THE BENDIX CORPORATION
Bendix
BRAKE
LINING
MARSHALL-ECLIPSE DIVISION

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MANAGEMENT STUDY OF
MARSHALL-ECLIPSE DIVISION
THE BENDIX CORPORATION
GREEN ISLAND, NEW YORK

by

THE NAVAL AND MARINE CORPS OFFICERS

IN THE

MANAGEMENT ENGINEERING PROGRAM

JUNE 1962

PREFACE

During the Spring Term, 1962, the Navy Graduate students in the Management Engineering Department of Rensselaer Polytechnic Institute conducted a study of the Marshall-Eclipse Division of The Bendix Corporation. The Division is located at Green Island, New York.

This report is the result of that study.

Members of the group, consisting of four Officers of the United States Navy and three Officers of the United States Marine Corps, contacted and interviewed Marshall-Eclipse employees at all organizational levels during the period of investigation. Our original intention was undoubtedly to gain complete knowledge of company philosophy, operations and procedures. The more we studied, however, the more obvious it became to us that we had set an impossible goal. Due to the short time allotted to the project and the complexity of company operations, we had to confine our detailed investigation to certain areas, while giving others only a cursory examination. We feel, however, that we have gained considerable insight into the workings and operations of the Division and that the results of the study should receive serious attention and consideration by the Management.

The report is presented in three basic divisions. The first two Chapters deal with general background material, including a brief history of Marshall-Eclipse and description of its existing organization. We realize that, in an expanding firm, an organization is a dynamic thing, that it is ever-changing. The existing organization chart was issued by the Division in January, 1962, and may be out of date in some areas already. But we chose this chart as a logical point of departure for our discussion.

Chapters 3 through 12 contain the substance of our report. Herein will be found descriptions of specific operations in each department, together with our specific comments and recommendations as we see them. Again, bear in mind that all areas have not been examined in detail.

In Chapter 12, recommendations and conclusions have been drawn together in an attempt to convey an integrated picture of the entire study.

We hope that what is presented herein will provide food for thought within the councils of Marshall-Eclipse as the day-to-day business problems are met and plans for the future made.

It has been our privilege, during the course of study, to enjoy the finest of cooperation on the part of Marshall-Eclipse personnel. We would especially like to express our appreciation to Mr. Harry Stolar, General Manager, for opening the doors of the company to us, and to Mr. Charles Menz, who served as our liaison with the company. These executives, as well as many other employees of Marshall-Eclipse, gave us much of their time and submitted patiently to our probings.

Our appreciation also goes to Professor D. W. Karger, our faculty advisor, for his guidance.

Lieutenant Colonel M.J. Padalino, USMC

Lieutenant Colonel D.W. Lindley, USMC

Major J.W. Harris, USMC

Lieutenant Commander D.E. Moore, USN

Lieutenant Commander A. Wasilewski, USN

Lieutenant C.K. Anderle, USN

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CHAPTER 1

HISTORY

Marshall-Eclipse Division grew out of the activities of The Asbestos Spinning and Weaving Company at Waterford, New York, in 1924. This small unit produced a conventional type of woven and folded brake lining on looms driven by direct water power drawn from a system of power canals.

The processes employed, common to the brake lining industry, required the use of expensive long-fiber asbestos. Efforts to cut costs resulted in the development of an exclusive process utilizing short fiber asbestos procured as paper similar to certain types of building and pipe insulation paper. The new method led to the formation of Slade Asbestos Corporation, which started operations in Watervliet, New York, in 1928.

Success of the new product in the automobile field was doomed almost at the start by the growing acceptance of the internal expanding brake, which required a lining of lower friction. Moving in 1929 to a new building located at Green Island, New York, and specifically designed for the manufacture of brake lining, the organization tried without success to adapt its product to the new brakes. Sales to numerous industrial users, such as elevator and hoist manufacturers, enabled the company to carry on its work in a woven lining, and to open investigation of a rubber base molded lining.

After absorption by The Bendix Corporation in 1933, production of rubber molded brake lining was successfully undertaken. Again,

however, it soon became evident that brake requirements were ahead of brake lining. Rubber binder products were disintegrating under the severe conditions imposed by higher speeds and small braking surfaces. Marshall-Eclipse turned to resin binders as the solution.

It was not, however, until 1938 that a production line method was perfected. Early difficulties were traced to lack of uniform characteristics in purchased resins. This difficulty was overcome by the use of a simple, economical synthetic resin developed and produced by the Division.

This development, quickly accepted by the passenger car and light truck manufacturers in the pre-war years, led to the adoption of the product as standard equipment on many military vehicles. Of particular note, all jeeps, whether built for lend-lease or for our own military use, were equipped with the Division's brake lining. Production of jeep brake segments alone, during the war amounted to 30 million pieces.

After the War, dry mix blocks and segments were developed for use on trucks, busses, and industrial equipment, as well as passenger cars. A new plant was completed in 1947 which more than doubled floor space. The peace time reconversion adjustment at Marshall-Eclipse was upward rather than downward.

Besides the brake blocks and heavy duty segments, considerable research and development work has been done on aviation segments in the ceramic and cera-metallic lines. Such development is in addition to the Division's work in passenger car brake lining. Formulations designed

to withstand the ever-increasing heats encountered in the newer, smaller passenger car brakes are set up, produced on pilot plant equipment, and tested.

To keep abreast of the constantly changing passenger car brake requirements, the company maintains a test fleet of cars and trucks. After dynamometer testing, test vehicles equipped with either current or developmental products are put on the road to check performance. The program frequently calls for round-the-clock operation of the fleet, which ranges from New York to California.

The greatest portion of brake lining production is for installation on original equipment -- new cars and trucks. However, in the past few years an effort has been made to expand sales in the service replacement area. The cera-metalic products, developed in concert with Bendix in South Bend, Indiana, have found increasing markets in the aviation industry. Marshall-Eclipse cera-mettalic brake linings are found on many jet aircraft of today -- both civilian and military.

Some of the resins produced are sold but the bulk of the production is used in the production processes at Marshall-Eclipse.

The Marshall-Eclipse Division operates on a 5-day week, three-shift basis. The Division operates a non-union shop, a fact that makes it somewhat unique in the modern industrial world.

CHAPTER 2

EXISTING ORGANIZATION

2.1 General

At this point, it is probably well to reiterate and to emphasize a point which was previously touched upon. The results of our efforts in making a survey of the Marshall-Eclipse Division of The Bendix Corporation have, at best, been cursory. In all justice to the loyal and company-spirited people with whom we have discussed the various aspects of the operation, we find that the limitation of time has merely provided us with the opportunity to skim the surface. In so doing, we have uncovered certain procedures, or lack thereof, which, when reviewed from a detached point of view, appear to lend themselves to improvement. We make no pretense that our observations and recommendations are in any way optimal. It will remain for Management to make the final analysis, aided by our report, by the many factors which we missed, and by factors we may have observed but, due to the time limitation, view out of context.

In Figure 1-1, the organization chart, issued by Marshall-Eclipse in January, 1962, is depicted. This is our point of departure in discussing the Existing Organization. Our comments in the succeeding chapters will be aimed at pointing out discrepancies between procedures as they are actually performed and how the chart indicates they should be performed. They also will be concerned with changes to present procedures whether or not such procedures are being performed in accordance with the present organization chart.

