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Worldwide Household Goods Information System for Transportation Modernization (WHIST-MOD) Conceptual Design

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ORNL/TM-11298

Energy Division

WORLDWIDE HOUSEHOLD GOODS INFORMATION SYSTEM FOR TRANSPORTATION MODERNIZATION (WHIST-MOD) CONCEPTUAL DESIGN

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ACRONYMS

AC	Area Command
AUTODIN	Automatic Digital Network
CERS	Carrier Evaluation and Reporting System
COBOL	Common Business-Oriented Language
DB2	An IBM Relational Database Management System
DBMS	Database Management System
DOD	Department of Defense
FO	Field Office
GBLOC	Government Bill of Lading Office Code
HHG	Household Goods
IBM	International Business Machines
IQCP	International Quality Control Program
ITO	Installation Transportation Officer
LAN	Local Area Network
MAV	Management Assistance Visit
MTIM	MTMC's Information Management Directorate
MTMC	Military Traffic Management Command
MTPP	Directorate of Personal Property, MTMC
MTPP-C	Rate Acquisition Division of Personal Property Directorate
MTPP-M	Management Support Office of Personal Property Directorate
MTPP-Q	Operations and Quality Assurance Division of Personal Property Directorate
MVS	[IBM mainframe operating system]
NFS	Network File Sharing protocol
NTS	Nontemporary Storage
ORACLE	[Relational Database Management System and family of software products]
ORNL	Oak Ridge National Laboratory
PC	Personal Computer
PPSO	Personal Property Shipping Office
QA	Quality Assurance
RDBMS	Relational Database Management System
RDDIP	Required Delivery Date Improvement Program
RSMO	Regional Storage Management Office
SAS	Statistical Analysis System
SQL	Structured Query Language
TOPS	Transportation Operational Personal Property Standard System
UNISYS	[Hardware and software vendor]
WHIST	Worldwide Household Goods Information System for Transportation
WHIST-MOD	WHIST Modernization

ABSTRACT

The Directorate of Personal Property of the Military Traffic Management Command asked Oak Ridge National Laboratory to design a decision support system. This report describes the proposed Worldwide Household Goods Information System for Transportation Modernization (WHIST-MOD). It is the result of an analysis of user requirements and the constraints imposed by the available hardware and software. Two hardware/software options and two data source options are presented.

This report advocates a user-driven system that will require several organizational adjustments. These include creating additional tasks, such as data administration and maintenance and modification of the system, as well as requiring additional training for present and proposed staff. Prototyping will be used for translating user needs into a finished design. A recommendation is made on how to proceed. WHIST-MOD will be an evolving system, designed to meet the dynamic needs of the personal property organization.

EXECUTIVE SUMMARY

The Worldwide Household Goods Information System for Transportation Modernization (WHIST-MOD) system being designed by ORNL will be a decision support system for the various organizations of the Military Traffic Management Command (MTMC) that establish and implement the Personal Property Movement and Storage Program. The Personal Property Program would be greatly aided in its role of program evaluator and policy setter by the development of a decision support system. The portion of WHIST-MOD that ORNL is designing will be primarily a decision support system and will upgrade the present WHIST system. WHIST-MOD will provide decision support capabilities to Directorate of Personal Property, MTMC (MTPP) staff through a centralized database and a powerful set of information management tools.

The WHIST-MOD decision support system will be flexible enough to track the effects of evolving policy within the Personal Property Program, offering easy access to a large selection of data elements to users with minimal computer experience while also offering analysts the capability to formulate complex queries and perform special studies. WHIST-MOD will be designed as a set of tools and strategies that will initially be used to develop a group of prototype applications. The system should be viewed from its inception as dynamic and evolutionary in nature, requiring long-range commitment and support from MTPP.

As the primary user representative, MTPP must ensure adequate support for system and data administration, training, and system maintenance and modification functions. MTPP has already started in this direction and has indicated a willingness to build the required infrastructure of hardware, software, and personnel. MTPP staff are also very supportive of the WHIST-MOD design efforts and are eagerly anticipating the implementation of the WHIST-MOD system.

The foundation of the WHIST-MOD system will be a large database that will be available for querying and reporting, with varying degrees of access, to all WHIST-MOD users. Users will need accurate information if they are to make good decisions based on WHIST-MOD data. Because WHIST-MOD data will come primarily from other systems, data administration will be crucial if users are to rely on the WHIST-MOD data. Data administration will include checking, correcting, and filtering of data that will be contained within the WHIST-MOD database. This effort will require MTMC staff dedicated to performing systems and data administration functions.

WHIST-MOD will be an evolutionary system. As users become more comfortable with the system, they will begin to build their own applications or at least to identify requirements for new applications. A maintenance and modification staff will be necessary to keep the WHIST-MOD system current.

Before the WHIST-MOD project proceeds, several decisions must be made. There are two hardware (and subsequent software) options and two data source options for WHIST-MOD. The two hardware options are (1) to run the WHIST-MOD applications on a command-wide mainframe or (2) to run the WHIST-MOD applications on an MTPP application server. Because it is projected that a command-wide mainframe suitable for WHIST-MOD processing may not be available for five years, we recommend the application server option. MTPP microcomputers will be linked to the application server workstation via a local area network (LAN). MTMC will test the effects of placing the fileserver on the MTMC LAN versus the MTPP LAN before this decision is made.

The two data flow options are (1) to upload the majority of the WHIST-MOD data from the Transportation Operational Personal Property Standard System (TOPS) or (2) to use other data sources in lieu of TOPS. Because the TOPS system is not currently available and its deployment

is uncertain at this time, we recommend prototyping the WHIST-MOD system using existing data sources such as Claims Center data, Finance Center data, and Automatic Digital Network (AUTODIN) messages.

The options cause a degree of uncertainty until decisions are made. There are several additional areas of uncertainty associated with this system. For the command-wide database machine, MTMC has chosen the Teradata DBC/1012. The acquisition schedule for this machine is uncertain. The MTMC Autostrad 2000 architecture has not been defined. Also, the implementation schedule for TOPS is unclear.

There are three possible strategies for continuing the development of WHIST-MOD:

- proceed with the design of WHIST-MOD under the assumption that uncertainties involving the MTMC system architecture and the implementation of TOPS will either be resolved before a major investment is made in WHIST-MOD or will have minimum impact on WHIST-MOD development,

- delay the design of WHIST-MOD until the uncertainties with system architecture and the future of TOPS have been resolved, or

- develop a first version of WHIST-MOD that is less dependent on the capabilities and use of the Teradata and the successful implementation of TOPS.

The third strategy entails the least amount of risk for MTPP because it provides a version of WHIST-MOD that brings the power of a user-based decision support system to current work processes while temporarily postponing the capability to access the wide range of data offered by TOPS. Because the Personal Property Program is currently relegated to the unfriendly interface of the Honeywell DPS8 computer or a data-less microcomputer, the third strategy would represent a large step forward and would allow the staff of the Personal Property Program to satisfy a number of needs identified in the Requirements Analyses. With the workstation acting as an application server for WHIST-MOD, a minimum of redesign will be needed when TOPS comes on-line. Because the application server will be able to store sufficient historical data, the Teradata's implementation schedule will not be critical to the implementation of WHIST-MOD. As the major uncertainties now facing WHIST-MOD are removed, it should be possible for the implementer to initiate a separate but parallel effort to begin the next version of WHIST-MOD that integrates TOPS output and new MTMC system capabilities.

