

DATA COMMUNICATION  
BETWEEN DATA TERMINAL EQUIPMENT AND THE JPL ADMINISTRATIVE  
DATA BASE MANAGEMENT SYSTEM

BY

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INTRODUCTION

Scope

This paper discusses approaches to enabling an installed base of mixed data terminal equipment to access a data base management system designed to work with a specific terminal. The approach taken by the Jet Propulsion Laboratory and our experiences to date are described.

Background information on the Jet Propulsion Laboratory (JPL), its organization and a description of our Administrative Data Base Management System is included.

Background

The data base management system need of JPL is unique among the NASA Centers. JPL is an operating division of the California Institute of Technology (Caltech). Caltech/JPL performs research, development and other related activities under contract with NASA using facilities provided by the government. The Caltech/JPL contract requires NASA standard administrative and financial reporting. However, the design and operation of the internal JPL management and administrative support systems are the responsibility of Caltech.

JPL is organized as a matrix, Projects and tasks are formed and funded within the Program offices as required and approved by NASA. The work is performed by the Technical Divisions in accordance with the requirements and guidelines established by the Program and Project offices. Financial, Procurement, Personnel and other administrative support is provided by the the Administrative Divisions.

Some large Planetary research and development projects currently being managed by JPL include the VOYAGER, GALILEO and IRAS Projects.

## COMPUTING AND INFORMATION SERVICES

### THE CISSP

In 1983, the Computing and Information Services System Project (CISSP) was formed with the primary objective of developing and adopting up-to-date computing, networking, and information services technology to meet the future data processing and data management requirements of JPL. The CISSP is comprised of two parts:

Development of a computer-communications network called the Technical and Administrative Computer Communications Network (TACCN).

The upgrade of JPL's Management and Administrative Support Systems, (MASS) the systems and data which support the management and administration of the laboratory.

The use of the TACCN to provide user access to the MASS is the subject of this paper.