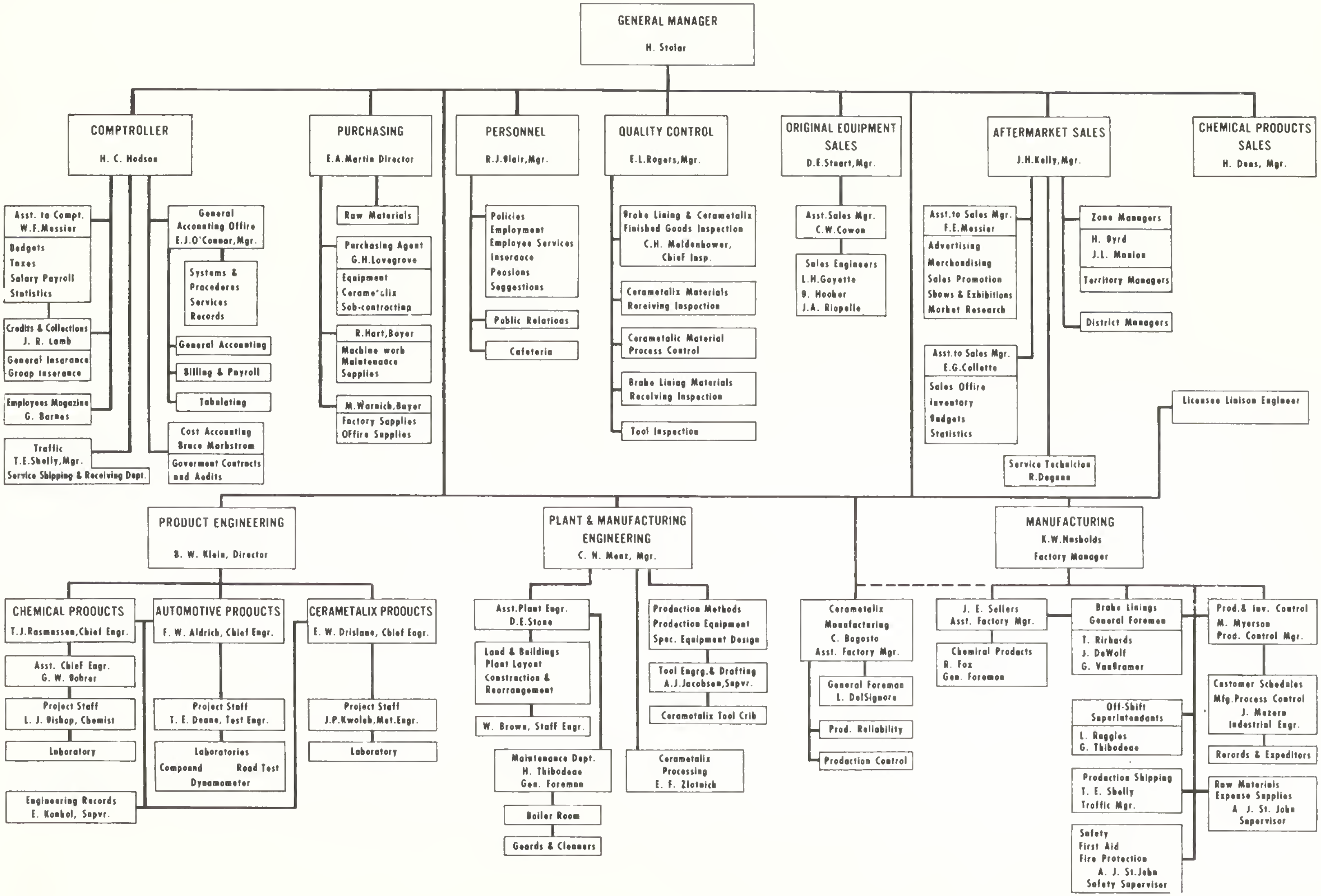


Fig. 2-1 MARSHALL-ECLIPSE DIVISION - PRESENT ORGANIZATION

2.2 General Manager

The General Manager has literally grown with the Division. He started his employment in 1937 as a Mechanical Engineer. Since that time he has held positions in sales, industrial relations, and manufacturing. In 1959 he assumed the duties of General Manager. It can be said therefore, that many of the policies (or the lack thereof) prevailing in the Division are those which the General Manager instituted while he was a member of middle management.

The autonomy of the Division places the General Manager in the unique position of being able to guide and control operations with minimum influence from the corporate level. Direction from that level is primarily concerned with capital expenditures and profits. The amount of attention devoted to the Division by The Bendix Corporation appears to be inversely proportional to the Division's profit. This is a characteristic of the decentralized organization.

His span of control is rather extended, consisting of ten coequal department heads; however, he is especially active in Original Equipment Sales. Because of the range of control, and what is considered to be his pre-occupation with Original Equipment Sales, the observation is that the General Manager has delegated extensive responsibility and authority to his Department Heads without instituting control measures for continuous performance evaluation. In consequence, several departments receive very little guidance from the General Manager.

A prime advantage which accrues from autonomous operation is time. Relieved from the constant, day-to-day pressures of corporate

interference, the General Manager should (he must) devote himself to long-range planning, policy formulation, evaluation of performance, and a firm control over all Division operations. However, there has been relatively little progress in these areas. It was found, for example, that there is a definite need for written Division policies, goals, and objectives. This supports the conclusion that the formal organization is not stressed by the General Manager, and serves to explain, in part, why certain assigned responsibilities have been neglected or relinquished by the department heads concerned.

These and other deficiencies for which the General Manager must ultimately be held responsible, are further amplified in succeeding portions of this report. It is strongly recommended, however, that in making any adjustment to the present organization, whether in line with the recommendations contained herein or as deemed appropriate by the General Manager, that he conduct a critical analysis of the existing formal organization. There is no doubt that a major finding of such an analysis will be to point up the urgent requirement for written policies governing interaction between departments.

2.3 Personnel

The normal functions of Industrial Relations are handled in this one-man department. A major reason for not having a larger staff is that the Division is non-union, making it unnecessary to administer a Union contract and the myriad of details which would go along with it. Should Marshall-Eclipse become a union shop, a much larger staff would be required.

All hiring of hourly employees, together with the laying-off and

recalling of present employees, is coordinated through the Personnel Office. While the final decision as to who is to be hired or laid-off may be made in the department concerned, the mechanical processes involved are handled here.

The hourly employee personnel records are administered in the Personnel Department. All changes in status (wages, grade, etc.) are handled here and permanent individual records of such status changes, together with performance ratings and other pertinent data are maintained.

Even though the shop is non-union, the employees have a grievance system through the General Manager's Open Door Policy. The Personnel Manager is an important part of this system.

Whenever a job opening exists for which present employees may like to bid, Personnel oversees the bidding and the mechanical aspects of the status change. In this connection, a seniority list of employees is maintained.

In addition to the items indicated above, the Personnel Manager is responsible for the administration of the system of fringe benefits which Marshall-Eclipse employees enjoy. The normal fringe benefits, such as Health, Accident and Life Insurance, among others are provided. A cafeteria is also maintained for the convenience of employees. In the administration of this program, as well as in many other personnel matters, Marshall-Eclipse is guided by general and specific policies of The Bendix Corporation. In general, the contracts which have been negotiated with the United Auto Workers Union, by other Bendix Corporation Divisions, are followed at Marshall-Eclipse.

2.4 Comptroller

The Comptroller is responsible for preparing, reporting and interpreting the accounting, budget and financial data required for managing the Division. He reports to the General Manager. The financial functions of the Comptroller are limited. He anticipates the need for working capital through a cash flow forecast, requests necessary funds from the corporation and is responsible to receive, safeguard and disburse funds in accordance with corporate policy.

In addition to the conventional responsibilities in the accounting line, the Comptroller acts as personnel officer for the exempt personnel of the Division. He maintains their personnel records and performs related personnel functions. The "Brakevine", the Division employees' magazine, is also edited by the Comptroller and published under his direction.