1. INSTITUTIONAL SETTING

1.1 GENERAL COMMENTS

The WHIST-MOD system being designed by ORNL will be a decision support system for various MTMC organizations that establish and implement the Personal Property Movement and Storage Program. This section discusses the Personal Property Program's organization, tasks, and responsibilities, and the influences of the institutions and the attitudes of the people working in the program on WHIST-MOD.

1.2 ORGANIZATIONAL STRUCTURE

The Personal Property mission is administered by a Headquarters MTPP office, two Area Commands (ACs), and two Field Offices (FOs). MTPP has three divisions: Rate Acquisition (MTPPC), Quality Assurance and Operations (MTPP-Q), and Management Support (MTPP-M). The Personal Property Directorate is charged with the overall management of the U.S. Department of Defense (DOD) program that moves and stores the personal property of service members. MTPP sets policy, promulgates and interprets regulations, evaluates program effectiveness, solicits rates, approves carriers, and acts as the principal source of information concerning the transportation of personal property to a variety of external entities. In order to perform these tasks, MTPP needs to extract and analyze data from its various databases and information sources. MTPP has both operational and decision support needs.

The ACs consist of two divisions: Traffic and Storage. The Traffic Division provides personal property traffic management services for military service installations and activities within each AC's appropriate area of responsibility and exercises technical traffic management surveillance over the shipment and temporary storage of the personal property of DOD personnel. The ACs have both operational and decision support needs.

The Storage Division of each AC consists of two Regional Storage Management Offices (RSMOs) that manage the DOD program for nontemporary storage (NTS) of government-sponsored household goods (HHG) in commercial warehouse facilities. The RSMOs are operational offices that negotiate rates and contracts with storage contractors, approve and inspect storage facilities, and provide functional guidance to Personal Property Shipping Offices (PPSOs). They also perform internal management and internal decision support activities.

The FOs have responsibilities similar to those of ACs. The FOs' mission is to supervise the DOD Personal Property Shipment and Storage Program in their respective areas. To fulfill this mission, they conduct Management Assistance Visits (MAVs), provide technical assistance and training, perform technical analyses and studies, and exercise technical supervision over intra-theater rate negotiations and contract functions applicable to the program.

1.3 CURRENT AUTOMATION SUPPORT

The Personal Property Program functions are described in further detail in the Oak Ridge National Laboratory (ORNL) documents "Requirements Analysis for the Worldwide Household Goods Information System for Transportation Modernization at Headquarters," February 13, 1989; "Area Command/Regional Storage Management Offices Requirements Analysis," April 27, 1989; and "Field Office Requirements Analysis," May 1, 1989.

The analysis of MTPP shows that the decision support functions of the program are mostly unautomated despite mission-specific needs to provide policy definition and oversight. MTPP staff spend the majority of their time manually gathering, organizing, checking, and distributing data; supplying information to other federal agencies; and interacting with carriers concerning data problems. For example, a major effort is required to produce information for the *Quarterly Traffic Management Progress Report*. Little effort can be expended in analyzing the data in this report or in considering alternative report presentations because of the time consumed in producing the report.

At the directorate level, MTPP is supported by a command-sponsored central computer system with management information support provided by MTMC's Information Management Directorate (MTIM). Access to management information data currently contained in WHIST is limited to preprogrammed Common Business-Oriented Language (COBOL) reports and an ad hoc query system that is resident on the Honeywell DPS8 computer. Neither mechanism allows MTPP personnel to retrieve data directly, and most requests to display or manipulate information require MTIM to modify or write a COBOL program.

At the individual level, the Personal Property Program has taken the initial steps toward automation. Most of the staff at MTPP, the ACs, and the RSMOs have microcomputers and access to a variety of software packages. Many of the action officers and clerks have developed microcomputer programs to help them perform their jobs. Efforts at data sharing are beginning to develop; however, these efforts are fragmented and not standardized.

1.4 INSTITUTIONAL ATTITUDES TOWARDS AUTOMATION

The WHIST-MOD development effort is supported at every level of the organization. The management and staff are pro-automation, and MTPP supports a user-driven system. There do not appear to be any entrenched interest groups that would oppose WHIST-MOD development. Staff members are excited about the capabilities the WHIST-MOD system will bring. In fact, many have already envisioned automation possibilities beyond the scope of the WHIST-MOD decision support system.

2. HARDWARE, SOFTWARE, AND DATA SOURCE OPTIONS

The two most significant decisions that must be made concerning the WHIST-MOD system involve the hardware/software configuration and the source of the data. The primary hardware decision concerns whether a mainframe or an application workstation will better serve MTPP. The collection of software must be selected that best complements the hardware procured. The major data source issue concerns the availability of TOPS data. If TOPS is not available, other data sources must be pursued. Figure 2.1 displays the available options in a matrix. All options provide the same functionality when the same data are available.

2.1 FEATURES COMMON TO ALL OPTIONS

All of the options have several points in common. First, the main database for WHIST-MOD will be housed at MTMC. This database will provide varied levels of access to WHIST-MOD users. Second, WHIST-MOD will initially act as a clearinghouse for communications flowing from any part of WHIST-MOD to other systems, such as TOPS. However, in the future this may not be the case for information sent from the RSMOs. Also, in all options both the hardware and connectivity of RSMOs and ACs remain the same. Additional items that have commonalities are discussed below.

2.1.1 RSMOs

Each RSMO will have a UNISYS 5000/80 minicomputer with several terminals, including microcomputers acting as terminals. The ORACLE Relational Data Base Management System (RDBMS), running on the UNISYS 5000/80, would support data entry, management, and analysis applications for the RSMOs. Initially, the MTPP UNISYS 5000/80, located at MTMC, will store data needed from the RSMOs for the WHIST-MOD database. After the data arrive at MTMC, they will be forwarded to the TOPS switcher for distribution to TOPS sites and/or processed and inserted into the main WHIST-MOD database.

2.1.2 Area Commands

Each AC will have one or two workstations connected to WHIST-MOD via high-speed modems operating over commercial dial-up telephone lines. This arrangement will give AC users access to all reporting applications and most standard analysis applications available at MTPP, as if they were nodes on the MTPP LAN.

To satisfy the AC's need for information from the Installation Transportation Offices (ITOs) before a MAV, applications that produce reports relevant to the MAV will be run on the TOPS field computers. These reports could be run by the ITOs at the request of the AC personnel and sent to the AC before a MAV or run during the MAV.

HARDWARE OPTIONS \ DATA FLOW OPTIONS		
	TOPS on COMMAND MAINFRAME	EXISTING DATA FLOWS on COMMAND MAINFRAME
	TOPS on APPLICATION SERVER	EXISTING DATA FLOWS on APPLICATION SERVER

Fig. 2.1. WHIST-MOD option matrix.

2.1.3 WHIST-MOD Data Administration Minicomputer

The quality of decisions a WHIST-MOD user makes is dependent on the accuracy and quality of the data on which the decisions are based. Because of the need for absolute accuracy, ensuring the quality of the data maintained by WHIST-MOD is a critical task. We propose that the WHIST-MOD UNISYS 5000/80 minicomputer support the tools for this task.

Data enter the main WHIST-MOD database by two main portals: the DPS8(s) and the UNISYS 5000/80. Rates data would be processed through the COBOL programs running on the DPS8(s) and stored on the command database machine, a Teradata DBC/1012. Data from Finance Centers and Claims Centers would come into the WHIST-MOD UNISYS 5000/80 data administration minicomputer via tapes or modem.

