INDUSTRIAL DATA PROCESSING APPLICATIONS REPORT

Applications: Installation of a Management Information System

Type of Industry: Aerospace

Name of User: Grumman Aerospace Corp.
Bethpage, Long Island (Headquarters)
New York

Equipment Used: IBM System/360 Model 30

IBM System/360 Model 50

Data Pathing Inc. Terminals (130)

IBM 2314 Direct Access Storage Facility

Synopsis

The Grumman Aerospace Corp. is a long-time user of large scale computers for scientific and engineering activities. In 1966, the corporation began a project that, using the corporation's existing computing power, produced a management information system as "belated" but notes that one of the advantages of a late entry was avoiding the false starts made by its competitors. This report outlines Grumman's preliminary planning, selection of personnel for a system team and consolidation of resources for the project.

Background

The Grumman Aerospace Corporation is a Long Island based aerospace firm with field operations in Florida, Maryland, California, and Texas. Its products range from the Lunar Module (LM), the first vehicle designed to operate solely in space, various military and commercial aircraft such as the A-6A Intruder all-weather attack bomber and the Gulfstream II, to the submersible PX-15, which may be the most advanced underwater research vehicle ever constructed. The swing-wing F-14 air-superiority fighter aircraft is the company's latest major product. Grumman moved from gross sales of $205 million in 1958 to $1.153 million in 1968. Present employment is about 35,000. Grumman, traditionally a producer of Navy aircraft, is now one of the leaders in the highly competitive, sophisticated aerospace industry.

Introduction

During the 10 year period of rapid growth from 1958-1968, the need for change from the informal, arms length method of operating was recognized by Grumman top management. The company was using large scale digital computers in its scientific and engineering activities, while many of the corporate staff and operating departments were using digital computers to mechanize some of their routine clerical tasks. There was a lack of centralized control in the use of computer-based systems often leading to controversies, not over the validity of information, but on the units used: for instance, man-hours, man-months, equivalent men. The necessity for prudent application of the computer was becoming more and more evident. The customers had also begun to recognize the great potential computer technology held for improving operations control. The time had come for a unified approach to the management of computer resources at a corporate level.

In 1966, Grumman Aircraft embarked on a comprehensive program to harness its computing resources and to apply advanced electronic data processing to the management of its operations. This step was a late start in comparison to industry rivals. From Grumman's point of view, this "belated" approach held advantages since the group was able to apply long-range approach to the design and operation of a truly corporate management information system. By learning from industry experience, and surveying the spectrum of new computing and data collection equipment on the market, the company says it was able to avoid some of the false starts made by its competitors. The successful demonstration of the management information system was a significant factor, the company feels, in winning the F-14 development contract.

Project Planning

Top management support was needed. Also, talents which, in some cases, did not exist within Grumman in 1966. Grumman had developed advanced weapons systems. It now needed to develop an advanced computer-based management system suited to the corporation's unique needs.

An ad hoc committee, composed of top line management people from Operations, Finance, Engineering, Manufacturing, Material, and Electronic Data Processing, was convened in May 1966. They reached definite conclusions and recommended a timetable for action. Some of these conclusions were: "We have most of the detailed data required to develop a total management information system, but they are not completely integrated in the total system sense."

We need to create the organizational environment necessary to proceed."

TIMETABLE	
1 June 1966	Appoint Director of MIS
1 September 1966	Complete Industry Survey
	Formulate estimates of resources necessary to establish an MIS
	Establish implementation Plans
15 September 1966	Obtain Management Approval of Plans

The committee had set formidable goals. The initial plans called for complete installation and operation of an advanced management information system in the 1970-71 period. After great soul-searching by top management, this already ambitious four-year plan was compressed to a two year schedule leading to what came to be called the Grumman "MIS '68 Project."

The establishment of a total corporate MIS at Grumman took a two pronged attack:

1. Consolidation of corporate computer resources under one management function reporting to the president of the company.

2. Creation of a corporate focal point for the design and implementation of computer oriented management information systems.