2.4.1 Traffic

The Division Traffic Manager is under the over-all supervision of the Comptroller for general traffic functions, receiving and shipping of after market, or service sales, shipments. The Traffic Manager comes under the supervision of the Factory Manager for production shipping. The Traffic Department audits and handles the filing and collection of over charge and damage claims. The Department also traces and expedites in-bound and out-bound shipments as required. The pre-cementing operation of bonded brake lining, carton and package making, and transportation arrangements for personnel are also functions of the Traffic Department.

2.4.2 Assistant to the Comptroller

The duties of the Assistant to the Comptroller include specialized accounting, statistics and statistical analysis, budgets and forecasts, tax matters and insurance. He is expected to exercise a wide degree of discretionary authority and have a broad knowledge of accounting in general. He also prepares cash and materials forecasts and develops special reports as required. Included under his general supervision is the credit and collection section.

2.4.3 Cost Accountant

The Cost Accountant is assisted by one junior cost accountant and two clerks. He performs cost accounting and cost control duties. He must also be familiar with tabulating machine accounting and have a working knowledge of general accounting. Cost accounting uses an operations costing system in determining product costs.

2.4.4 General Accounting

The Manager of the general accounting office is responsible for accumulating and recording most accounting statistical data related to general accounting. He prepares the external accounting reports. General accounting procedures to be used by the Division are contained in the Manual of Accounting promulgated by The Bendix Corporation. The Chart of Accounts is likewise specified. Conventional accounting practices are followed. A separate payroll account is held for each employee and approximately 200 active customer accounts are maintained.

The general accounting office also handles billing, preparation

of payroll and tabulating. The chief billing clerk is responsible for the routines and procedures of billing. The chief payroll clerk is responsible for the routines and procedures of payroll. The chief time keeper reports to the chief payroll clerk. The tabulating department supervisor is responsible for operating the machine accounting system. He must have the ability to adapt Division accounting procedures to the tabulating equipment. Data processing is by punched cards.

2.5 Purchasing

The Director of Purchasing is responsible for buying all materials and items the company needs to operate. He reports to the General Manager. The Purchasing Department is wholly centralized and functions as a service unit to all elements of the Division. The Purchasing Department deals with procurement only. The purchasing function does not include material supervision, receiving inspection or salvage.

The Purchasing Department personnel include a Director, a Purchasing Agent, two buyers and a secretary. The Director normally handles all raw materials purchases. The Purchasing Agent is responsible for equipment purchases, sub-contracts, and cerametalix requirements. One buyer procures outside machine work, outside maintenance requirements and maintence supplies. General factory and office supplies are purchased by the other buyer. The secretary types purchase orders and performs general secretarial duties.

Over-all basic raw material needs are estimated on the basis of the yearly sales forecast. For high usage raw materials the Director analyzes the forecast, decides on the raw material requirements, selects

the vendor and places a blanket order with the vendor for the total estimated material required during the forecast period. Necessary negotiations for prices, freight rates and so forth are generally made at this time. Specific quantities of the materials are then ordered released as required by means of letter or phone calls from Purchasing. Release schedules are planned, maintained and adjusted as necessary by the Director, based on a weekly inventory report and production forecast.

Raw material purchases are influenced by rapid changes in production scheduling and the limitations imposed by storage space available.

Although some of the raw materials prices fluctuate widely and are traded on the Commodity Exchange, corporate policy prohibits speculation in futures. Single sources are used on some raw materials due to their nature. The Purchasing Department, however, deals with over 800 regular suppliers.

Economic lot size purchases are made wherever practicable.

Other material purchases are originated by the using departments of the Division. Their needs are determined by the users themselves and a purchase requisition is prepared, approved and sent to the Purchasing Department. Technical aid concerning suppliers is available through the Purchasing Department if required. A complete vendor file is maintained. Upon receipt of the purchase requisition it is checked and a purchase order is prepared. The requisition is then filled out with the purchase order information and returned to the originator.

No Purchasing Manual has been developed but an up-to-date Engineering Standards Manual is maintained as well as vendor catalogs. There

is no purchasing guide at corporate level; however, certain corporate agreements with some suppliers exist. Local purchases are made wherever possible.

A firm bidding policy is generally not followed and most contracts are negotiated. Purchases for private use may be made for company personnel through the Director of Purchasing.

2.6 Sales

The existing sales organization for this Division consists of three separate departments, each with a sales manager reporting directly to the General Manager. The separation of the departments is by product use rather than by product type, with the exception of chemical products sales.

2.6.1 Original Equipment Sales

The Original Equipment Sales Manager and sales force are physically located in Detroit due to the concentration of automobile manufacturers and component suppliers in that area. The Sales Manager is responsible to the General Manager of the Marshall-Eclipse Division in Troy, and has a sales force of four men. Original equipment consists of drilled and undrilled brake linings for passenger cars and accounts for over three-fourths of the dollar volume of sales. A limited amount of the cerametalix material is also being sold for passenger car use.

2.6.2 Chemical Sales

The chemical sales force at present consists of one man working out of Troy. This department markets synthetic resin to be used in the

manufacture of brake linings, metal castings, paper saturants and various laminating uses. The area covered is the Eastern Seaboard and includes Detroit as well. The resin sales provide approximately two percent of the volume of sales.

The basic reason, however, for the manufacture of resin by the Division is for use in its own manufacturing processes.

2.6.3 Aftermarket Sales

The Aftermarket, or Service Sales, organization is engaged in selling drilled and undrilled passenger car lining, light and heavy duty truck brake blocks, some cerametalix products for off-road equipment and a small amount of woven linings as a convenience item for customers. The sales organization is headed by a sales manager, located in Troy, who reports to the General Manager. There are seventeen field representatives, including two zone managers, covering the entire United States. Each salesman has a predetermined geographical area to cover. The size of these areas is determined by the location of the marketing centers and business potential.

The local organization consists of the Sales Manager, two assistants, one Service Technician and an office and clerical staff.

The distribution of aftermarket products is primarily through rebuilders who bond the linings to brake shoes and then distribute them to distributors and associate distributors, either under the Bendix label or a private brand label. The rebuilder business accounts for about eight-five percent of the aftermarket sales. Drilled linings are distributed directly to the various distributors for further sale to the actual

service agencies. Four warehouses are maintained for the distribution of drilled linings to small jobbers. These are located in Chicago, San Francisco, Dallas and Atlanta. They represent a very small portion of the products distributed.

Aftermarket sales represent approximately ten percent of the Division dollar volume of sales.

2.7 Quality Control Department

The Manager of the Quality Control Department reports directly to the General Manager. His department is staffed with 78 persons, 65 of whom are female packers or inspectors, 5 are organic brake lining inspectors, 6 are cerametalix inspectors and 1 is a tool inspector.

The functions listed in the paragraphs below are not the responsibility of the Quality Control Department in all product areas. Therefore, each function will be discussed in relation to the three product areas of Organic, Chemical and Cerametalix. Other departments with quality control responsibilities in these areas will be identified.

2.7.1 Receiving Inspection

Receiving inspection of raw materials, parts, and components is accomplished by two sections, with one man assigned to each: the Brake Lining Materials Receiving Inspection Section, and the Cerametalix Materials Receiving Inspection Section.

Organic incoming raw materials are checked in accordance with the Engineering Standards Manual for screen analysis, bulk value, moisture content, acetone extraction, and specific gravity. There are no parts or

components associated with organic products. Therefore, the department has no responsibility in this area.

