The Planning & Management System of the Low level Radioactive Waste Transportation

K.Tanaka [1], *K.Yoshida* [1], *J.Miyamoto* [1], *T.Sanui* [1], *T.Noura* [2], *K.Kitanishi* [3] *and S. Nara* [3]

[1] Nuclear Fuel Transport , Tokyo, Japan

[2] Transnuclear, Tokyo, Japan [3] Fuji Electric, Tokyo, Japan

INTRODUCTION

Nuclear Fuel Transport Co, Ltd. (hereafter called NFT) was the first in Japan to transport low-level radioactive waste (LLW). It is now engaged in preparatory operations with the slogan "Improved Safety and Reliability" and is introducing advanced mechanization systems to provide safety and reliability in software management such as transportation planning and transportation information management. The following is an introduction of these systems, which provide overall support in transportation planning determination and transportation management operations related to the LLW transportation cycle.

BACKGROUND TO THE INTRODUCTION OF THE SYSTEMS

The transportation and burial of LLW involves the transportation and collecting a large number of drums (approx. 25,000 drums a year) from many nuclear power stations. Safety and reliability from the time the waste is generated, through transportation, and up till the time of burial, are of the utmost importance during this process, and a highly reliable method of central management of a large amount of information and data is essential.

In Japan, to set up such a centralized data management system, research has been carried out since 1989, in the Joint Study by electric power companies, on conditions overseas (for example, the Tracking system used in France) and on the introduction of such systems.

Furthermore, a working group was set up within the Federation of Electric Power Companies (FEPC) to investigate methods directly applicable to the transportation and burial of LLW starting from 1992, and a method was adopted by which the accumulated data in the calculators of each organization are transferred on floppy disks rather than an on-line system such as the Tracking system, and arrangements were made regarding the items of data to be transferred and their format.

NFT also carried out independent research in 1989 on the automation of transportation-related operations. In 1990, based on the results of this research and the decision of the above-mentioned working group, NFT established a basic policy of automation centred on transportation planning and management systems.

DETAILS OF THE INVESTIGATION

(1) LLW Transportation Operations Analysis and Basic Structure of Automation

The flow of packagings or packages in LLW transportation is shown in Figure 1.

The packagings are used many times. The transportation ship moves around Japan during the cycle of delivery of empty packagings to the nuclear stations and collection of full packagings from the nuclear power stations. The main operation of LLW transportation involves the management and monitoring of the safe implementation of transportation in accordance with the plan required to set up the transportation cycle, all the time taking account of port conditions, the requirements of individual nuclear power stations, and other restrictions.

Details of the operation are given in Table 1. The effects of automation of these operations were analysed, and items in which improvements in labour-saving and safety could be made were systematized. The basic structure of the system is as follows.

(Basic Structure of System)

- Planning system
  - Transportation planning preparation function
- Management systems
  - Distribution of packagings or packages management and monitoring function
  - Transportation condition monitoring function
  - Transportation documentation management function
  - Radiation information management function

(2) Outline of System Functions (See Figure 2.)

1. Transportation Planning Preparation Function

This function is used to draw up and revise the overall plans covering the entire range of LLW transportation operations. The transportation plan is devised taking into consideration conveyance and burial planning and the practical utilization of transportation packagings. Navigation plan of vessel, operating plan of packagings, and licensing plan are then devised on the basis of this plan.

A unique feature of this function is that a transportation plan can be drawn up interactively on the computer display using a mouse.

2. Distribution of packagings or packages Management and Monitoring Function

The ID number of packaging can be read by means of FAMDAS, a device which automatically reads the ID number assigned to the transportation packaging at each distribution point in the LLW transportation. By combining this information with the package data received from the power company, it is possible to manage distribution, such as the preparation of loading and unloading plans, and to monitor the distribution conditions, such as confirming the level of radioactivity of transportation packagings and confirming the whereabouts of transportation packagings.

3. Transportation Condition Monitoring Function

The LLW vessel is equipped with GPS (Global Positioning System) equipment which enables its position

to be determined automatically. This information is communicated by computer via a maritime satellite (INMARSAT), enabling the location of the vessel to be monitored at all times from the land. An example of a display of the vessel location is shown in Figure 3.

4. Transportation Documentation Management Function

Various documents, such as application forms to the authorities, must be prepared for LLW transportation, and, because the number of packagings involved in each transportation is large, the amount of information to be handled also is very large. As a result, the required information (transported material data etc.) is obtained from the power company on a floppy disk and it is confirmed by automatic calculation that the transported materials satisfy the requirements of the transportation regulations. Necessary data for application documents and the documents can be prepared using those data.

Examples of Application Document
Notification of transportation of radioactive substances
Transportation report for nuclear fuel and other substances
Application form for confirmation of radioactive package transportation planning safety
Dangerous substance loading inspection application form
Dangerous substance detailed statement.

5. Radiation information management Function

This function is used to store and manage personal exposure management information and radiation level of the transportation vehicles as measured before the start of transportation at Mutsu-ogawara port.