In 1966 Grumman had its scientific computing facility reporting to the director of research. Business data processing reported to the treasurer, while various test data processing activities reported to the director of flight testing. Also, many departments had their own full-time computer programers and systems analysts. The consolidation of the machine and personnel computing resources under one corporate head was a prime prerequisite for success within the demanding schedule that had been set. The consolidation of computer personnel and the areas from which they were drawn is outlined in Figure 1.

The MIS '68 Project

The MIS '68 Project was formed to create a sole point for corporate MIS. The name MIS '68 set the goal. The tasks originally planned for a four year span had to be completed by the end of 1968, a span of two years.

The planners realized that the design of a management information system required a good management system as a basic point of departure. Support was needed from the corporate users in establishing the management systems amenable to computerized management information systems. The project matrix approach, familiar to the Grumman way of operation, was used. This approach resulted in user participation and acceptance and centralized planning and control of MIS efforts.

People were drawn from the user departments -- the people who knew what they wanted from the MIS. The consolidation of corporate computing resources allowed the planners to provide management with systems analysts and programers -- the people who could answer how the MIS should work.

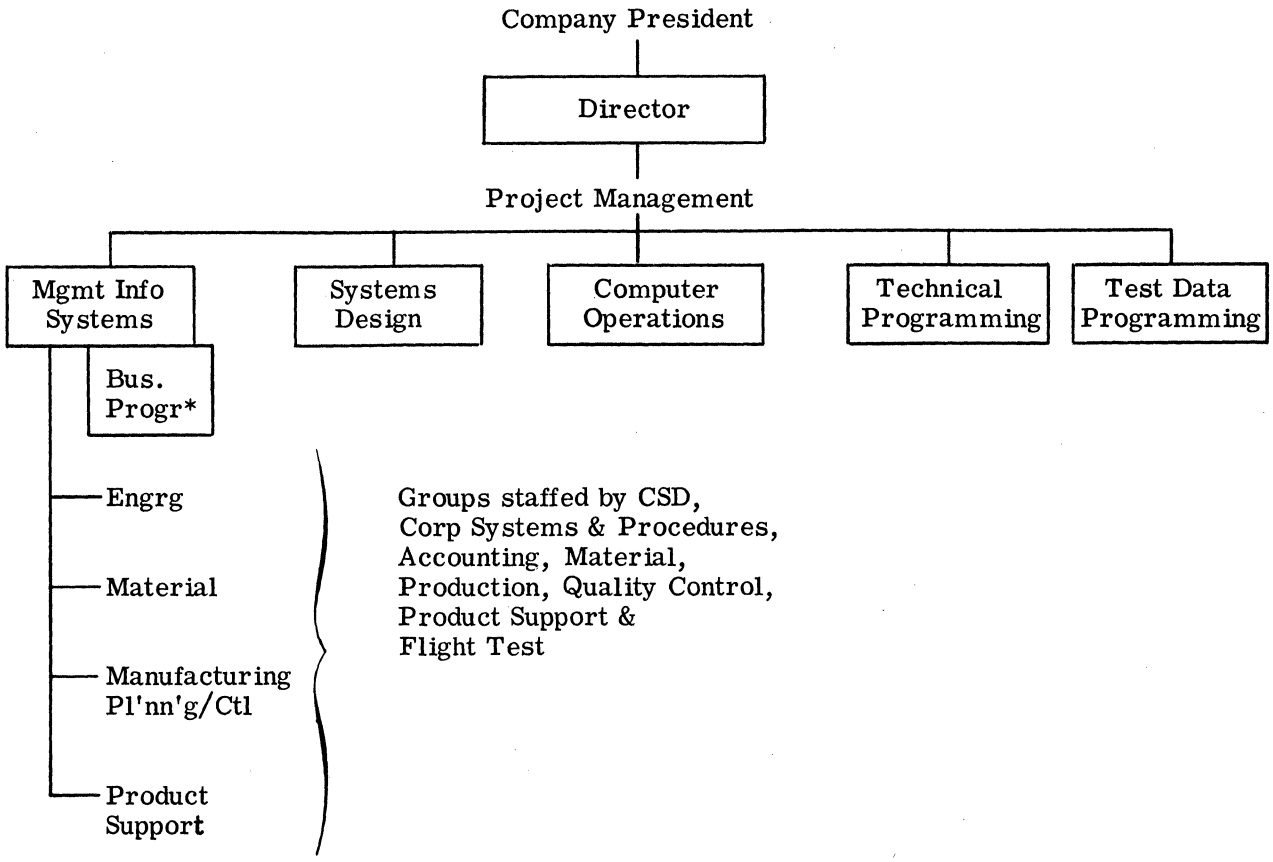


Figure 1
COMPUTING SYSTEMS DEPARTMENT (CSD)

As MIS '68 was formed, an honest self-appraisal was made. The talent needed to do the job effectively was not complete. People were hired from other aerospace companies and other industries in the expectation that Grumman could learn from their experience.

Equipment