Chemical raw materials are checked by Quality Control only to a limited degree, that is, their concern is only with those resin products used in organic brake linings. Such products are examined for distillation temperatures, freezing points, gel times, reactivity, etc. All chemical raw materials <u>not</u> used in organic linings are inspected by the Chemical Products Section of the Manufacturing Department. There are no parts or components associated with chemical products.

Cerametalix raw materials, mostly metal powders, are examined by Quality Control in accordance with the Engineering Standards Manual. Depending on their content, powders are checked for items such as screen analysis, hydrogen loss, compactability, etc. All vendor hardware items are examined for proper dimensions, bead counts, screen weld, etc.

2.7.2 Tool Inspection

New tools and castings used in the organic lining process are inspected by the Tool Inspection Section of the Quality Control Department. There is no formal program for periodic in-use inspection of these items. Rather, this appears to be a function of Manufacturing foremen and supervisors. Micrometers are maintained and checked by the Manufacturing Department. Inspection and calibration of ovens and presses is accomplished by the Plant and Manufacturing Engineering Department.

Tools, jigs, etc. as such, are not associated with the chemical process. Inspection of new equipment components is accomplished by the Manufacturing Department. Inspection and calibration of process control

instruments is accomplished periodically by outside instrument manufacturers such as Minneapolis-Honeywell.

All cerametalix tools, etc. are inspected by the Tool Inspection Section. All tools, jigs, and fixtures are checked prior to being returned to the cerametalix tool crib for subsequent reissue. Micrometers and process control instruments are checked and calibrated periodically.

2.7.3 Process Control

In organic linings, process control is accomplished informally by Manufacturing foremen and supervisors. Linings are checked "periodically" at various process stages for thickness, width, appearance, length, twist, and cracking.

Chemical process control is accomplished by the Chemical Products Section of the Manufacturing Department. Samples are drawn from resin kettles at various stages and tested for flow point, viscosity, screen analysis, and melt time.

Cerametalix products are examined at various stages of manufacture by the Cerametalix Material Process Control Section of the Quality Control Department. Pieces are examined for bulk density, weight, thickness, crimp angle, curing times and temperatures.

2.7.4 Finished Goods Inspection

Both organic and cerametalix finished products are examined by the Brake Lining and Cerametalix Finished Goods Inspection Section of the Quality Control Department. This section is also responsible for stenciling and mass packaging these products.

Finished organic linings are sampled for Gogan hardness, width, length, curvature, and twist. All pieces (100% inspection) are then examined visually for cracks, chipped ends, feather edges, blisters, foreign material, twist, casting marks, and mixed formulas. A Rework Inspector examines all rejects for possible salvage to smaller sizes, and the Senior Inspector checks the clarity of rubber stencil impressions and the appearance of color-code stripes.

Cerametalix products are 100%-inspected for washout, foreign material, cocked fasteners, bad grinding, chips, and other physical damage.

Chemical finished goods are sampled by the Manufacturing Department for viscosity, flow point, percent solids, water solubility, etc., depending on the nature of the product.

2.7.5 Finished Goods Inventory

Organic finished brake linings are inventoried by two separate departments. The Quality Control Department is responsible for taking a weekly count of all on-hand linings for sale to original equipment manufacturers. This count is made every Friday by one of the finished goods inspectors. The Aftermarket Sales Department is responsible for maintaining inventories of all on-hand organic linings destined for aftermarket sale.

Finished goods inventories of chemical and cerametalix products are taken by the Manufacturing Department.

2.8 Product Engineering Department

The Product Engineering Department is organizationally comprised

of the Chemical Products Section, Automotive Products Section, Cerametalix Products Section and the Engineering Records Section. The Department has a complement of about 53 personnel and is headed by the Director of Product Engineering. The basic function of this department is to establish and administer the engineering policies, objectives and programs which are in conformance with Division and Corporate objectives and which are approved by the General Manager.

2.8.1 Engineering Record Section

As the name implies, this is an administrative section which is used by all the product engineering sections for formal recording and issuance of all correspondence which relates to product drawings, bills of material, releases, changes, process specifications and quality control standards.

2.8.2 Chemical Products Section

This section is responsible for the development of chemical products through research projects which are of a chemical or chemical engineering nature. The research is primarily orientated toward developing and improving resins utilized in the manufacture of friction materials. In addition, the Chemical Products Section also develops chemical substances for rubbers, abrasives, binders, adhesives, and coatings, which are manufactured for other industries.

The Chief Engineer of the Chemical Products Section is responsible for production releases, product specifications, process instructions and quality control standards for both raw material and chemical products.

2.8.3 Automotive Products Section

The Automotive Section Chief Engineer is responsible for the formulation, development, test, and release of all types of organic friction materials. In addition he is responsible for product specifications, process instructions and the establishment of physical, chemical and functional quality control standards of the final products. The test facilities which include dynamometer and road tests are the direct responsibility of this section. The Chief Engineer is responsible for the maintenance of these test facilities, test records and other engineering records.

2.8.4 Cerametalix Products Section

The Chief Engineer of this section is responsible for the overall effort in the research and development of automotive and heavy equipment cerametalix products. He is responsible for the production release, bills of materials, product specifications, process instruction and approval of all materials used in the manufacture of the finished product.

In addition to the above the Chief Engineer of the Cerametalix Products Section acts as a resident engineer for Bendix Products Aerospace Division in the production of aircraft cerametalix products. The research and development as well as the production releases, bills of materials, and general engineering instructions are issued by Bendix Products Aerospace Division. The Chief Engineer of the Cerametalix Products Section is then responsible for issuing the necessary process instructions and acts as overall coordinator on all matters that pertain to aviation cerametalix products.

2.9 Plant and Manufacturing Engineering

The Plant and Manufacturing Engineering Department is organizationally comprised of the Land and Buildings Section, Maintenance Section, Production Methods and Equipment Section, Tool Engineering and Drafting Section, and the Cerametalix Processing Section. The personnel complement of this department is approximately 75 and the Plant Engineer and Master Mechanic is the department head. The basic functions of this department are to provide and maintain the physical plant and buildings, utilities, and production equipment. In addition, the department is responsible for specifying certain production equipment, tools and methods.

2.9.1 Land and Building Section

This section is responsible for plant layout and for construction and rearrangement and is headed up by the Assistant Plant Engineer. The plant lay-out is in effect an engineering service which is supplied upon request. It attempts to arrange the work areas and equipment in a manner that provides the most economical and productive utilization of existing facilities. In fulfilling the responsibility for plant construction, the Assistant Plant Engineer furnishes specialized engineering knowledge and recommendations concerning proposed new construction projects.

2.9.2 Maintenance Section

This section is charged with the responsibility for the maintenance of all land, buildings, utilities and all factory equipment. This includes preventative maintenance on all factory equipment utilized by all departments of the Marshall-Eclipse Division. In this respect it is noted

that maintenance includes calibration of the instrumentation of ovens and presses in the organic brake lining department.

2.9.3 Production Methods, Production Equipment, and Special Equipment Design Section

This section is not staffed with permanently assigned personnel. Rather, functions are executed on a project basis under the close supervision and guidance of the department head. Although the intent may be for this section to accomplish methods engineering and tool design equally for all product lines, in practice these functions are applied to differing degrees in the three product areas. For this reason, the functions will be discussed in terms of their application in the separate product areas of Organic, Chemical, and Cerametalix.