(3) Configuration of System Facilities

The configuration of the system facilities is shown in Figure 1.
Computers are located at the head office (Tokyo) and at the Rokkasho office (Aomori prefecture) and are connected on line via the NTT network.

Moreover, communication computers are installed in the transportation vessel and data concerning the vessel cargo handling information and the transportation packagings are transferred between the land-based computer systems by means of maritime satellite communication lines.

The head office is equipped with a computer for transportation planning and a computer for transportation management. These two computers are compatible and can back each other up in the unlikely event of a breakdown.

FUTURE PLANS

The planning system is to be put into practical application after the empty transportation packaging distribution plan has been determined in 1992. The installation of the computers for the management system has now been completed and trial operation adjustments are to be made in parallel with the distribution of empty packagings to prepare for the transportation of full packagings from around December 1992.

Item		Operation details	
		Human operations	Mechanizations/OA
PLANNING	1 Preparation of transportation plan	· Collecting information by tel and fax · Manual calculation, handwritten plans · Fax communication	· Collecting information by tel and fax · Automatic calculation, mechanical printing
	2 Preparation of details plan · Licensing plan · Vessel operation plan · Packaging operation plan	· Manual calculation, handwritten plans · Communication by forms · Issue of slips	· Automatic calculation, mechanical printing · Automation of issuance of slips
MANAGEMENT/MONITORING	1 Monitoring of transportation condition	· Data collection & monitoring by tel, fax and telex · Checking by mean of planning table	· Automatic data inputing · High-level monitoring
	2 Monitoring of transportation result	· Data collection by tel and fax · Result data collection totalization, daily report preparation from slips	· Automation of collection & totalization · Sorting of monitoring data & management data
	3 Management of distribution of packagings	· Data collection by tel & fax; sorting & referencing by management using ledger and by visual and handwritten means	· Automation of data collection: high-speed referencing of monitoring & management data
	4 Management of cargo operation results	· Collection & totalization of results by using slips	· Simplification of inputting: high-speed and abbreviated record preparation
	5 Management of packagings	· Stock & history management control by ledger	· Automatic management of stock & history
	6 Management of transportaion documents	· Manual sorting of data lists · Handwritten documents	· Mechanization of preparation of data lists · Mechanical printing

Table 1 LLW Transportation Business Operations

Fig-1 Flow of Materials and Concept of LLW Transportation Planning & Management System