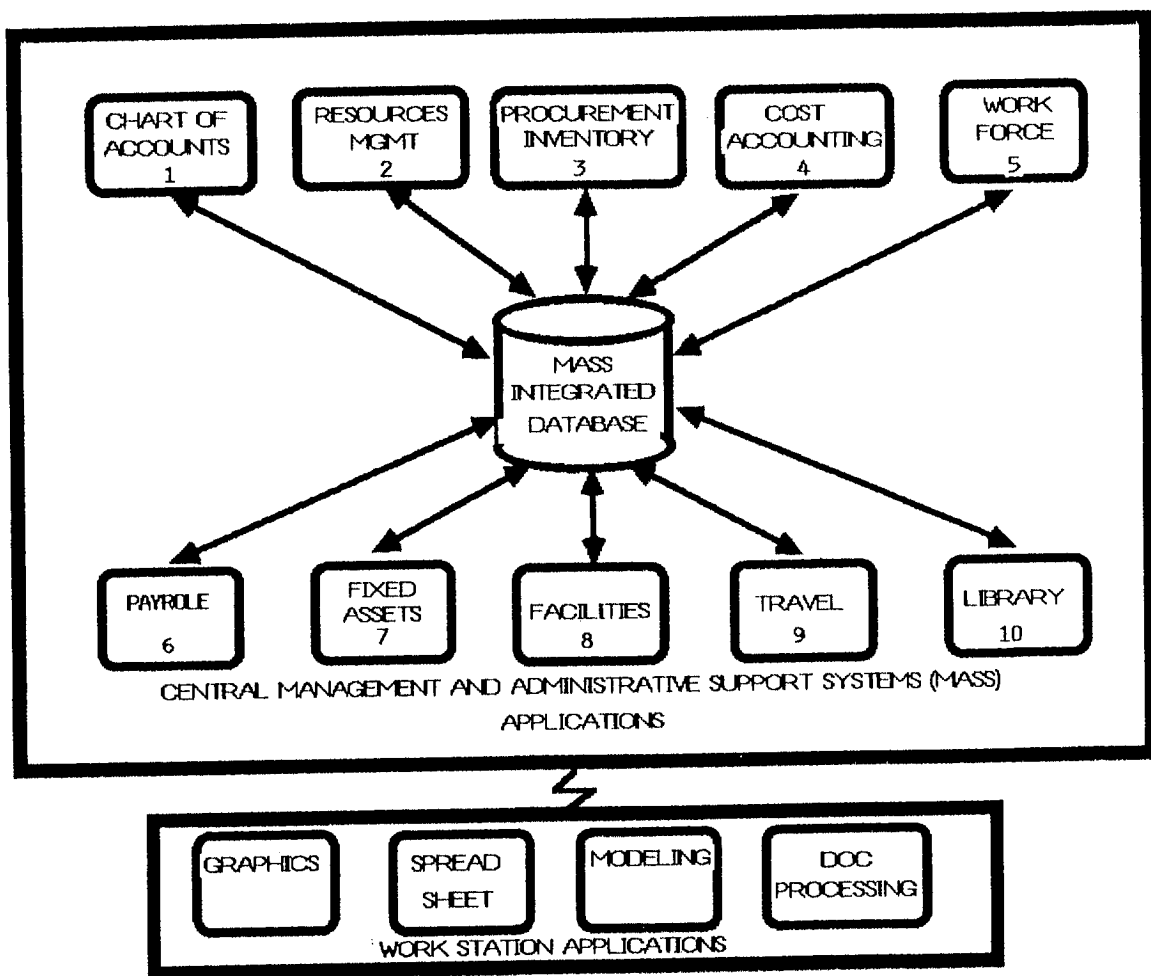
### THE MASS

The previous administrative support systems at JPL have been developed ad-hoc and uncoupled. Our Resource management, Procurement, Inventory, Cost accounting, Payroll and similar systems have operated in a stand-alone, batch, labor intensive environment.

In 1982, plans for an integrated, interactive Management and Administrative Support System (MASS) were developed and implementation of this system was started in 1983 with the establishment of the CISS Project and the procurement of a generalized data base management system. A IBM 3083 Computer was procured early in 1984 to host this system.

The overall implementation precept for the MASS is to procure commercially available applications software wherever possible. One of the foundations of this precept is the use of a commercial generalized data base management system. The Integrated Database Management System (IDMS) by the Cullinet Corporation was selected as this foundation. The selection of IDMS dictates a set of applications which can be purchased to perform MASS functions. The commercial availability of applications compatible with the Cullinet IDMS determines the order in which the JPL systems will be implemented. A characterization of the target applications of MASS when all elements have been completed is shown in figure 1.

FIGURE 1



## TACCN

The TACCN is being developed concurrently in support of the MASS. The major elements of the TACCN are shown in figure 2. These include:

- \* The IBM 3083 Computing System which hosts the MASS software.
- \* The Institutional Local Area Network (ILAN) which provides reliable high speed data communications between terminals, from terminal to computer and computer to computer.
- \* File and print servers on the network.
- \* Electronic message store and forward services.
- \* Office Automation services
- \* Science and Engineering computing services.
- \* Flight Project Support Services

## THE DATA COMMUNICATION ENVIRONMENT

### THE ILAN

The ILAN will provide the primary data communications functions for the laboratory. The ILAN uses Broadband technology and is based on hardware and software purchased from the Ungerman-Bass Company. It will provide on line data communications for over 1000 users. Additionally, dial communications facilities will be provided via a Northern Telecom Digital Telephone central office provided by Pacific Telephone Co.

There are currently over 1500 Data Terminal Equipment (DTE) units at JPL. There are over 100 separate models or types of DTE which must be served by the ILAN and the MASS. The major users of the MASS (The Program and Project Office, The Administrative Divisions and the Technical Division Management) use Micro computer workstations (IBM PC/XT), Word Processors (WANG), Executive desk sets (Northern Telecom Display Phone), and Portable hardcopy terminals such as the TI Silent 700's.