MIS uses a variety of data processing equipment. Keypunched cards and magnetic tape are used to enter data into the system. Data collection terminals are located in the areas controlled to gather status and performance data in an on-line mode. Centralized data processing is used to manipulate and operate on data. High speed printers are used to provide reports. On-line inquiry terminals are provided for timely response to requests for information.

The Work-In-Process tracking system uses 130 Data Pathing, Inc. (DPI) terminals linked to four 16,000 byte DPI receiver/processors. These receiver/processors maintain a real time interface with 512,000 byte cpu IBM System/360 Model 50 operating in a multi-processing environment. Direct access storage of work-in-process information is maintained on an IBM 2314 direct access storage facility.

The material receiving and inventory system uses 34 IBM 1050 teleprocessing stations tied to a 64,000 byte IBM System/360 Model 30. Direct access storage of procured parts and material information is provided by an IBM 2314 direct access storage facility. Grumman's corporate view of computing resources allows maximum flexibility and expansion possibilities as the Grumman MIS grows to meet increased needs.

Information Flow

The flow of information in the MIS system is illustrated in Figure 2. The major computer files and documents used to transmit, store, and process data are as follows:

Files

Product Master File (PMF) composed of:

- Engineering Master File (EMF) - includes part number, part name, next assembly, quantity/vehicle, effectivity, material specification, finish code, etc.
- Master Requirement File (MRF) - includes scheduling data, release quantities, job number, etc.
- Manufacturing Operations Sheet File (MOS) - includes group number, model part number, part number, manufacturing operations, material size codes, etc. (i.e., identification and routings).

Material Master File (MMF) - Direct access computer system which describes purchased parts needs, action, seller deliveries, and part availability and disbursement activities.

Work-In-Process File (WIP) - Direct access computer file containing a record of work-in-process status.