2.9.3.1 Organic

Methods engineering in the organic brake lining area is tied closely to the Product Engineering Department functions. Because new and modified brake linings are designed to fit existing manufacturing processes, the Plant and Manufacturing Engineering Department is often bypassed and the task of determining how to best fit the various organic products to existing equipment is left largely to Manufacturing foremen and supervisors, and, in some instances, to individual operators. New production equipment design is the responsibility of Plant and Manufacturing Engineering. However, modifications to existing equipment are made by the Manufacturing Department. Plant and Manufacturing Engineering is consulted only when problems arise which are beyond the capacity of Manufacturing to solve. The initial design

and subsequent modification of special equipment is a well-defined responsibility of the Plant and Manufacturing Engineering Department. Such equipment is designed and furnished to the Manufacturing Department where and when required, and to the Product Engineering Department upon request.

2.9.3.2 Chemical

Plant and Manufacturing Engineering has no responsibilities for methods and process engineering, and equipment design, in the chemical area. These functions are carried jointly by the Product Engineering and the Manufacturing Departments. Outside consultants are utilized to design major chemical processing facilities. The only responsibility of Plant and Manufacturing Engineering in the chemical area is to coordinate with the Purchasing Department in procuring equipment specified by Manufacturing and Product Engineering.

2.9.3.3 Cerametalix

Methods engineering and equipment design of the original manufacturing process for cerametalix aircraft products was accomplished on a cooperative basis with the Bendix Products Aerospace Division. Continued engineering and design, however, are clearly the responsibilities of the Plant and Manufacturing Engineering Department, both for aircraft and automotive cerametalix products.

2.9.4 Cerametalix Processing Section

The major function of this section is to convert the broadly stated cerametalix "Process Instructions" received from Product Engineering, into detailed manufacturing instructions for use by Manufacturing personnel

and other interested departments. This section is also charged with the process control function of finding and removing the causes of deficient products as reported by the Quality Control Department.

2.9.5 Tool Engineering and Drafting Section

This section is responsible for designing the specialized tools and equipment used in the organic and cerametalix manufacturing processes. If such tools and equipment cannot be made in the plant, this section selects an appropriate vendor source and works closely with that source to ensure that specifications are fully met.

This section also serves as a central drafting agency for the entire plant and provides product and plant drawings upon request by various departments.

A third function is the operation of the Cerametalix Tool Crib. This crib maintains and issues specialized cerametalix tools and dies, as well as detailed manufacturing instructions for each part number, to the Manufacturing Department. Procedures have been established whereby no tools can be issued for use until the Quality Control Department has inspected them for accuracy, wear, and damage.

2.10 Manufacturing

Manufacturing within the Marshall-Eclipse Division encompasses three areas: (1) organic brake lining, the major function; (2) resin; and (3) cerametalix. Brake lining composition is either "dry" or "wet" mix. Cerametalix lining, as the name implies, is a powdered metals product. Resin, a bonding agent, is used in the manufacture of organic brake lining

and is also sold commercially.

Brake lining and resin manufacture are under the Factory Manager while cerametalix manufacturing is under an Assistant Factory Manager who is responsible directly to the Division General Manager. The organic brake lining and resin manufacturing, and cerametalix manufacturing are two distinct organizational functions. The manager of one has no responsibility for the function of the other. For this reason, Cerametalix Manufacturing will be treated separately. There is an Assistant Factory Manager, reporting to the Factory Manager, responsible for the resin plant and the compression mold process, one of three methods used in the formulation of brake lining. He also acts for the Factory Manager in his absence.

The three manufacturing functions are carried out in contiguous areas of the plant which permits centralized raw materials support and other service support functions organic to the Factory Manager organization. No proration of charges for these services is made to either the resin or cerametalix functions.

2.10.1 Factory Manager

The Factory Manager is charged with the general responsibility for the establishment and maintenance of effective manufacturing policies, programs, and objectives in accordance with Division policy. He assists Sales and Management in the preparation of an annual sales forecast. Using the sales forecast as a base, he calculates annual machine and man power requirements and reflects these data in the Manufacturing Budget.

He spends approximately equal time in three major areas: (1) pricing products and studying new products relative to size, tooling and

price; (2) guiding Production Control which includes his relations with customers and Sales in the area of manufacturing capability and customer desired delivery dates on their orders; and (3) meetings and conferences, primarily with his Production Control Manager and three Factory General Foremen.

The Factory Manager controls the manufacturing operations by coordinating the functions of the Assistant Factory Manager, Brake Lining Foremen, and the Production Control Manager.

2.10.2 Organic Brake Linings

Three General Foremen, under the Factory Manager, are responsible for the production of the organic brake lining from the raw material stage to the finished product. One general foreman is responsible for all the dry mix of the various formulations, for the block line, and for the warehousing and delivery of raw materials into the production stream, including raw materials required for resin and cerametalix product manufacturing. Another general foreman is responsible for the extruders, presses, roll machines and cure ovens for all products. The third general foreman is responsible for all operations on the linings involving bending, grinding, drilling and finishing.

2.10.3 Off-Shift Superintendents

There are two off-shift superintendents, each working one of the shifts between 4:00 P.M. and 8:00 A.M. During his shift the superintendent is responsible for the entire brake lining production process.

2.10.4 Production Control Manager

The Production Control Manager is responsible for the establishment

and supervision of adequate programs and procedures for the most efficient and effective flow of materials through the factory to meet customer requirements. He is charged with the direct supervision and coordination of all scheduling, machine loading and man power requirements consistent with engineered standards and procedures.

Specifically, he is responsible for the establishment of a rate of production to conform to customer weekly requirements; a production control system which coordinates weekly factory production schedules; and to act as liaison engineer on all brake lining (organic) processing problems. He maintains tooling records on castings, segment press molds, block molds, dry mix bending trays, wet mix bending trays, drills and counterbores, and submits new tool requirements to the Factory Manager. He establishes manufacturing process data on all parts consistent with engineering standards procedures.

Based on established factory schedules, the Production Control Supervisor is responsible for the delivery commitments to all customers. Jointly with the Production Control Manager, he determines weekly customer requirements on all part numbers and determines rates of factory production to meet these requirements. He also maintains direct contact with customers regarding delivery dates.

He is responsible for the preparation and distribution of Manufacturing Process Cards on all new part numbers consistent with engineering specifications and procedures. He must be familiar with all processing procedures.

Under the Production Control Supervisor, clerks maintain records

on customer requirements, finished goods inventory, in-process inventory, material scheduled, unscheduled requirements, and future manufacturing schedules.

The Production Expeditors are responsible for the prevention and early recognition of production situations which may jeopardize delivery schedules, and take the necessary corrective action.

2.10.5 Raw Materials and Expense Supplies

The Raw Materials Control Supervisor maintains records reflecting the current stock status of raw materials. Based on the results of a weekly physical inventory and the raw materials requirement to support current work schedules, he computes replenishment requirements and passes this information to the Purchasing Department for procurement action.

2.10.6 Production Shipping

Production shipping is a function under the Traffic Department and is concerned with the planning and execution of a shipping schedule for the delivery of original equipment linings. The planning data necessary for this shipping schedule is furnished to Production Shipping by the Production Control Manager.

2.10.7 Safety, First Aid and Fire Protection

The Safety Supervisor, who is also the Raw Materials Control Supervisor, conducts a weekly inspection of the plant, noting violations of safety. He is accompanied by different members of the supervisory echelon each week. A list of the violations is distributed to each foreman for his use at safety meetings.

A safety shoe and eyeglass program is maintained which includes a small retail store for the sale of safety shoes to factory workers at cost. Safety glasses are furnished to workers engaged in eye hazardous operations, free of charge.

A small first aid room, staffed by personnel who have been trained in first aid, is equipped to take care of minor personal injury cases.