Data from other systems must be reformatted, filtered, checked, and corrected before they can be added to the WHIST-MOD database. Data formatting, filtering, and most of the checking will be done automatically by applications on the data administration machine, which is a UNISYS 5000/80. These data checks will generate exception reports identifying data that should be examined by the data administrator. Other checks and all corrections to the data will require the intervention of a data administrator. When the data administrator accepts the data, applications on the data administration machine will be used to cast the data into the required formats.

The WHIST-MOD data administration machine will also provide data to the TOPS switcher when necessary. Rates data stored on the Teradata will be retrieved, reformatted from Teradata format to TOPS ORACLE format, and forwarded to the TOPS switcher. Also, NTS storage rates will be uploaded from the RSMO's computers to the data administration machine, then passed to the TOPS switcher for distribution to the TOPS field computers.

2.1.4 Honeywell DPS8(s)

WHIST-MOD has a continuing requirement to collect and manage rates data. Because the rate acquisition and management programs exist on the DPS8(s), it is expected that the DPS8(s) will continue to perform this function. The DPS8(s) run large COBOL applications against many MTMC databases. These databases are expected to be migrated to the Teradata over the next few years. Because the Teradata supports queries embedded in COBOL, eventually these programs could run on the DPS8(s), or their replacement, against the Teradata databases.

2.1.5 Other Systems Interfacing with WHIST-MOD

Other systems will interface with WHIST-MOD. These include TOPS, the Claims Centers' computer systems, and the Finance Centers' computer systems. These systems will provide data to WHIST-MOD through the data administration machine.

2.2 HARDWARE AND SOFTWARE OPTIONS

In this section the distinctive characteristics of the hardware (and accompanying software) options are discussed. The functions of each hardware component are summarized in Fig. 2.2.

Function	Option 1	Option 2
Data Admin. Machine	Unisys 5000	Unisys 5000
Rate Acquisition	Honeywell DPS8	Honeywell DPS8
Database Machine	Teradata DBC 1020	Teradata DBC 1020
Application Server	IBM 3090	Sun 4/280
User Machine	Terminals	Unisys Micros.

Fig. 2.2. Whist-Mod hardware by function.

2.2.1 Option One: Mainframe and Terminals

The first hardware option would allow user access via terminals to a mainframe running the report, query, analysis, and data entry applications required to support WHIST-MOD. This arrangement is illustrated in Fig. 2.3. The mainframe would be channel-connected to a Teradata database machine containing the WHIST-MOD central database. This configuration would provide the quickest access to data, the best applications development environment, and the most control over the data.

The Teradata allows users the ability to make simple queries on, enter data into, and generate some reports from the information in the database. However, WHIST-MOD has a requirement to provide a user-friendly interface to the database that will allow ordinary users to access the data in their own business terms through application screens. Tools to support and build these screens are found in RDBMSs that can interface with the Teradata. A large host machine will be necessary when the applications are built and many users are accessing the system simultaneously. To support MTMC's processing requirements, the optimum host for the Teradata would be a powerful processor that channel-attaches directly to the Teradata. This host should have been supported by Teradata long enough for potential interface problems to have already been worked out.

The host should support a RDBMS to simplify communication with the Teradata's relational databases. This database package should have Structured Query Language (SQL) capability that is compatible with the Teradata's SQL querying capability. Also, because Teradata Corporation is committed to keeping its SQL current, the host's RDBMS vendors should demonstrate the same commitment.

The Teradata host should also support a powerful statistical analysis package with easy-to-use graphic output capabilities. This package should provide users with the ability to apply complex statistical analysis to their data without having extensive programming or mathematical skills. It should allow users to easily specify the data set to which statistical tests should be applied. The package also must be able to interface directly with the RDBMS because the volume of data WHIST-MOD will deal with is very large, a situation that makes it necessary to use the RDBMS to retrieve and filter data before the statistical package receives it.

Of the available hardware that meets the criteria outlined previously, an International Business Machine (IBM) mainframe running the MVS operating system would provide the most diverse tool set and the best development environment for use with the Teradata. It is our understanding that MTIM's goal is to have a large front-end machine such as an IBM 3090 connected to the Teradata within five years. The actual selection of a mainframe will be dependent on the dynamics of competitive acquisitions and funding levels. For the purposes of this option, it is assumed that this new front-end machine would not immediately replace the DPS8(s) because of the expense of porting the large amount of COBOL code running on the DPS8(s).

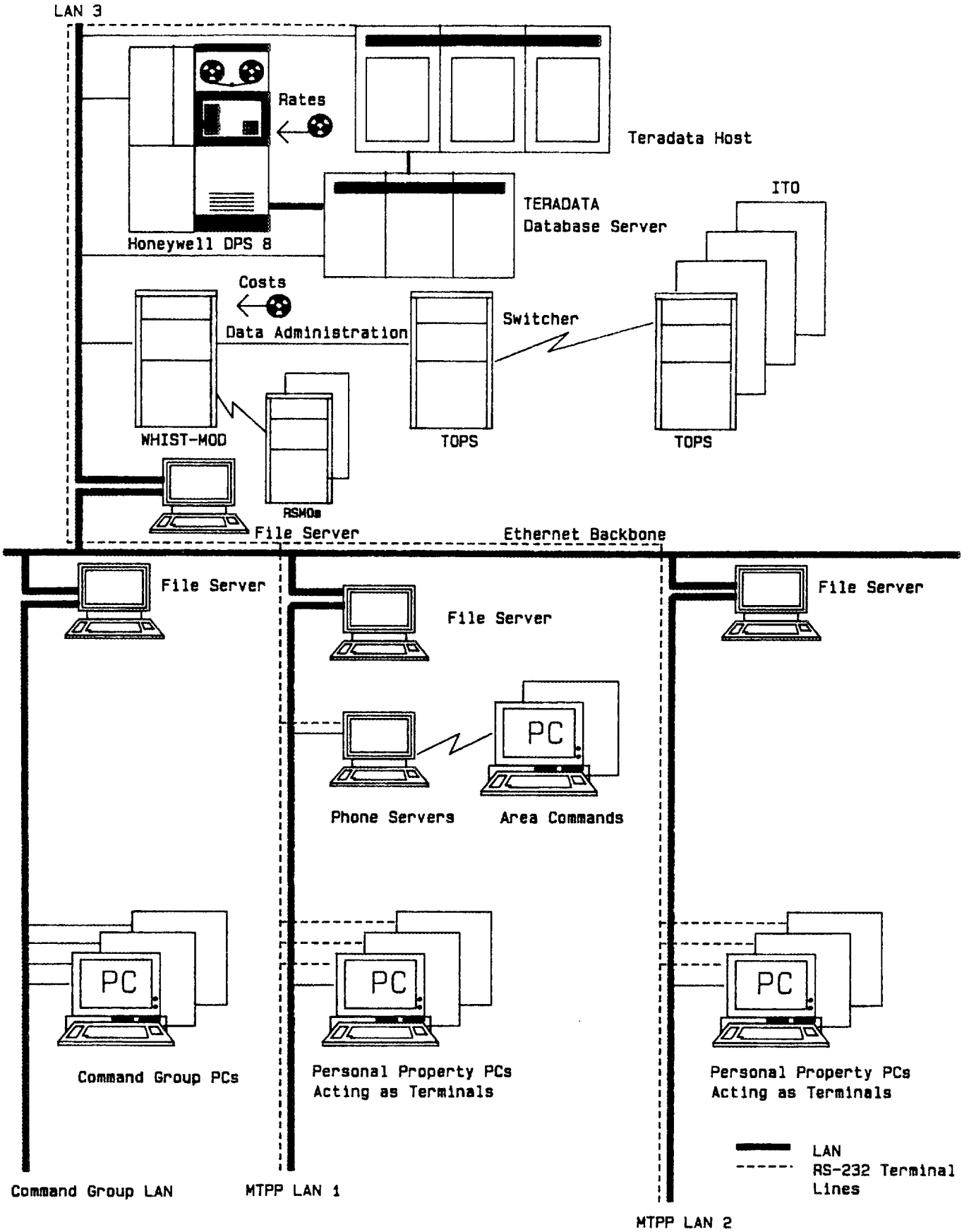

Fig. 2.3. Mainframe and terminals configuration.