Documents

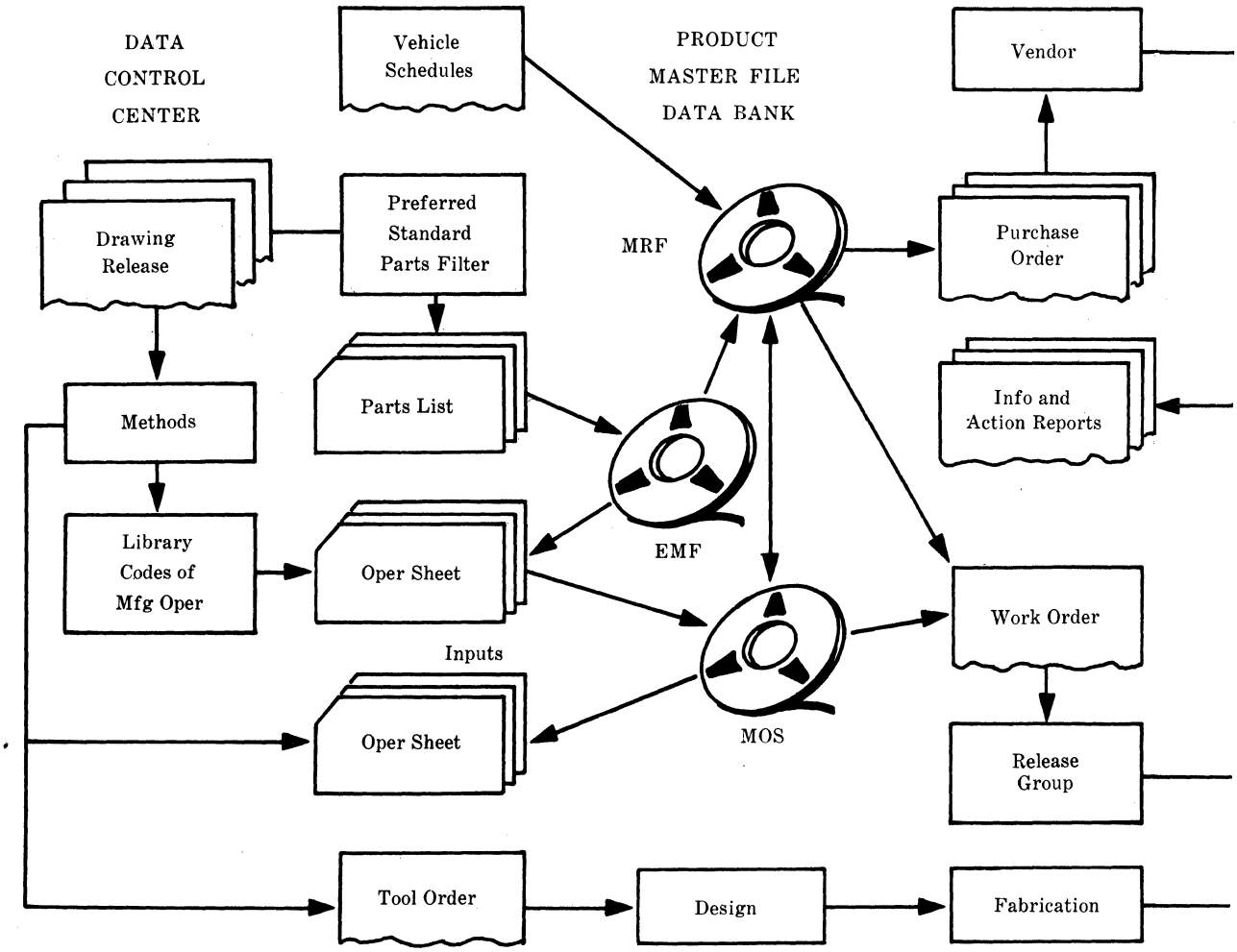
Work Order (W/O) - Document released to shop (prepared from MOS) to describe and authorize the work needed to produce a detail part.

Purchase Order (P.O.) - Document defining and authorizing the purchase of material/parts.

Inventory Material Requisition (IMR) - Document authorizing the transfer of material/parts from a warehouse/stockroom to a production stockroom.

The important points in the Grumman integrated approach are:

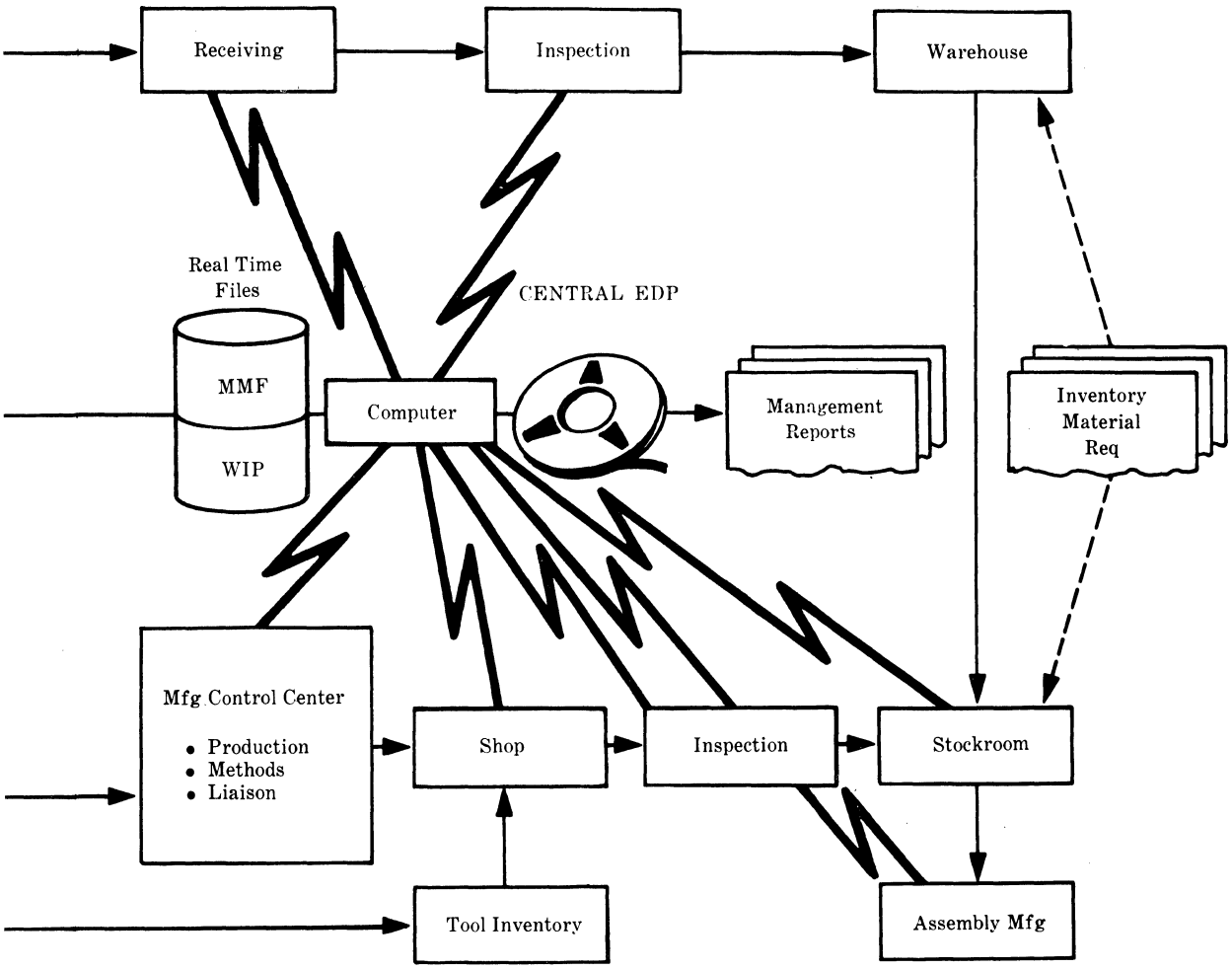
1. All make or buy authorization documents are generated from a common data base.
2. Real time data collection and reporting is used for in-house work-in-process and material in-float items.
3. Information and action reports are generated on an up-to-the-minute basis, with specified action responsibilities.
4. The flow of information builds on the framework of a good management system.



System Flow

A typical MIS flow for a Grumman-made detail part begins with the engineering design activity. Technical data (drawings, parts lists, etc.) are processed through a data control center and placed in an EDP data bank which acts as the central source for materials, manufacturing, and logistics requirements. Necessary data reports and documentation are also drawn from the data bank. Material is ordered by use of computerized files. Automated work orders provide quantity, schedule, and methodizing data and are used to route work through the production shops. As the detail part proceeds through its production cycle, the integrated MIS monitors part status and collects labor and shop activity data on a real-time

INFORMATION SYSTEM



basis for central electronic data processing. When the part reaches the stockroom, up-to-the-minute information is used to update computerized ship coverage records. About 80,000 work orders of an average of 20 pieces each are tracked. The real-time feature of MIS allows immediate remedial action for situations such as tool and material shortages on the shop floor and configuration discrepancies. The shop tracking data collection system can handle up to 36,000 transactions per hour.

Lot-type subassemblies are controlled much like detail parts. Large, complex assemblies are controlled through the use of product master file (PMF) data base information, and schedule and budget items tied to fine increments of assembly fabrication.

