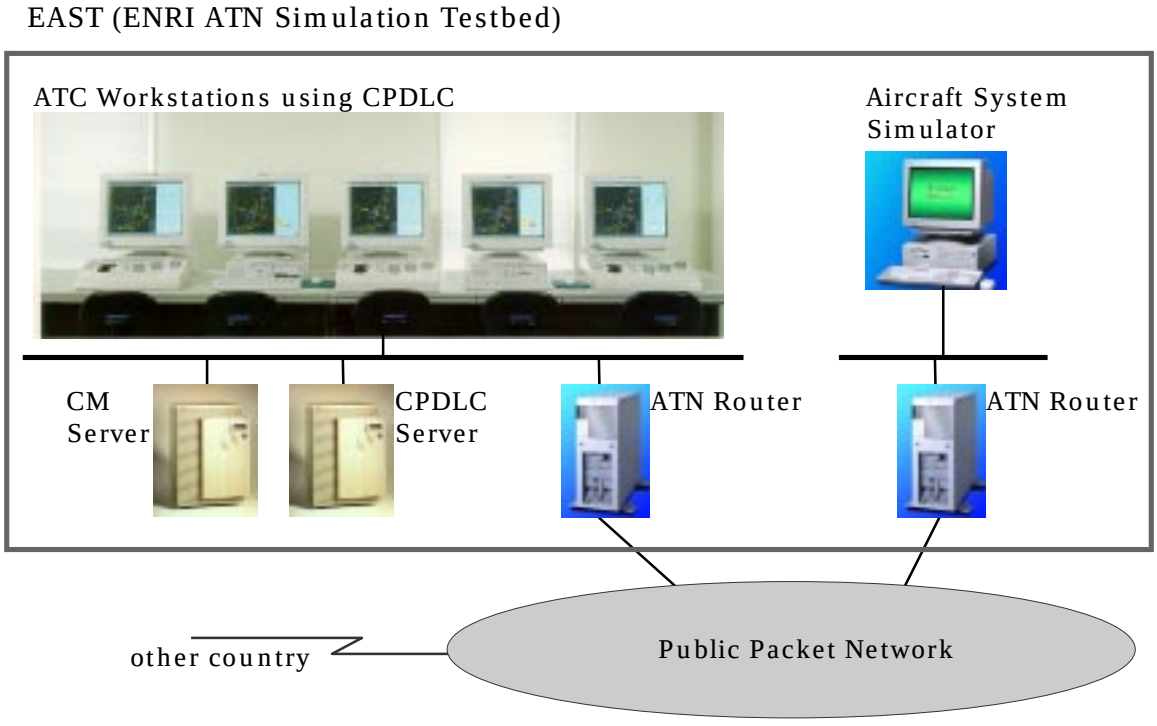


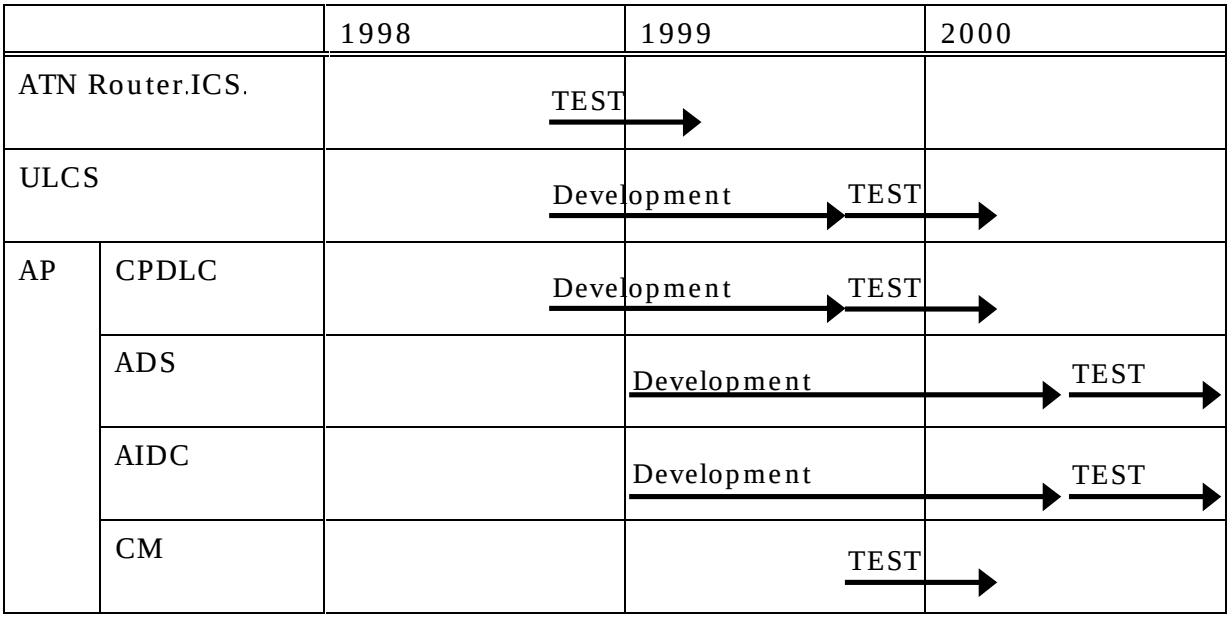
Figure1 EAST image diagram

Applications will be ADS, CPDLC, FIS and CM.
The ground/ground operation plan is based on AMHS and AIDC. Operation based on AMHS will commence between Japan and the U.S. in 2000 3Q. Operation based on AIDC will commence in 2001 or later.

2.2. Development and Evaluation Research Plan

To realize the above-mentioned ATN Implementation Plan, research was started on the ATN router, CM, CPDLC and other components in 1996 and will continue through to 2000. This research project is called the ATN Application Development and Evaluation (A^2DeE) Project.
The project started with local experiments at router level in Japan. Network load during data transmission has been tested using a dummy transmission line in place of the air/ground sub-network.
With an understanding that the most important task before implementation is to evaluate mutual interoperability, it was decided that the research project include connection experiments with other countries for the purposes of clarifying and resolving problems resulting from differences in interpreting ICAO SARPs between Japan and other countries before proceeding to implementation.
With this aim, an international connection experiment with Eurocontrol has been scheduled to run from 1998 3Q through to 2000. This experiment is intended to test the mutual connectivity and compatibility of ICS and UPCS as well as CPDLC and ADS, all at protocol level. Details of the experiment plan are presented later in this paper.

The primary schedule of the experiment is as follows.



3. Introduction to EAST

3.1. System Configuration

The planned final configuration of EAST is shown in the block diagram below. Development of shaded blocks has already been completed at the time of writing.