If an IBM mainframe is purchased, we propose that DB2 be the RDBMS for WHIST-MOD because DB2 is a leader among RDBMSs on IBM mainframes. It has a tool set capable of supporting the sophisticated user interface, queries, and reports that WHIST-MOD users will require. In addition, DB2 would allow the knowledgeable user to create a temporary database for analysis and modification purposes and easily fill that temporary database from the central database on the Teradata. Finally, the evolution of SQL is closely tied to developments in DB2, so both DB2 and Teradata SQL could be expected to stay synchronized.

Statistical Analysis System (SAS) is recommended for the statistical package to be run on an IBM mainframe. As the standard statistical package for ORNL, SAS has been proven to be able to support a large organization with diverse and large statistical analysis needs. It provides a powerful statistical analysis environment, a good user interface, and excellent graphics display capabilities. In addition, it is the industry leader in statistical analysis packages. SAS provides a product that interfaces DB2 with SAS. This would let users query data from the Teradata via DB2, perform statistical analysis on the data, and generate graphic displays of the data or results.

The combination of SAS and DB2 running on a large IBM that is channel-attached to the Teradata would benefit both the WHIST-MOD users and developers. Because SAS and DB2 appear to be well integrated, the WHIST-MOD applications developed within this environment could be easily designed to present a seamless interface between machines and among different data manipulation tools.

While the IBM or a comparable front-end machine would support the WHIST-MOD applications and host the users, the Teradata would be the location of the definitive copy of the WHIST-MOD database. Because the Teradata is designed for storage and high-speed querying of very large databases, WHIST-MOD users accessing the Teradata through the mainframe would have the computing power to quickly manipulate the entire WHIST-MOD database containing at least five years of data. In addition, since the Teradata supports SQL embedded in COBOL, it would allow the command to use the strengths of an RDBMS without abandoning its investment in the existing COBOL programs.

2.2.2 Option Two: Application Server

Because we do not expect MTMC to purchase a mainframe computer to support user applications for the next several years, we recommend a second hardware option for the design, prototyping, and implementation of WHIST-MOD. In both hardware options the Teradata holds the central WHIST-MOD database, and the data acquisition and administration tasks are performed by the DPS8s and the UNISYS 5000/80 respectively. In addition, the data sources options supplying WHIST-MOD are the same for both hardware options. Finally, the same type of sophisticated user interface for querying, reporting, and analyzing the data would be provided under either option. The design and functionality of WHIST-MOD applications should not have to be changed to accommodate either option.

As shown in Fig. 2.4, the primary visible difference between the options is that Option Two uses a large UNIX-based workstation to host MTPP's applications instead of a large mainframe that would host all of MTMC's applications. The large workstation, or application server, and the data administration computer would send data to and receive data from the Teradata over the MTMC LAN instead of being channel-connected. Also, the user's microcomputers or workstations would

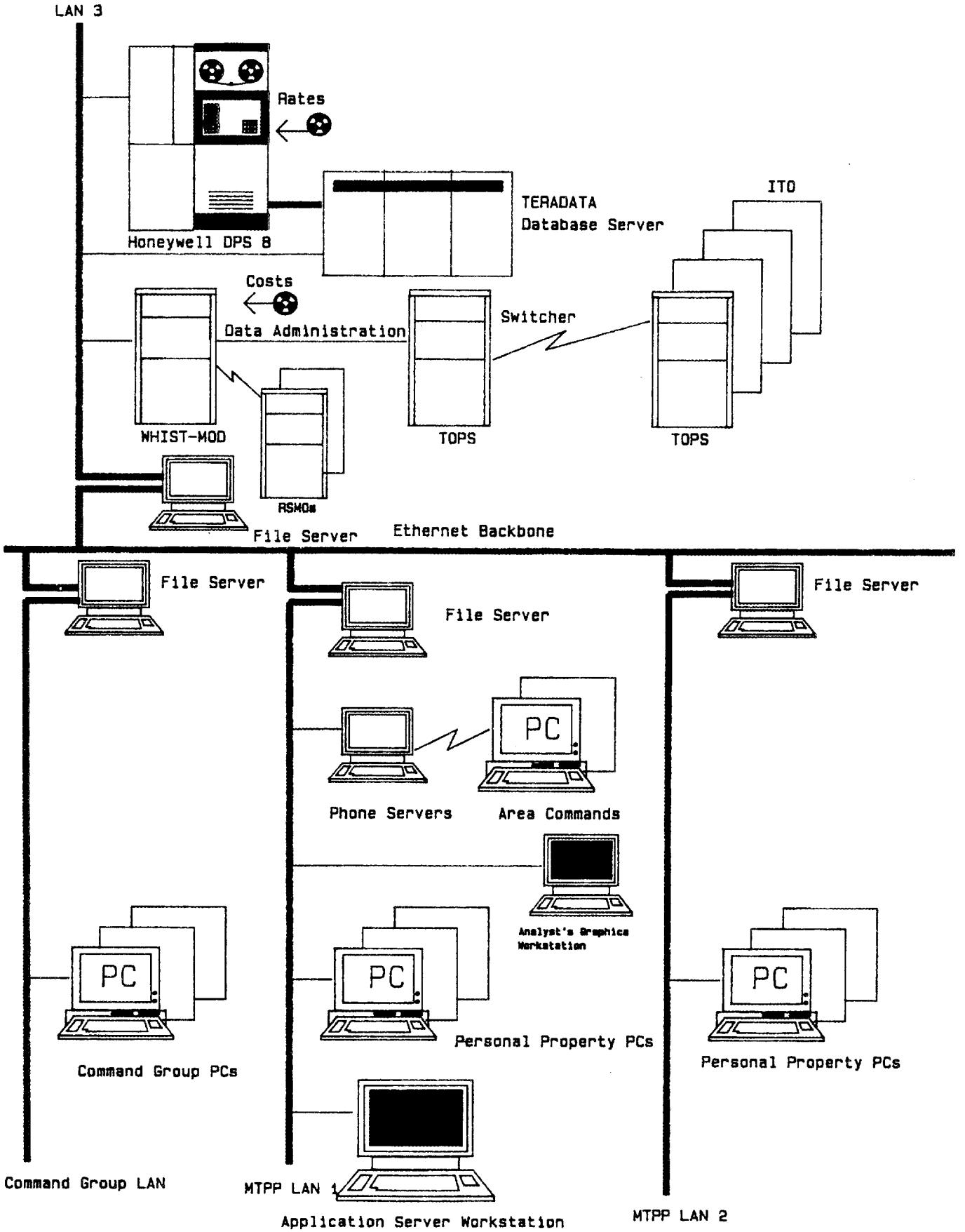

Fig. 2.4. Application server configuration.

be connected to the applications server by the LAN instead of by terminal lines as in the first hardware option. The only machine channel-attached to the Teradata would be the DPS8(s). We also recommend an additional workstation to act as a backup to the application server workstation. This second workstation would have enhanced graphics capabilities and would serve additional analysts.