2.10.8 Assistant Factory Manager, Chemical Products

Under the Factory Manager, the Assistant Factory Manager for Chemical Products assumes all manufacturing responsibilities for the resin products and assigned manufacturing responsibilities for compression molded brake lining. In this latter function he is responsible for the operation of the mix room, roll machine and benders to meet scheduled production as set forth by the Production Control Manager. He acts for the Factory Manager in the latter's absence.

2.10.9 Licensee Liaison Engineer

Through negotiated contracts, the Marshall-Eclipse Division provides technical data on brake lining processes, formulations, production methods, and machinery to foreign brake lining manufacturers. The Licensee Liaison Engineer, under the Factory Manager, serves as the Division intermediary for this purpose. He assembles the technical data, answers queries of these foreign brake lining manufacturers, and maintains the necessary data storage files. A good portion of his time is spent in the collection of these technical data since there has been no concerted program in the past to reduce to writing the details of this function which would serve

to facilitate his task.

2.11 Cerametalix Manufacturing

The manufacture of ceramic-powdered metal (cerametalix) friction products is relatively new at the Marshall-Eclipse Division. Originally manufactured in South Bend, the production facilities were moved to Marshall-Eclipse in 1955. Present production is predominantly brake systems elements used on aircraft, though new applications for cerametalix products are being researched.

Since the products are for aircraft use, engineering specifications are rigid and quality control requirements stringent. Bendix Products Aerospace Division, the major customer, provides the engineering specifications and inspection requirements for raw materials and the products. The Chief Engineer, Cerametalix Products, acts in the capacity of Bendix resident engineer. The Manufacturing Engineering Department determines the process methods and controls for the manufacture of the products. Quality Control personnel inspect raw materials, in process work, and finished stock to insure manufacture of high quality products. At present, only a small part of the total production is devoted to non-aviation cerametalix products. However, the same degree of engineering exactness and quality control inspection is applied to the "commercial" products which have been produced in limited quantity, such as elements in clutch assemblies, for heavy duty construction equipment.

2.11.1 Assistant Factory Manager, Cerametalix

The Department Manager is responsible for the manufacture of all

cerametalix products and reports to the General Manager. The manufacture of organic brake linings and cerametalix products are separate functions within the Division organization. Normally, the only item requiring coordination between the two manufacturing managers is manpower allocation during heavy factory work schedules.

The Manager's responsibilities are fairly well defined and are restricted primarily to manufacturing functions. He is responsible for manufacturing a quality product at minimum costs and meeting customer requirements. The department includes a general foreman, two off-shift superintendents and a normal production work force of sixteen persons.

In addition to his basic manufacturing responsibility, the Department Manager is the contact between factory and customer for schedules, facilities, and price quotations. To fulfill the latter function, it is necessary to maintain cost data records in cooperation with the Comptroller.

2.11.2 General Foreman

The General Foreman serves as supervisor of all activities within the Cerametalix Department under the direction of the Assistant Factory Manager. Implementation of factory work schedules through the best use of men, materials, and equipment is his concern. The off-shift superintendents perform this function during his absence.

2.11.3 Production Control

The Production Control Section maintains work schedules to meet customer requirements and monitors the production records to determine

variances. Weekly inventories of stock are taken to check production records, for adjustment of work schedules, and to insure shipping schedules are met. Raw materials inventories occur weekly and requirements for materials are communicated to the Purchasing Department.

CHAPTER 3

PERSONNEL

3.1 General

At the present time, Marshall Eclipse is a non-union shop. However, while the group was studying the Division, it was petitioned by employees to put to a vote the question of joining the United Auto Workers Union. While this was a most interesting development from the vantage point of an outside observer, it naturally was a source of concern to the Management. It also made questions concerning employee attitude and morale somewhat difficult to answer. Because of the delicate situation, a direct examination of all areas of Industrial Relations and Personnel was not attempted. Comments on procedural matters are the result of direct examination, but other comments may stem from observations of operations or from general impressions gained on our weekly plant visits. This should not lessen their value, however, because it is usually easier for an outsider to become aware of these things than for a person who has day-to-day contact with the environment.

One general comment on the situation seems to be in order. No preparations are being made by the Division in anticipation of a pro-union vote. While it is undoubtedly true that much help would be forthcoming from the corporation level in this event, it also seems to be advisable that some steps should be taken in case of a pro-union decision on the part of the employees, regardless of how remote the chances for such a decision might be.

3.2 Salary Payroll

At present only the hourly employee payroll and records are maintained and administered by the Personnel Department. Salaried employee records and payroll are administered in the office of the Comptroller. The removal of the hourly payroll to Personnel is a relatively recent change. Hiring of salaried employees is not normally handled through personnel.

In the interest of continuity and consistency, the Personnel Manager should be given the function of maintaining the entire payroll and all employee personnel records.

3.3 Employee Magazine

Since its inception, the Employees' Magazine has been under the editorship of the Comptroller. The magazine, The Brakevine, has been extremely successful, winning for the company and its editor various awards and recognition. It is a well prepared organ and does a fine job of keeping the employee informed.

However, the purpose of any house organ is communication to, and recognition of, the employee. These are primarily Personnel (Industrial Relations) functions. The Personnel Manager is theoretically closer to the worker and should be in the logical place to handle such a function.

3.4 Personnel Records

In the course of interviews and discussion with the Personnel Manager, certain practices concerning maintenance of personnel records

were reviewed. At that time, recommendations were made to, and accepted by, the Personnel Manager. The recommendations resulted in material savings in both storage space for records and in required clerical time. The recommendations have either already been implemented or are scheduled for implementation in the near future.

No further discussion is deemed necessary here.

3.5 Training

At present, no in-service training program of consequence is in existence at Marshall-Eclipse. It was conceded by the several executives with whom this matter was discussed, that retirement, departure or incapacity of any of several key men would present a serious problem insofar as replacement is concerned. The present General Manager was afforded the opportunity of becoming involved in the activities of most, if not all, of the departments before assuming his present position and, as a result, was well qualified for the promotion. At present, however, no one is in training for, or even thinking about, any job other than the one he is presently holding.

If the Division is to sustain its growth and to maintain its present policy of promotion from within, it is imperative that a training program be established in at least two areas.

First, at a junior executive level, new personnel must be brought in to train for positions in the "Assistant To" category. Certainly, not many personnel in this category are needed, but a few are.

Second, at a middle management level, some effort should be made to qualify present talent for greater responsibility. This could be

accomplished quite painlessly through an in-plant training program, where all middle management personnel spend part-time in other departments, learning the rest of the business. Very few extra personnel would be required as assistants to free department heads to learn other aspects of the business. Better qualifications in all fields plus a much closer coordination and understanding between departments would be only two of the direct benefits derived from such a plan.

Should personnel in such a program at Marshall-Eclipse come up against a situation where promotion is impossible because of lack of openings, it seems that there should be a spot for them somewhere with The Bendix Corporation. The recent installation of a system of classification of college degree holders at the Corporate Office should be a great help in the successful implementation of this program throughout the Corporation. Even if Marshall-Eclipse were the loser in a few instances, The Bendix Corporation, as a whole, would most certainly be the winner.

It is recognized that a program of this sort is costly. However, failure to install such a program, in the long run, is likely to be more costly.

3.6 Job Descriptions

A system of defining responsibilities and authority through the use of job descriptions was instituted in July, 1961. These are to be reviewed and revised as necessary on an annual basis. However, the first review is not yet complete as of this date, eight months later.

The initial writing of job descriptions is only the first step. They must be reviewed for accuracy, for overlapping responsibility between

persons, and for gaps where no one claims responsibility. It is essential that each person knows exactly how far his job goes and what the jobs of others are. Without this, some confusion and conflict must exist.