FIGURE 2

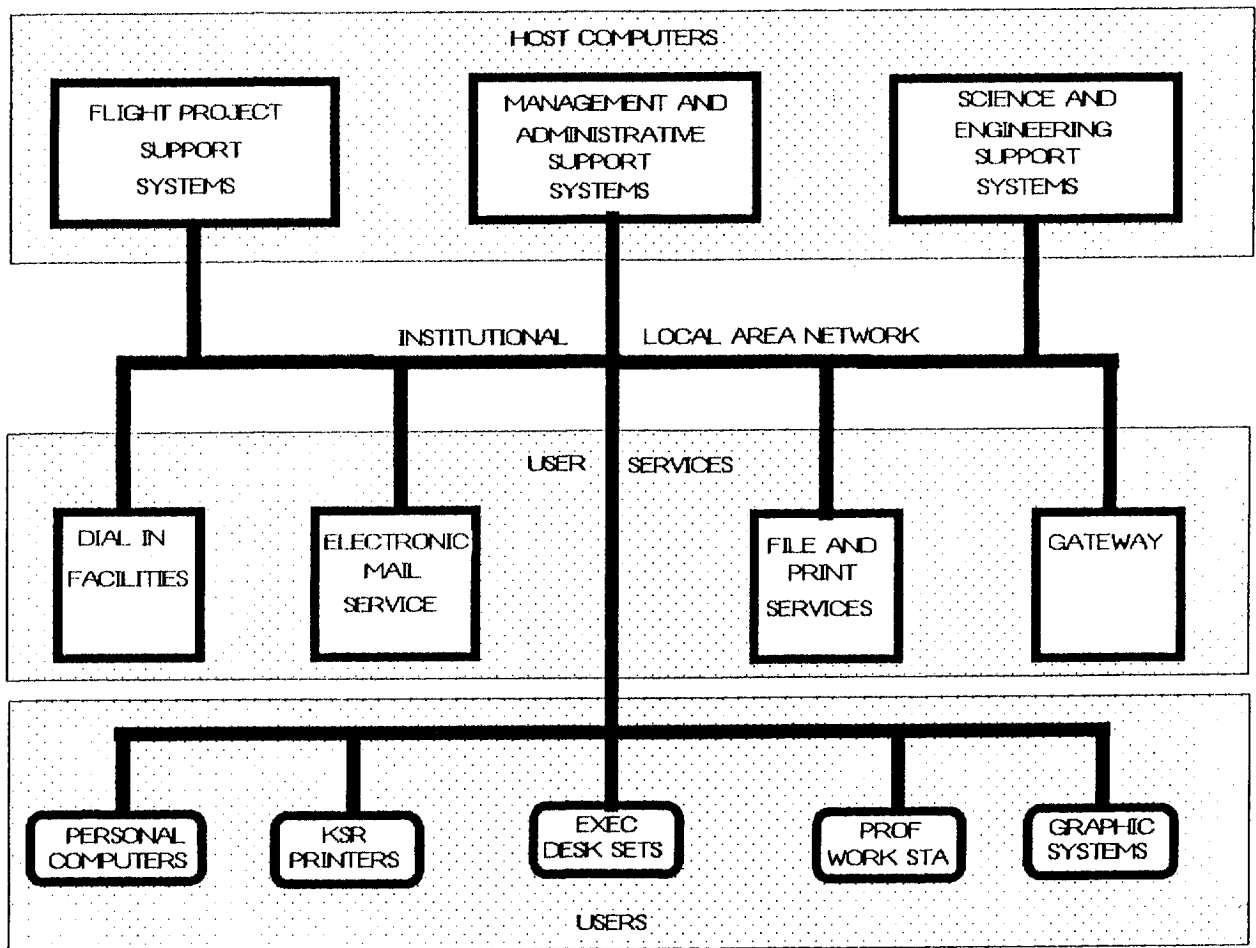


FIGURE 2- ELEMENTS OF THE TECHNICAL AND ADMINISTRATIVE COMPUTING AND COMMUNICATIONS NETWORK (TACCN)

## THE MASS/TERMINAL INTERFACE

Ideally, all terminals connected to the MASS/IDMS/IBM 3083 would be IBM 3278 terminals (or their equivalent), each operating at 9600 bps allowing the transmittal and receipt of a complete CRT screen in one second. However, because JPL's inventory of terminals includes only about 30 IBM 3278 terminals it is necessary to find ways to either adapt the non-compatible terminals to the MASS communication environment or to adapt the MASS environment to over 100 different types of terminals. The later option would violate the fundamental precept of a commercial generalized database management system and applications.

Effective use of the large inventory of DTE will require one or more of the following work-arounds:

- \* Install IBM 3278 emulator hardware or software in the Micro-computer based terminals and connect them to a IBM 327x controller via coax cables.
- \* Install IBM 327X controller emulation in the Micro-computer terminals to allow direct host connection via the ILAN.
- \* Replace 327X controllers with protocol converters to allow asynchronous devices to operate in the MASS/IBM 327X/SDLC environment.

Possible configurations of these options are shown in figure 3. The first two options are attractive for IBM PC's or their clones. We plan to use emulators where possible. The availability of commercial emulation packages for other micro-computers is uncertain at this time.