Because the application server does not have a very high-speed link with the central database on the Teradata and because the software tools available on the applications server do not integrate closely with the Teradata, a copy of the central database would need to be resident on the application server. The application server would be able to query the Teradata and send data to the Teradata in batches over the LAN. For routine processing the users would interact with the database on the application server. Two advanced software development and implementation packages would facilitate the use of data on the application server: an RDBMS and a statistical analysis package. One of these should provide easy-to-use graphic output. A powerful RDBMS is necessary to evaluate large amounts of data. This RDBMS must have tools to build the sophisticated user interface and reports needed for WHIST-MOD, or it must be able to interface with tools that accomplish those tasks. The statistical analysis package should provide users the ability to apply complex statistical analyses to their data without requiring extensive programming or mathematical skills. Because the volume of WHIST-MOD data is large, it will be necessary to use the RDBMS to retrieve and filter data before passing it to the statistical package. To prototype WHIST-MOD, we have chosen the ORACLE RDBMS and the SAS statistical analysis and graphics package. Among available RDBMS packages, we believe that ORACLE best provides the functionality to support WHIST-MOD. Furthermore, ORACLE is the RDBMS for the TOPS system and for the RSMOs, ACs, and FOs.

As discussed under Option One, SAS is our choice for a statistical analysis package. In addition, at least one vendor whose workstations support both ORACLE and SAS works closely with the Teradata.

The functionality supported by the second option is the same as that in the first option, but the way that functionality is supported and delivered is considerably different. In this option, the applications would be hosted on an application server and would be designed to operate over a LAN. The recommended software packages that support the applications are designed to allow distributed processing using the LAN and the processing power of both the application server and the users' microcomputers. ORACLE allows the application server to host the database and the kernel of the RDBMS while the microcomputers are running the screen manager, SQL*Forms. The two parts communicate over the LAN using the SQL*Net software. SAS allows the SAS code to be downloaded from the application server to a microcomputer via the LAN. When SAS is loaded to the microcomputer, it uses the Network File Sharing (NFS) protocol to access files produced by the ORACLE-SAS bridge on the application server as if they were local to the microcomputer.

This option avoids the cost of a large mainframe host and cushions the development schedule from slippage in the Teradata acquisition schedule. Because the application server workstation would have a large amount of disk storage space, the design and development of the user applications can proceed independent of the acquisition of the Teradata. The only part of the WHIST-MOD design that requires the use of the Teradata is testing the reformatting software that moves data between the ORACLE RDBMS and the Teradata. This work could be left until late in the design process, allowing considerable time for the Teradata to come on-line before affecting the WHIST-MOD schedule.

2.3 DATA FLOW OPTIONS

In this section the distinctive characteristics of each data flow option will be discussed. Each of these options can be supported by either of the previously mentioned hardware options.

2.3.1 Option One: WHIST-MOD with TOPS Data

The first data flow option (Fig. 2.5) relies on TOPS to provide all pertinent shipment descriptive and shipment Quality Assurance (QA) data. This data will be entered into the TOPS machine at each installation and transmitted overnight via modem to the TOPS switcher machine. After the data from all of the installations are transmitted to switcher, a copy of the data will be transferred to the WHIST-MOD data administration minicomputer. The WHIST-MOD data administration machine will then extract the data elements required by WHIST-MOD, format records for the WHIST-MOD application server and Teradata table structures, and transmit the files to the WHIST-MOD application server and Teradata machines via the MTMC LAN. Under this option, additional data from the Finance and Claims Centers not collected in the TOPS system will be loaded onto the WHIST-MOD data administration minicomputer from magnetic tape. These data will be loaded and audited for quality during normal working hours as tapes are received from the various centers (monthly). Once the appropriate quality checks have been run, the data will be formatted to the WHIST-MOD and Teradata table structures and transmitted, via the MTMC LAN, to both the WHIST-MOD application server and Teradata machines.

Data from TOPS are expected to be of a high quality because of the edit checks built into the TOPS data entry screens. These data should also be very timely because they are transmitted nightly via TOPS switcher.

2.3.2 Option Two: WHIST-MOD without TOPS Data

The second data source option (Fig. 2.6) provides a higher degree of certainty of data collection within the current WHIST-MOD development scheduling constraints. The functionality is identical to the TOPS data source option. The difference between this option and the first is that in this option shipment data and shipment QA data are not received from TOPS but come into WHIST-MOD from a variety of sources.

Shipment QA data currently comes to MTPP via AUTODIN messages from the installations. These messages are received by the Communications Center and ported to the DPS8(s), where they can be corrected within certain limits and used to produce QA reports for MTPP. Unfortunately, once the report is printed, the data are purged from the DPS8(s). Currently Carrier Evaluation and Reporting System (CERS) carrier summary data, Required Delivery Data Improvement Program (RDDIP) data, and International Quality Control Program (IQCP) data are received via AUTODIN messages.

Under this option the WHIST-MOD data administration machine would accept the file used to print the QA report from the DPS8(s) and process it for storage in the WHIST-MOD database. In addition, it could host applications to allow manual entry of data supplied on forms.