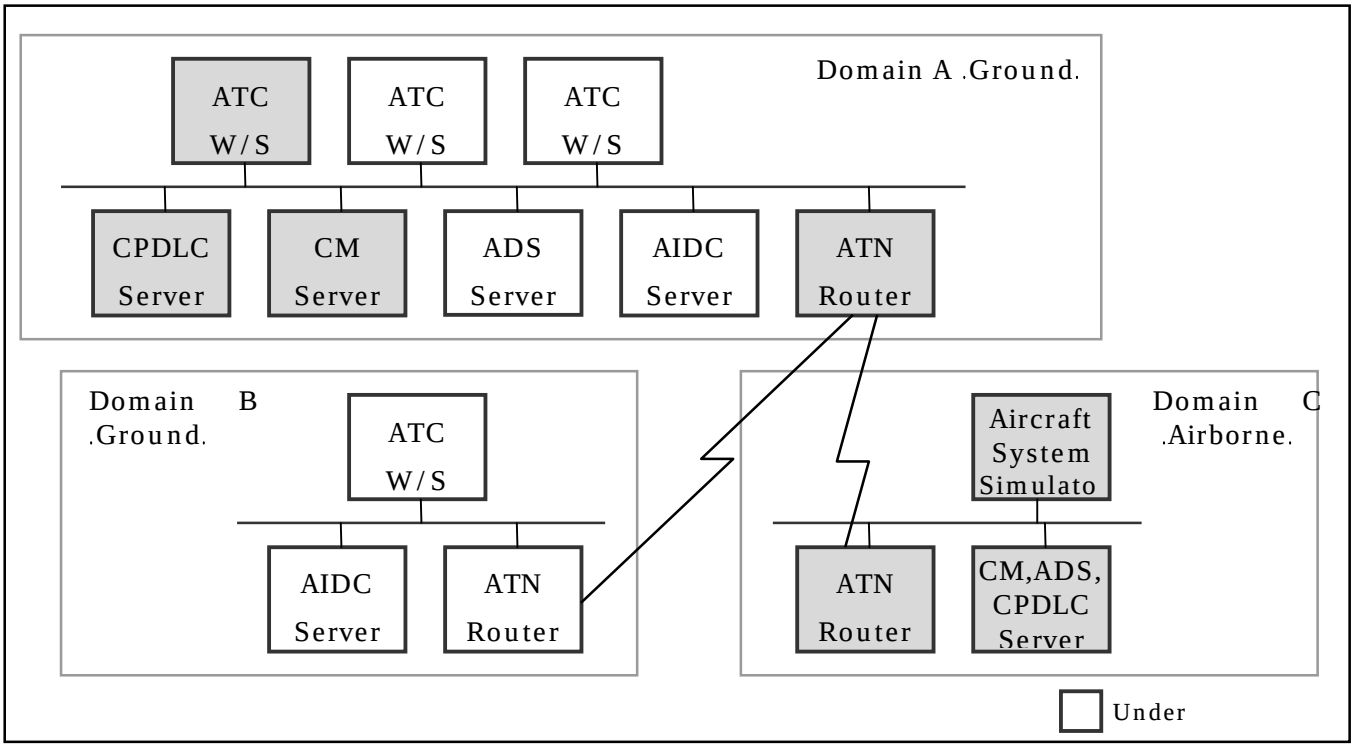


Figure 2 Configuration of EAST (ENRI ATN Simulation

The total system comprises three domains; two ground domains and one airborne domain.

The ATC Workstation is a user interface device for control and it is equipped with the minimum test functions needed for the connection experiment. The user interface for CPDLC is the subject of a separate study.

The Aircraft System Simulator has been developed to evaluate the ground system, and is equipped with the CPDLC, ADS and CM components of an airborne system.

The X.25 interface will be employed for connection between ATN routers. In the international connection experiment, the public packet network will be used to connect with a router in the destination country.

The present system including routers employs Microsoft Windows NT as its operating system. For the AP Server, however, a change to UNIX is under consideration.

3.2. Protocol Stack

The figure below shows the EAST protocol configuration.