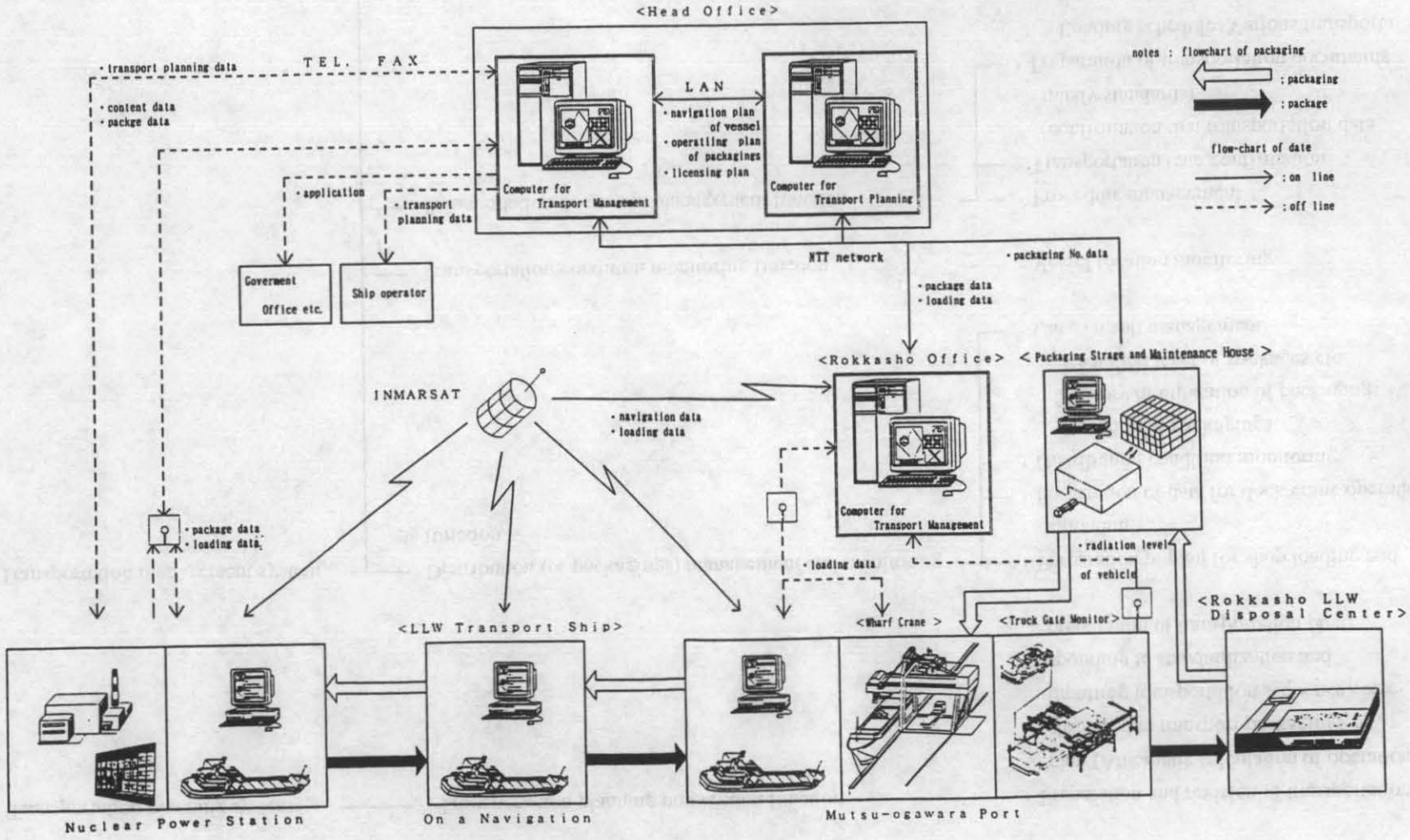

Figure 2 Outline of System Functions

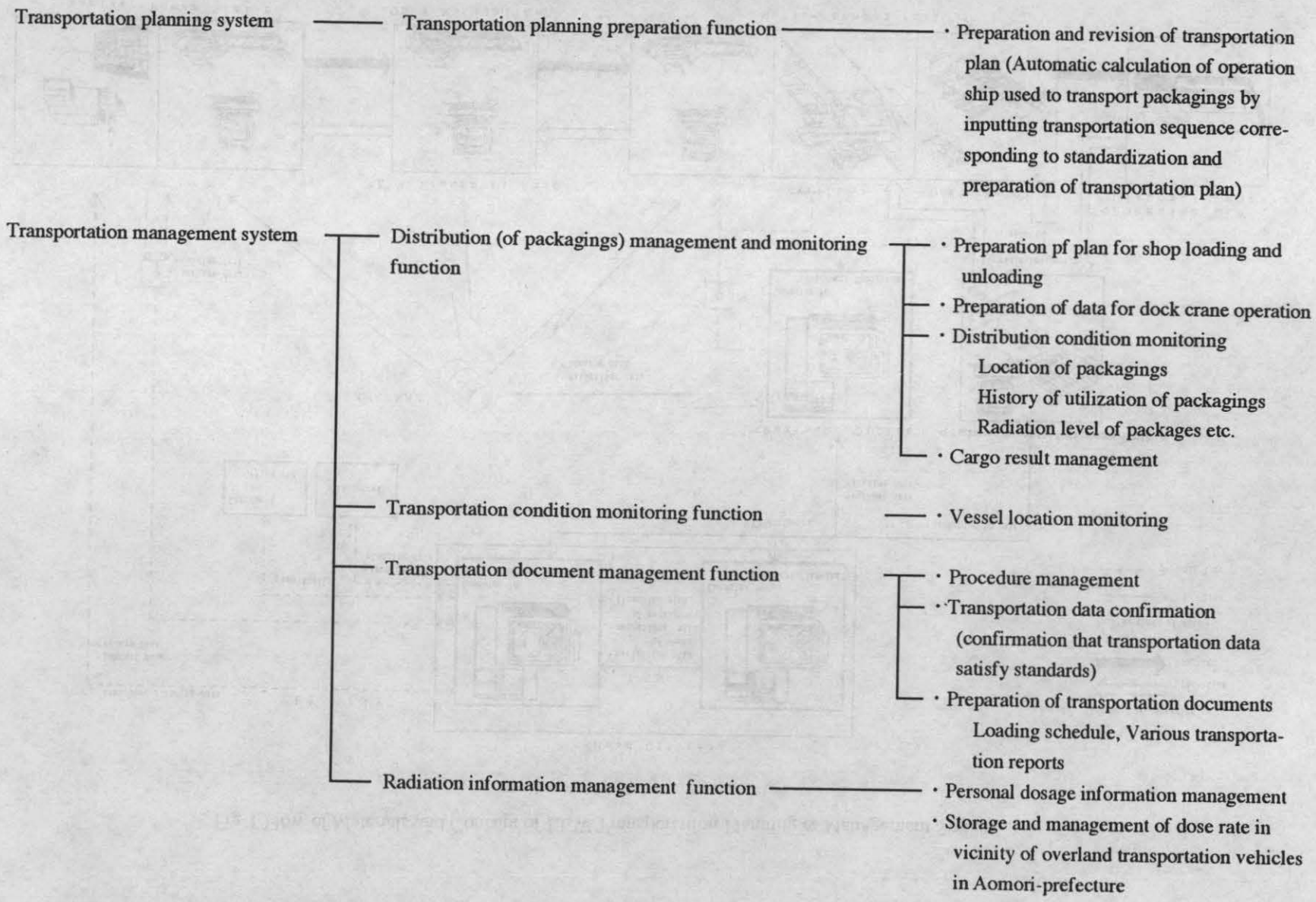

Figure 3. Example of display of LLW Transportation Vessel Location