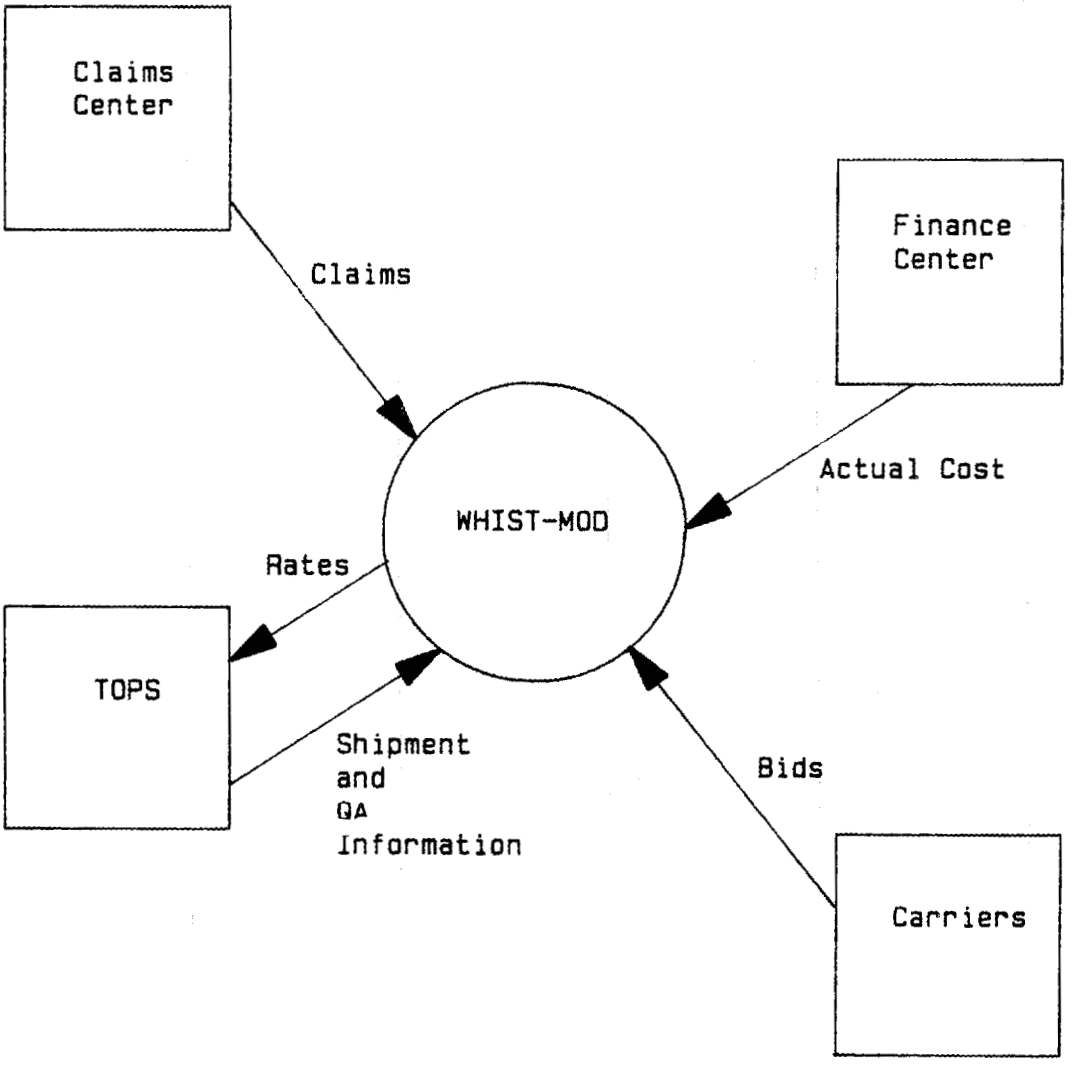

Fig. 2.5. Data flow for Whist-Mod with TOPS.

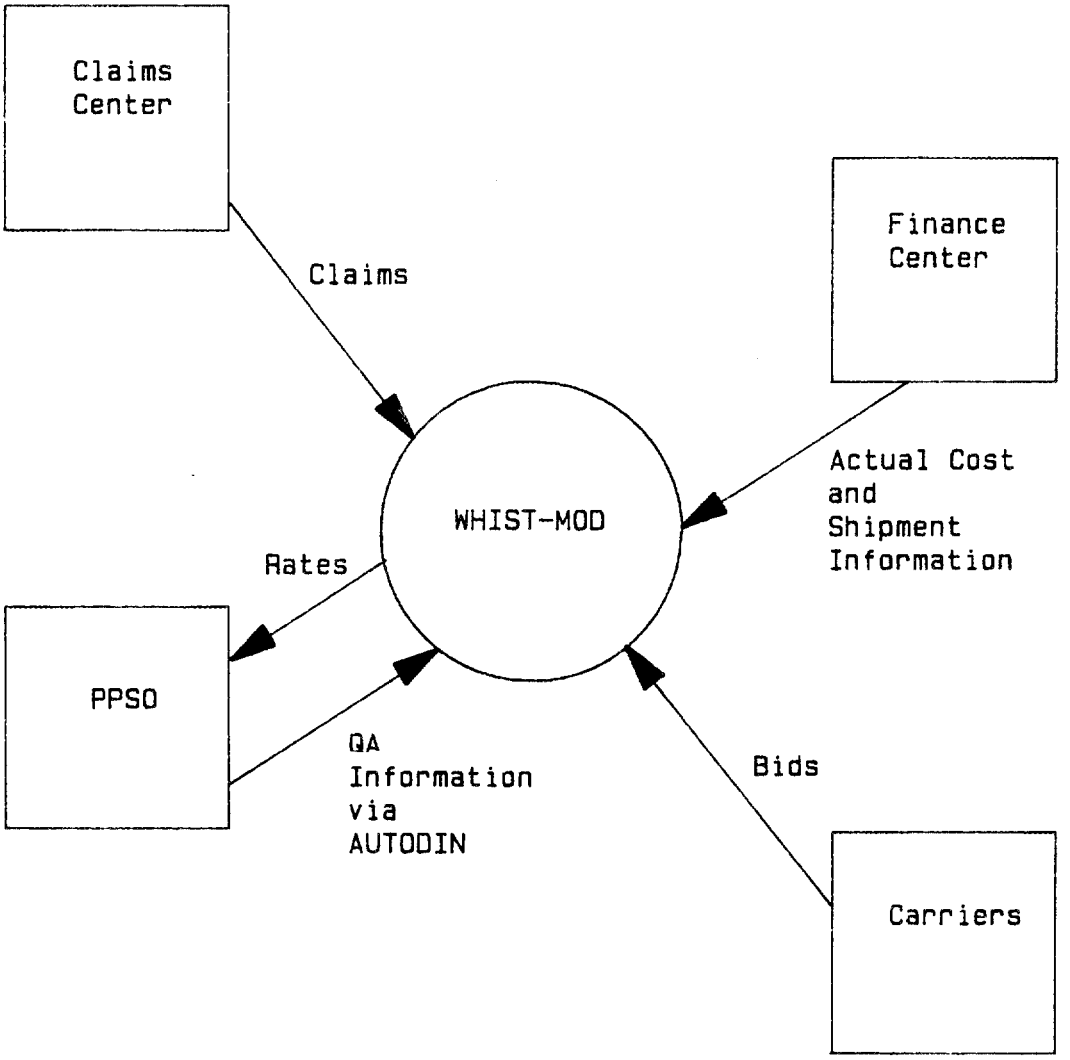

Fig. 2.6. Data flow for Whist-Mod without TOPS.

The shipment data gathered from the Finance Centers would be limited and would contain validation problems. The data would come from the bills filed by carriers. Because these data come from carriers, some information, such as delivery dates, would be suspect. The bills are keypunched onto cards, and this process allows for keypunching errors that would be very difficult to detect. Currently MTPP receives 26 elements from the Finance Centers. The number of data elements received must be increased to approximate the data captured by TOPS.

The Claims Center data would also contain validation problems. It is keypunched onto cards and sent to MTPP on magnetic tape. Because claims may be filed up to two years after a delivery, timeliness of the data is sometimes a problem.

Checks for completeness and consistency for shipment data from the Finance Centers, QA data from forms, and QA data via AUTODIN messages would be as tightly controlled as if the data had come from TOPS. To accomplish this, the data administration task under this option would have to be extended. This task would include checking for consistent field usage by ITOs and checking valid data values in data elements from these data sources.

In summary, Option Two is a design of WHIST-MOD using an expansion of existing data flows. The interfaces to other systems would be considerably different (e.g., obtaining shipment data via tapes from Finance Centers and QA data from AUTODIN messages and forms instead of electronically via TOPS). Also, because there would have to be more checking for valid values in these data flows, the data administration tasks would be more extensive than for a system using TOPS data.

2.4 RECOMMENDATIONS

In the preceding sections two categories have been identified in which decisions have to be made before proceeding further with WHIST-MOD. The first decision concerns the hardware and software environment in which WHIST-MOD will be developed, and the second concerns WHIST-MOD data sources. We recommend that WHIST-MOD proceed using existing data flows on an application server that is a node on a LAN (i.e., Option Two in each category). By following this recommendation, MTPP will minimize potential risks associated with future MTIM purchases and any slips in the Teradata DBC/1012 delivery, testing, and operation schedule. This option will also insulate WHIST-MOD development from any slippage in the TOPS deployment schedule. When TOPS becomes operational, WHIST-MOD can develop an interface to collect data required from that system.