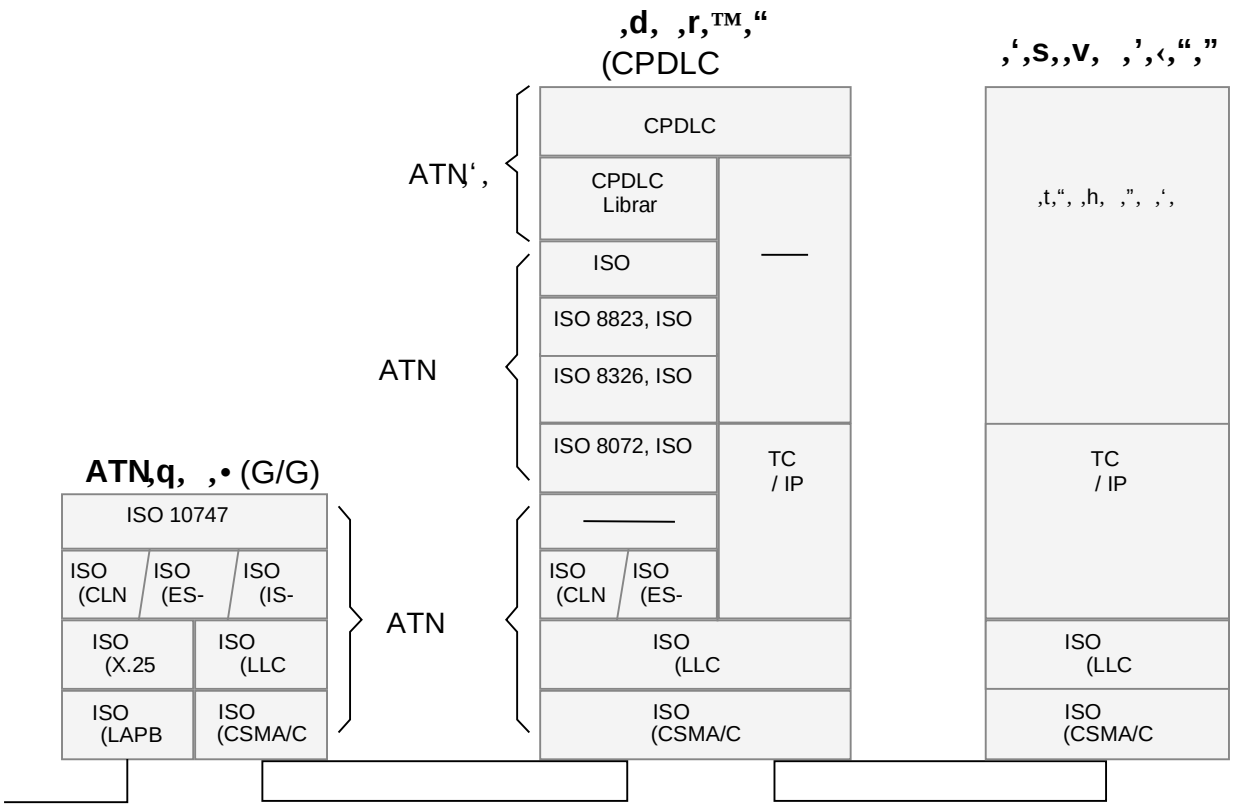


Figure 3 EAST Protocol Stack

3.3. Development Policy

Development of EAST is proceeding under the following policy.

For ICS and ULCS, all items that are regarded as mandatory in PICS are to be developed. Development of each optional item shall be determined as required, considering its research requirements and necessity for the international connection experiment.

For applications, development is limited to items for which research is considered to be necessary and to the service items and data items which are required for the international connection experiment as defined by ANSI. For CPDLC, for example, the Forward service is not provided at present. At present, about one third of the total number of CPDLC messages have been developed.

4. Introduction to the Eurocontrol Connection Experiment

This section introduces the experiment for connection with Eurocontrol, which is one of the tasks in the A²DeE project.

4.1. Experiment Schedule

It is planned to split the Eurocontrol connection experiment into a number of steps as below, and to conduct experiments for each layer. For the system configuration at each step, please refer to the attached document (Attachment 1).

Description of Experiment Schedule

	Description of Experiment	Experiment Period
Step1	ICS	1998.4Q.1999.1Q
Step2	ULCS and AP.CPDLC.	1999.4Q.2000.1Q
Step3	AP.ADS.	2000.3Q.2000.4Q

4.2. System Configuration for Router Connection Experiment

The router connection experiment will be conducted in two configurations. One configuration is as shown below and needs no direct intervention from Eurocontrol. In this configuration, data transmitted from Japan are returned by the router on the Eurocontrol side so that data are effectively transmitted and received between terminals on Japanese side. Two domains will be established in Japan and one in Eurocontrol, and Japan and Eurocontrol will be connected via three packet communication networks (TRANSPAC, VENUS-P and INS-P) operated by network providers.

Table 1 shows the parameters of this experiment.

The other configuration will be the opposite to the above, and data will be returned from the router on the Japanese side.