The authors considered at some length the placement of the responsibility for coordinating a job description system and the development of an organization manual. As indicated here, and elsewhere in this report, this is considered essential. It seems that there is no place in the organization where this function fits ideally. The General Manager must assume over-all supervision and direction of the project but someone must coordinate it and see that it is done. He must have the unqualified support of the General Manager and responsibility accompanied by necessary authority. Without it this study or project will die, as others at Marshall-Eclipse have done.

A job description system would, to some extent, alleviate the problem mentioned previously: The problem of replacement and promotion on an emergency or planned basis. This problem has not been faced at all by the Marshall-Eclipse Division.

3.7 Safety

At present, this function is located under the Manufacturing Department. It lacks the active support of Management and supervisory personnel. This is evidenced by the fact that, as this is written, not even all supervisory personnel in jobs involving eye hazards have safety glasses despite the fact that the company pays the bill. This was brought out at a foreman's meeting attended by one of the authors. The directive handed out at that time in this regard was something less than forceful.

Safety is a paramount concern to any enlightened management and, as such, it must be actively pursued by all personnel. Workers on the floor will not pursue it unless supervisory personnel and management exhibit an interest.

Because it is primarily an Industrial Relations function rather than a Manufacturing function, it is recommended that Safety be made a function of the proposed Industrial Relations Department. However, the comments contained herein concerning Management support are still valid regardless of organizational position.

3.8 Human Relations

The management of most companies, if queried on the existence or effectiveness of their human relations program, would reply that they have a going program, that it is effective and that all hands understand and implement it fully. Marshall-Eclipse is probably no exception. However, on reflection and investigation, certain things have come to light which are symptomatic of a somewhat less effective program than desired. Examples of breakdown of communication are not difficult to find. Laying off employees with little notice is another symptom. The fact that the company is being petitioned for a union vote may be indicative of a weakening employee-management relationship. A human relations program is not something with which to fight fires. It should not receive crash priority when faced with a union vote or some other crisis. It is a continuing, well thought out program with clear-cut policies, procedures, and objectives.

Throughout the report, the reader will find reference to human

relations problems which might arise as a result of making suggested changes. In some cases, the changes have been considered by the Management, but have not been implemented because, at least in part, a concern exists of offending the employee and possibly losing the non-union shop. That this is a well founded concern is recognized by the authors. However, the authors also feel that if an effective human relations program is pursued, if the employees are really made to feel as though they are a part of the company, if the employee becomes a part of the changes and can identify himself with the company and the changes, then these fears can be overcome.

For these reasons, the authors have decided to outline a basic human relations program in a very general form. It is for the Management to decide how it can best be implemented.

3.8.1 Human Relations Factors

The program starts with the philosophies and goals of the parties involved. These special interests come together for integration in the organization. The interests of the individuals involved interact with those of the group and evolve into a whole set of new interests. The two groups are, of course, the firm and its employees.

It is in the organizational units that the interests must be reconciled and integrated by the leadership: Department Heads, Managers, Foremen. Recognition must be given to the fact that leadership is exercised both within the Formal and Informal Organization.

The formal organization attempts to implement its philosophy and objectives by means of policy, organization structure and procedures.

Policy guides the conduct of the organization. Organization arranges the work in terms of jobs for which individuals will be held responsible. Procedures designate the time, methods and sequence of work performance. Structure follows lines of authority, but procedures may cross lines of authority because they follow lines of work performance.

In considering all of this, the informal organization must be included. It affects the way the group members interact with each other and, sometimes more important, with the firm. It gives the group the power to act without the use of formal authority. It is spontaneous, nebulous, and difficult to recognize, but it does exist in every formal organization and has a significant effect on human relations. The informal organization cannot be abolished.

Controls are the stimuli to action. The different organizational influences may cooperate or they may clash at a particular point. This creates conflict and forces the individual to decide which control to accept. Some evidence of this is now in existence and leads to misunderstanding on the part of those involved. These instances will be brought out later in the report.

The system of controls interacts with a person's attitude to produce motivation of a certain type. If attitudes, controls or situation change, then the motivation, too, will change. For example, tightened control, leaving attitudes and situation unchanged, will produce a change in motivation and produce different results. We are proposing certain changes which, if not carefully handled, may lead to attitude and motivation changes.

Motivation, in turn, determines a course of action or behavior, which produces a certain result. This is the end product of the human relations program which is generally considered to be a success if it increases productivity, other things being equal.

3.8.2 The Human Relations Program

Although the subject of human relations is discussed under Industrial Relations, the primary responsibility for a successful human relations program must rest with Top Management - the General Manager. An announced program of human relations will not survive long without his express and unreserved support. It must be communicated to all concerned and carry with it the full weight of Top Management backing.

The objectives of the human relations program are not revolutionary. They are what every good management wants - increased productivity, on and off the job satisfaction and the development of a human relations attitude.

Policy is primarily a guide for management decision. But it must not be overlooked in its usefulness as a guide for the employee as well. Knowledge of policy helps the employee understand and anticipate management decisions. Remember, it is the people at lower levels who make the policies work. Human relations policies and objectives are as much a part of the company's policy as is a statement of company sales policies and profit objectives. As such, human relations objectives and policies, too, should be set down in writing.

3.8.2.1 Communication

Leadership takes effect through the process of communication. As

such, communication is the heart of the human relations program. Without communication an organization cannot be effective. Communication is three dimensional - upward, downward, and horizontal. Day-to-day contact may not fulfill the requirements of communication in any direction. It is imperative that a plan of communication be developed so that all who need to know "get the word." Most of the readers will remember times when they were not informed of actions which clearly affected their situations. The resulting feeling is not pleasant. The employee is affected every day by decisions of the Management. Is he informed?

Upward communication is sufficiently different to warrant a few separate comments. It is the only vehicle which brings to management a knowledge of how downward communication is accepted, better understanding of employee views and problems, and, of great importance, better information to management for evaluation and decision making. Employee participation and interest is thereby stimulated and valuable employee ideas received. However, formidable barriers to upward communication exist, barriers which are not easily recognized. Status and prestige, manner of speaking and dressing, freedom of movement - all distinguish between the manager and the employee.

The open door policy is essential to the handling of grievances in a non-union shop, and is a means of upward communication. Marshall-Eclipse Management describes it as effective. Before accepting this description, perhaps a searching look should be given the policy with a special eye to the above mentioned barriers and their effects.

3.8.2.2 Employee Appraisal

A system of employee appraisal is a must if a human relations

program is to operate effectively. Without it, an employee at any level can drift on for a long period of time without ever knowing exactly where he stands.

But before an employee appraisal system can function, other things must be developed. Sound organization planning must be done, up-to-date charts maintained, and organization, policy and procedural manuals developed. Another essential is a complete set of current job descriptions. Without these benchmarks, what is there to tell an employee whether or not he is measuring up to his job and responsibility, let alone what his job is? The employee and supervisor, both, must know what each expects of the other. Periodic discussion of progress, goals and performance is needed. This shows the employee what contribution he is making to the firm and what contribution the firm expects. It indicates he is worth something to the firm as an individual.

An organized supervisory training and executive training program is needed, both on the job (as discussed earlier in this chapter) and by taking advantage of suitable educational institutions and management groups. The training referred to here should be slanted toward the leadership aspect rather than toward the technical, professional aspect. This will not only assist in the employee appraisal, but also in other parts of the human relations program as well.

3.8.2.3 Other Aspects

Recommended ways of implementing a human relations program are legion. They can be found in any good text on the subject. We are not recommending that managers and supervisors become amateur psychologists,

try to build character, or analyze personalities. This section is intended only to refresh Management's awareness of the need for a continuing program, one that is stable, yet flexible enough to change as times change. The base is there - it need only be expanded.