3. NECESSARY ORGANIZATIONAL ADJUSTMENTS

3.1 INTRODUCTION

The success of WHIST-MOD is dependent upon adjustments to the work processes within MTMC that currently involve or support the Personal Property Program. The existence of the WHIST-MOD system will create new tasks as well as alter the levels of skills and training needed by individuals performing the work. For instance, data administration will be crucial to the success of WHIST-MOD and will require the services of a data administrator. WHIST-MOD will also need a maintenance and modification staff to keep WHIST-MOD current with the changing needs of MTPP.

3.2 SYSTEM ADMINISTRATION

The WHIST-MOD system architecture is complex and is based on state-of-the-art technology. As with any system, it will require knowledgeable personnel to maintain the various components.

The system administration function should ensure the security of the system and assign privileges to users appropriate to their needs. Other system administration duties will include maintaining the operating systems, application software packages, communication software, numerous hardware platforms, and components specific to the MTPP LAN; performing regular system backups; and monitoring system performance.

3.3 DATA ADMINISTRATION

Because WHIST-MOD data will be used in shaping MTPP policy decisions, data administration policy, tools, and resources are needed to ensure that the quality of the WHIST-MOD database is maintained.

Data administration must ensure that every user has quality data and knows how much credence to put in data supplied by others. Most of the data in the WHIST-MOD system will not be generated by WHIST-MOD users. Instead, data will be gathered from sources such as Claims Centers, Finance Centers, AUTODIN messages, and TOPS. WHIST-MOD users cannot be responsible for the accuracy and completeness of any data except the data that they personally entered.

Most of the data coming into WHIST-MOD will either have more fields than WHIST-MOD needs (TOPS switched data), be in an incompatible format (Claims Center data), or have both attributes (Finance Center data). The data administrator will be responsible for keeping the WHIST-MOD data as correct as possible and for conveying to the WHIST-MOD users the relative level of correctness and completeness of the data. He or she will also be responsible for maintaining both database security and an up-to-date data dictionary for WHIST-MOD users and will also need to be familiar with the data and their uses. An important component of the data administrator's job will be interaction with external agencies and the management and staff at MTMC to resolve data problems.

3.4 MAINTENANCE AND MODIFICATION

The WHIST-MOD system is expected to evolve with the changing needs of the organization. As the staff gains experience with the system, they may identify and promote specific new applications, many of which will be unique to individuals or work groups. Initially, the maintenance and modification staff will develop these applications, but as users grow more comfortable with the system, they may develop many applications themselves. This situation would create a user-driven system for which the users assume responsibility for all but the most complex system outputs. The maintenance and modification staff and data administrator would maintain the basic system and ensure discipline in the maintenance of shared data and shared system functions. This task will require a staff dedicated to that purpose.

3.5 EFFECTS ON FUNCTIONAL STAFF

One of the primary goals of WHIST-MOD is to reduce the paperwork burden so that MTPP staff will have more time to do analysis. For WHIST-MOD to meet the users' needs, adjustments will need to be made in the way that MTPP work is structured. Consideration should also be given to computer aptitude and analytical skills when making hiring decisions because almost all MTPP staff will be using WHIST-MOD to some degree. MTPP has already started in this direction and has indicated a willingness to build the required infrastructure of hardware, software, and personnel. This attitude of preparing for change and facilitating it will increase the chances for success of the WHIST-MOD system.

3.6 EFFECTS ON TECHNICAL SUPPORT STAFF

WHIST-MOD will require technical support from a staff knowledgeable of an operating system such as UNIX; an RDBMS such as ORACLE; development tools such as SQL*Forms, SQL*Plus, SQL*ReportWriter, and SQL*Net; a statistical analysis package such as SAS; LANs; and theories of distributed and relational databases. This staff will be responsible for maintaining the system in a manner that is responsive to the users' operational needs. The staff will also handle system administration issues including (but not limited to) security, backup, and disaster recovery planning.

3.7 TRAINING

The WHIST-MOD system will require formal user training if it is to be used to its maximum potential. At a minimum, WHIST-MOD users will need an introductory course that will teach them how to navigate through the WHIST-MOD screens, a user manual, and on-line help facilities. Users will also need a way to learn about the data available in the WHIST-MOD database. It would be most effective to let the users learn about the content of the databases through an up-to-date on-line data dictionary, because the contents of the database will be constantly changing. Additional periodic training will be required as the system evolves.

Because the analysts, data administrator, and modification staff will be using ORACLE, SQL, SAS, and UNIX directly instead of through the standard interface, they will require more training than the average WHIST-MOD user needs.

4. THE WHIST-MOD CONCEPT

4.1 INTRODUCTION

The objective of WHIST-MOD is to design and create a prototype of a decision support system for MTPP. By definition a decision support system should provide the staff at MTPP with access to the information required to help them make intelligent, informed decisions regarding the operation and management of their organization. More specifically, a decision support system should ensure that the data provided are relevant, of the highest quality, readily accessible to users of various skill levels, and flexible enough to adapt to changing demands.

4.2 CAPABILITIES

The initial version of WHIST-MOD should have the following attributes:

- powerful data administration tools,
- sufficient operations applications to gather and maintain a minimum database from currently available data flows,
- reporting capabilities that include standard reports and ad hoc database queries, and
- policy or special studies capabilities.

WHIST-MOD will have a common, centralized database where Personal Property data are maintained. The WHIST-MOD system will collect data from a variety of sources, reformat them, and store them in the database. This database should be accessible to all WHIST-MOD users. Occasionally it will be necessary to collect additional data from outside the WHIST-MOD database for special studies. Because of this requirement, the system should be flexible enough to accept additional data either from existing sources or from entirely new sources. The external data may be entered manually or via electronic media.

WHIST-MOD will serve two types of users. The first group is the staff who monitor and evaluate their area of responsibility in Personal Property. These include action officers, division heads, and branch chiefs at MTPP, the ACs, and the FOs. These users need flexible standard reports and graphics and a user-friendly interface. They will manipulate and query the data using familiar terminology via an interface that will access and display the data through standard reports and graphics. The interface is supported by a powerful and flexible data manipulation tool (RDBMS), a statistical RDBMS evaluation package, and a graphic presentation package.

The second group of users includes the analysts, data administrator, and the maintenance and modification staff. The analysts will answer questions that cannot be answered using the reporting and data manipulation capabilities provided through the standard interface. The maintenance and modification staff will build applications for the first group as needs for additional standard reports arise. Both the analysts and the maintenance and modification personnel will have access to the standard interface. They also need direct access to the tools.

Because the objective of WHIST-MOD is to provide information that MTPP personnel will use to monitor and direct the Personal Property Program, data administration will be a critical part of the system. Data administration supports the concept that quality data are critical to the system and provides a set of tools and policies that permits the data to be maintained at a maximum quality level. It will ensure that the quality and reliability of the data supporting MTPP decisions are as high as are feasible and that the level of confidence in the data will be known to the users.

The majority of data in the WHIST-MOD database will come from external sources. In addition, data will be supplied internally by operations personnel at MTMC and RSMOs. Multiple data sources make ensuring data quality and reliability more complicated. The level of quality and reliability will vary among data sources and within each data source. Because data administration is critical and because the variety of sources makes it even more difficult, WHIST-MOD will provide tools to make the job easier.