FIGURE 3

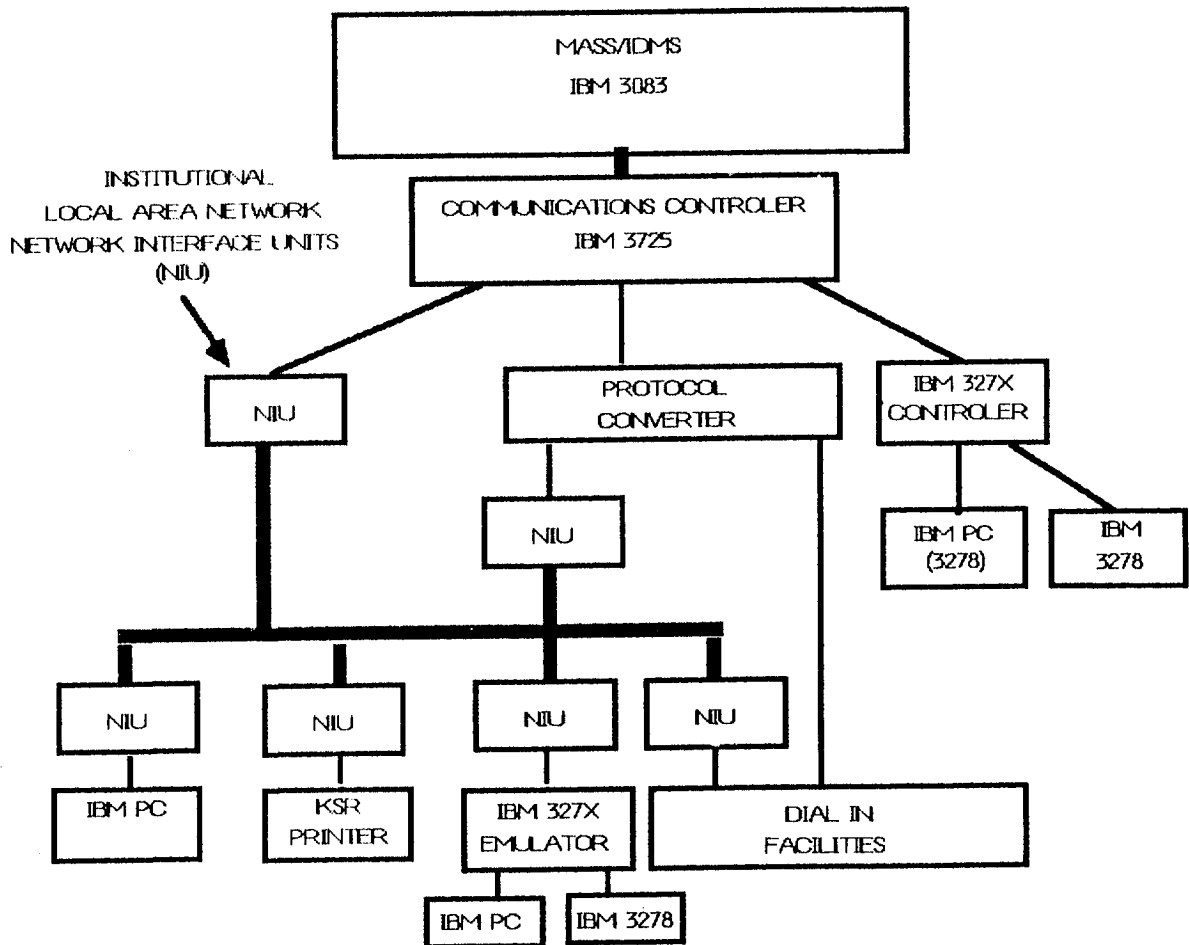


FIGURE 3- ALTERNATIVE METHODS OF PROVIDING A IBM 327X/SNA ENVIRONMENT

Two protocol translators purchased from the Renex Corporation have been installed at JPL for evaluation. The Renex Translator display system interfaces with the IBM communications processor in exactly the same manner as an IBM 327X control unit. The host thinks that the Translator is a 327X and communicates with it in the same manner. Asynchronous terminals connect to the Translator which has control over the data and cursor positioning at the terminal.

According to the Renex Corporation, almost any asynchronous ASCII terminal which can operate in the full duplex, character mode and which has an addressable cursor can be supported by the translator. It optionally supports Keyboard Send/Receive (KSR) printers such as the TI silent 700's for both line by line and full screen applications. However, invoking some 3278 functions such as screen refresh on a KSR will cause all 24 lines to be printed (at 300 baud this may take a while). There is a set of PROM's which are available for installation in the translator which supports most commonly used terminals.

The JPL experience to date with the protocol translator approach has been mixed. The protocol translation function appears to work as advertised except for some KSR terminals. The desired MASS environment should allow for data file upload and download and this capability is not available for many terminal types.

#### CONCLUSION

The objective of the Computing and Information Services System Project is to provide up-to-date computing, networking and Information services technology at JPL. This includes an integrated, interactive Management and Administrative Support System utilizing commercially available data base management and applications software compatible with the IBM System Network Architecture (SNA). Our capital investment in a large inventory of non-SNA terminals requires some temporary work-arounds which include use of protocol translators. The use of a error free data communications system (the ILAN) and 327X emulators in or near the micro-computer based equipment will provide a longer term solutions while allowing flexibility in the replacement of the older equipment as it becomes obsolete.