Typical Reports

The true worth of any management information system obviously lies in the quality of information it can furnish from the data it collects. The Grumman MIS has the capability to provide a wide variety of operational, financial, planning and control, and accounting reports on a periodic or as-needed basis for use by program management, corporate management and operating and functional personnel, as well as for reporting to the customer. The common data base of MIS allows for consistency and efficiency in reporting. Report by exception is stressed, with a high degree of information processing to provide output data which requires little or no re-interpretation, analysis, accumulation, reconciliation or re-recording. A tabulation by type, contents, and typical uses of some of a small number of reports is shown in Figure 3.

(Figure 3) COMPREHENSIVE REPORTS

TYPE	CONTENTS	USES
Labor Distribution	Labor (cost) expended per job	Manufacturing Operations Program Management
Departmental Performance	Actual hours vs. expected hours by department	Manufacturing Control Manufacturing Operations
Job Behind Schedule Can't Start Not Reporting Split Rework Exception Reports	Job status on a work order basis ...for expediting, schedule adjustment and status reporting	Manufacturing Control Program Management
Planned Actual Routings	Variance from planned production shop routings for adjustment to methods	Manufacturing Planning
Load vs. Capacity Forecast	Long range planning information on facility loading, and anticipated loads for future programs	Manufacturing Resource Planning Corporate Planning
Inspection Statistics	Disposition of inspection items	Quality Control, Engineering Program Management
As-Built Configuration	Information used to fabricate parts assemblies, for configuration verification	Configuration Control Program Management
Shop Schedules	Release dates of parts assemblies, for processing material	Material
Parts Assembly Cost Report	Cost per item, for payroll and labor distribution	Contracts
Payroll & Labor Data	Tape for payroll processing and labor distribution	Accounting
Material Part Breakouts	Listings of parts made from specified materials, for failure analyses	Reliability Engineering
Seller Delivery Performance	Information on deliveries, seller performance	Purchasing Program Management
Production Priority Shortage Reports	Listing of parts critical to production	Production Foreman Production Control

"We've learned a lot in the past two years", says Richard Peters, assistant to the director of the computing systems dept., "some of the schooling wasn't easy for us or for the people who use MIS." However, Grumman's edp staff is willing to share its knowledge. Some of the more valuable lessons are:

1. Try to keep your data processing experts from forgetting that the computer is a means to an end - namely servicing the system - rather than a system itself.

2. Be prepared for organizational as well as systems changes - plan for the modification of organization entities as well as functions.

3. You can't begin education too early. Start at the top and work down as your system evolves. A basic computer orientation course for all users is a good idea.

4. Don't confuse education with selling your system to the users - tell it like it is - they'll find out soon enough if you don't deliver.

5. Watch out for the guy who isn't getting his cut early in the game. He may throw you off the track before you reach his station. Let him know he is on the schedule.

6. Be sure to exploit the multi-processing capabilities of today's computers. Use of MVT, for example, can allow operating present batch system while implementing new on-line systems.

7. The key to system success is total involvement of the users: trite to be sure, fundamental without a doubt.

8. Make sure your implementation plans are unambiguous, well publicized, and documented in a form easily understood by top management.

9. Be sure user departments are aware of the staffing requirements they must meet to operate their part of the system - make sure user representatives on the design team maintain their identity as users. They should never bear the stigma of "EDP experts."

10. Above all, don't oversell the computer. It takes time, money (lots of money), and good people (very good people) to install a successful computer-based system. Make sure top management is aware of these facts.

Conclusion and Summary

A spokesman for the computing systems dept. sums up the Grumman experience this way: "We've come a long way in two years. We expect to go a lot further by building on the data base created by the Grumman MIS. The place of management information systems in our corporate organization reflects a dedication to a continuing effort toward a complete, totally integrated MIS. Our corporate view of computer management permits us to meaningfully use the advanced analytic techniques now available for modern management, and keep pace with the growing complexity inherent in aerospace operations."

According to Peters, "The unification of these resources was not easy; but the results have been encouraging. We have achieved significant cost/performance benefits from a total corporate view of computing resources. In addition, this central control of all machines and men involved in computing enabled us to start the design of a truly integrated system for the control of our operations areas."