WHIST-MOD will provide tools for system administration. The machines affected by these tools will have to be determined, but they may include the data administration minicomputer and the application server.

4.3 CONFIGURATION

WHIST-MOD will provide the capabilities listed in the preceding section on a collection of hardware and software maintained and located primarily at MTMC. As previously mentioned, the central component of WHIST-MOD will be the data. It will be maintained on a workstation that will function as an application server using the ORACLE RDBMS. A backup of the database will also be maintained on the Teradata DBC/1012. The data will be accessible through a variety of tools developed in SAS, UNIX and ORACLE's SQL*Forms, SQL*ReportWriter, and PRO*C.

Data will be loaded via applications on the WHIST-MOD application server, WHIST-MOD Data Administration machine (UNISYS 5000/80), TOPS SWITCHER (UNISYS 5000/80), MTIM (Honeywell DPS8(s)), and various microcomputers. All of this hardware will be linked through MTMC's Ethernet LAN. In addition, limited data will be entered via the RSMO machines (UNISYS 5000/80) and computers at the ACs linked to MTMC by modem via standard phone lines.

4.4 CONSTRAINTS

Personal Property decision support requirements are dynamic and evolutionary; therefore, a powerful toolset consisting of software and hardware will be necessary to meet the diverse needs of MTPP's variety of users. All such tools are initially met with some level of apprehension from users who, because of a new system, are required to learn to do their jobs in a new way. MTPP must recognize and accept this reality; it must develop a long-range plan to train WHIST-MOD users and must fill future positions with personnel adept at learning to use and support the WHIST-MOD system.

MTPP must also realize that the WHIST-MOD toolset will require constant evaluation and modification to react to, if not anticipate, its users' evolving needs. This is particularly relevant with respect to the data entered into and maintained by the WHIST-MOD database. It is easy to continue to capture data without considering whether or not that data is still relevant or accurate; but without quality data, any decision support system can be dangerous. WHIST-MOD will have data administration tools that support this function; however, without a commitment to their use, the tools alone will not ensure accurate, pertinent data.

WHIST-MOD will rely heavily on operational data supplied by various other systems and organizations. It is critical that these other sources be operationally stable and supply high-quality data in a timely manner. Because data are at the heart of WHIST-MOD's functionality, plans for the use of alternative or backup data flows should be examined regularly. Data from external sources should be imported occasionally, as a test, based on available resources. This safeguard will reduce the dependence of WHIST-MOD on the successful implementation or continued operation of any other single system.

Specifically, the parallel development of WHIST-MOD and TOPS may become an enormous constraint on any WHIST-MOD design that is solely dependent on TOPS data. Because so much of the data needed by WHIST-MOD will originate within TOPS, the successful implementation of TOPS will be a vital link in the development of WHIST-MOD.

Similar backup strategies should be practiced with regard to the WHIST-MOD system. Regular backups of the data should be made standard practice, and plans should be made to reduce the dependency of the system on any single component. This line of reasoning supports the idea of maintaining two workstations, the application server and the backup, and supporting a duplicate database on the Teradata.

4.5 DEVELOPMENTAL STRATEGY

It is particularly difficult to specify decision support systems without experimentation involving the user. However, this task is both costly and time consuming. To put capability in the hands of the user sooner and reduce the cost of initial design, we recommend a development strategy that expends development resources on constructing flexible tools rather than specifying and constructing a large collection of applications. These tools should be considered a starter kit for the eventual decision support system that will allow the inexperienced user to quickly locate and extract data, initiate ad hoc and standard reports, and in the case of the experienced user, help formulate complex data queries. For example, an Action Officer in the Rates Division will be able to calculate the average weight of shipments for any code of service, from or to any Government Bill of Lading Office Code (GBLOC), and for various time frames.

We recommend that prototyping be used for translating user needs and wishes into a finished design. It should help resolve design issues and develop useful examples of applications in each major functional area. Because a decision support system is open ended by its nature and because it is difficult to agree upon what constitutes an acceptable initial system, a set of examples that will demonstrate a minimum acceptable system will be negotiated early in the prototyping effort.

As the staff gains experience with the system created by the implementer, it will identify and promote specific applications, many of which will be unique to individuals or work groups. Thus, a user-driven system will be created, and users will assume responsibility for the form of all but the most complex system outputs. The advantages of this evolutionary approach are that it promotes champions among users for system products and helps to ensure the continued life and improvement of each system function. The role of MTIM in this concept is to maintain the basic system and ensure discipline in the maintenance of shared data and shared system functions.

4.6 CONCEPT SUMMARY

WHIST-MOD should provide decision support capabilities to MTPP staff through a centralized database and a powerful set of information management tools. These tools should ensure easy access of information for users with a broad range of skills and promote the maintenance of high-quality data while accommodating evolving organizational demands. Though WHIST-MOD will employ data from various sources and integrate a number of hardware environments, it should be as independent as possible from any other specific component, planned or existing.

WHIST-MOD will be designed as a set of tools and strategies that are initially used to develop a group of prototype applications to demonstrate the potential of the WHIST-MOD tool set. The system should be viewed from its conception as evolutionary in nature, requiring a long-range commitment and support from MTPP.

5. RECOMMENDATIONS

Under the WHIST-MOD concept, the following three options for development are available:

- proceed with the design of WHIST-MOD under the assumption that uncertainties involving MTMC system architecture and the implementation of TOPS will either be resolved before a major investment is made in WHIST-MOD or will have a minimum impact on WHIST-MOD development,

- delay the design of WHIST-MOD until the uncertainties with system architecture and the future of TOPS have been resolved, or

- develop a first version of WHIST-MOD that is less dependent on the capabilities and use of the Teradata and the successful implementation of TOPS.

The third option entails the least amount of risk for MTPP at this time. It provides a first version of WHIST-MOD that brings the power of a user-based decision support system to current work processes while postponing temporarily the capability to access the wide range of data offered by TOPS. Because the Personal Property Program is currently relegated to the unfriendly interface of the Honeywell DPS8(s) computer or a data-less microcomputer, such a system would be a large step forward and would allow the staff of the Personal Property Program to satisfy a number of needs identified in the Requirements Analyses. With the workstation acting as an application server for WHIST-MOD, a minimum of redesign will be needed when TOPS comes on-line. Because the application server will be able to store sufficient historical data, the Teradata's implementation schedule should not be critical to the implementation of WHIST-MOD.

Because the proposed system is a cost effective first step in building a useful MTPP system, we recommend that once begun, the system should be pursued to completion. It is an axiom of system development that development teams need an identified, stable goal. As the major uncertainties now facing WHIST-MOD are removed, it should be possible for the implementer to initiate a separate but parallel effort to begin the next version of WHIST-MOD that integrates TOPS output and new MTMC system capabilities.

MTPP will need to ensure that appropriate maintenance and modification staff and data administration resources are identified and trained. MTPP has already moved part way down this path and has indicated a willingness to build the required infrastructure of hardware, software, and personnel.

This report has shown that the Personal Property Program would be greatly aided in its role of program evaluator and policy setter by the development of a decision support system. As the discussion of need in preceding sections suggests, the WHIST-MOD decision support system must be flexible enough to track the effects of evolving policy within the Personal Property Program, offer easy access to a large selection of data elements to users with minimal computer experience, and also offer analysts the capability to formulate complex queries and perform special studies.

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