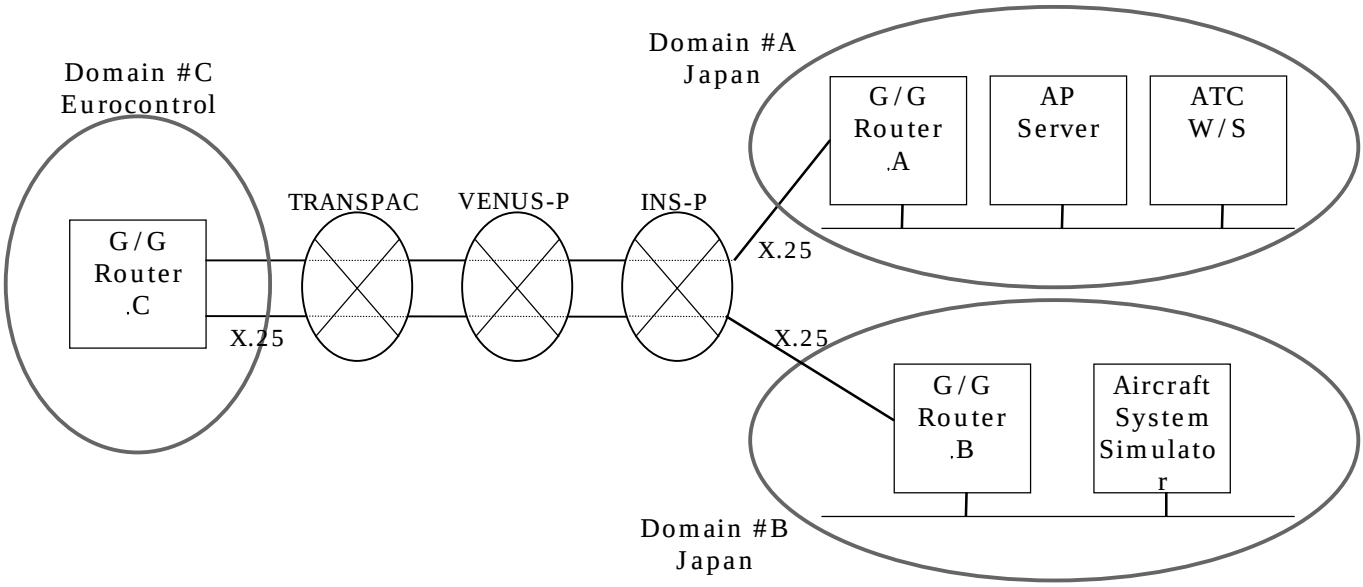


Figure 4 Configuration of Connection Experiment at Router

4.3. Experiment Description

The connection experiment at router level is to test transmission and reception between routers in basic sequence on each PDU and to check the validity of relevant operations (such as of the incorporated routing information).

Major experiment items are:

(1) Router connect and route addition
(2) Multiple Router connect and route addition
(3) Router disconnect and route delete
(4) Normal data transmission
(5) Data transmission during terminal malfunctions
(6) Data transmission when there are malfunctions between Routers
(7) Malfunctions between Routers and Router re-connection

4.4. Experiment Result

The first connection experiment with Eurocontrol was carried out on 17-18 December, 1998 in the configuration under which data were returned by the router on the Eurocontrol side. All experiment items were confirmed satisfactorily, including routing information exchange and the reception and transmission of data between routers.

Table 1. Parameters

Category	Items	Domain #A (Japan)			Domain #B (Japan)		Domain #C (Eurocontrol)
		CM TEST Terminal	CPDLC TEST Terminal	G/G-RT#A	G/G-RT#B	CM_CPDLC TEST Terminal	G/G-RT#C
IDRP	RDI	-	-	470027814A50 4E00000001	470027814A504 E00000002	-	4700278145555 200454332
	NLRI	-	-	470027814A50 4E00000001	470027814A504 E00000002	-	4700278145555 200454332
	Security ID	-	-	06042B1B0000	06042B1B0000	-	06042B1B0000
	Security Tag	-	-	ATSC Class A	ATSC Class A	-	ATSC Class A
	Hold Time (sec)	-	-	180	180	-	180
	KEEPALIVE send timer (Sec)	-	-	60	60	-	60
ES-IS	CT(sec)	30	30	30	30	30	-
	HT(sec)	65	65	65	65	65	-
CLNP	Security	ATSC Class A	ATSC Class A	ATSC Class A	ATSC Class A	ATSC Class A	ATSC Class A
	QOS	Global Unique	Global Unique	-	-	Global Unique	-
	Priority	0x0A	0x0A	-	-	0x0A	-
	Partial Route Recording	NET Number =3	NET Numner=3	-	-	NETnunmer=3	-
COTP Class 4	TSEL	01	02	-	-	01 (CM Test Terminal) 0202CPDLC TEST TerminalCP	-
	Re-send Timer (sec)	5	5	-	-	5	-
	Number of re-send	7	7	-	-	7	-
	Max TPDU length	1024	1024	-	-	1024	-