3.9 Recommendations Summary

1. Place all payroll records administration under Personnel.

2. Place the Employee Magazine under Personnel.

3. Institute a training program to better acquaint and better qualify present executive personnel in the activities of other departments. Institute a training program for a selected few new personnel at the lower management level to provide future talent and free present talent for further training.

4. Coordinate the development of a job description system to better define responsibility and authority areas of executives, eliminating gaps and overlaps in these areas. Extend to include organizational development.

5. Place Safety under the proposed Industrial Relations Department.

6. Implement a program of Human Relations as described in this chapter.

CHAPTER 4

COMPTROLLER

4.1 General

The authors were quite favorably impressed with the general organization of the Comptroller function. It appears that the procedures in use are well understood by all concerned. In this connection it seems that replacement of key personnel on either a planned or emergency basis would be no problem here. Key personnel have more than a basic understanding of what responsibilities others bear. This is something of a contrast to the situation existing in other departments throughout the Division. Included here are only those functions or points within the Comptroller areas on which specific comments are deemed appropriate.

4.2 Cost Accounting System

Because of the essentially chemical nature of the raw materials and the fact that many end products, i.e., different brake lining parts come out of a single mix, an Operations costing system is used. Input costs are not readily identified with any specific product output.

Costs are accumulated in four cost centers: Product Engineering, Brake Lining, Cerametalix and Resin. Costs incurred in Product Engineering are then redistributed to the other Cost centers. Burden is distributed to these three cost centers on the basis of Direct Labor Dollars, which seems to be a reasonable basis.

Variances are treated as a period cost and closed each month to Cost of Sales.

4.2.1 Material and Labor Costs

Standard material inputs for each mix are obtained from Engineering Standards Sheets. Standard material costs are obtained by computing the standard material cost of each mix and converting it to a cost per part based on the weight of the part and the cost per unit weight of the mix.

Standard material cost data are supplied to the Cost Accountant by Purchasing.

Standard labor costs are based on standard times for individual operations. These times are based on historical data gathered from the time cards punched by workers as they perform the necessary operations.

Recomputation of standard cost data is done at least annually and also as changes in operations or mix occur.

New product labor cost is obtained by comparing it with a similar existing product, noting and allowing for deviations.

Using historical data for computation of labor costs does not necessarily provide a sound basis for standard costs. This recommendation is related to one which appears in another section (paragraph 10.2) of this report: That a complete methods and standards study be made of all manufacturing processes. Standard time and cost data based on this type of study would be far more realistic and accurate than those based on historical data.

It is also felt that data based on an engineering study would be more readily accepted by Manufacturing Department Personnel than the data now used. Data in use now is derived basically for accounting purposes and by accounting methods. Acceptance of the data as sound and meaningful is

essential to acceptance as control data.

4.2.2 Overhead

Overhead is distributed to each of the burden centers based on Direct Labor Dollars. Standard burden rates have been computed and burden variances, unlike other variances, are used to some extent for control. This is a highly recommended procedure. However, because costs are not first accumulated by departments throughout the plant, it is highly questionable in its effect as a control device in its present form.

A revision of the budget system is now in progress, which will alleviate the situation as it now exists. Each Department will have its own budget and accumulate its own costs as controllable and non-controllable costs. Far better control of cost and more realistic assignment of responsibility will be the result.

4.3 Variances

A major purpose for computing variances is to maintain control of costs and to assign responsibility for deviations. Price, Labor and Yield variances are all computed.

However, none of the variances are used for control. Efforts have been made to use them for control purposes without success. If this is not done, then a major reason for computing the variances is to keep inventory valuation on a constant, consistent basis. Since variances are closed monthly to the Cost of Sales, their effect is not felt on inventory valuation. They then become an accounting device and not a control device. No responsibility is assigned or assumed by production personnel for the

variances, a situation which cannot lead to recognition or rectification of the reasons behind their existence.

Successful implementation of such a system must rest on a full understanding by all concerned as to the implications and importance of the variances.

4.4 Pricing

As indicated elsewhere (paragraph 2.10) in this report, the Factory Manager spends a significant portion of his time on pricing matters. Cost data is supplied to him by the Cost Accountant and is used to determine a price recommendation which is then sent to the Sales Departments or to the customer.

It appears to an outside observer that the Factory Manager is only a middle man in the pricing function and should not be involved in it. Prices should not be a concern of the Factory Manager. His only concern should be staying within the Standard Cost Data supplied by the Cost Accountant. Variances supplied to the Factory Manager should be used for control and should be his main concern in this area.

The function of pricing should be handled by the Comptroller who would furnish prices to the Sales Department, based on an acceptable profit margin. Significant deviations from the recommended price should be referred to the Comptroller or the General Manager for approval.

A similar situation exists in both Cerametalix and Chemical Departments. The same recommendations hold for these two areas as well.

4.5 Employee Magazine

At present, the employee magazine is edited by the Comptroller.

It is a highly successful communication and the credit for its success must go to the Comptroller. However, this is not a logical function of the Comptroller. It is a part of the Industrial Relations function and should be so placed. Other discussion of this point will be found in paragraph 3.3.

4.6 <u>Exempt Personnel</u>

Records of exempt personnel are maintained by the Comptroller who performs related personnel functions for employees of this category. In the interests of consistency and continuity, this function should be transferred to the Personnel Manager. Related discussion appears in paragraph 3.2.

4.7 <u>Reports Control</u>

There is, at present, no centralized control of reports within the Division. No one has a complete file of all required reports for all departments. Some reports require the cooperation of two or more departments in preparation. Yet, no one has follow-up responsibility for those in process or those to be initiated. In fact, no one has analyzed all the reports for their value to management.

Maintenance of a report file should be instituted to extend the system already in effect in the Comptroller's Department to encompass all regular, irregular and special reports. As reports come due, a tickler should be sent to the responsible department. If the report is not forthcoming when due, a follow-up is then possible by a central authority. All reports would be returned to the Comptroller's office for mailing when

completed. Responsibility for this should be assigned in writing.

A system of this sort will preclude what has happened on occasion in the past: A partial report was filled out by one department and sent on to another department for completion and was delayed because the responsible person was on vacation. The interim replacement had no knowledge of the requirement. Follow-up is a requirement for efficient, timely administrative procedures.

4.8 General Accounting Office

The General Accounting Office Manager is concerned with general accounting records, systems and procedures, services, billing and tabulating. He also has certain office management responsibilities but these are not spelled out in his job description.

General accounting procedures are established and audited by The Bendix Corporation. Controls appear to be good. The office seems to be well organized and efficient.

4.9 Records

Records management within the department is good. Efficient records storage practices are in evidence; however, there is no over-all division records management supervision. There is no established policy for retention of records except in the case of those required for audit.

4.10 Services

A study is needed to determine the costs of office services. Standards should be developed, and costs should be properly allocated and included in department budgets.

4.11 Credit and Collections

Apparently, the Credit Manager operates without formal policy guidance from higher management. Since the key problem in credit evaluation is to decide which accounts are to be given credit, how much, and under what circumstances - particularly in the case of high risk accounts - the Credit Manager should have written guidance on what risks to accept. Higher management should balance the risks of loss and possible tie-up of funds against the value of the prospective sales involved, based on the company's production and sales situation. These decisions should be passed to the Credit Manager in the form of policy which represents higher management judgement.

Once initial credit to a new customer is established, a credit line (limit) should be extended, and a system of "management by exception" should be established. It seems inefficient to require the Credit Manager to check every incoming order every day before order processing can proceed.

4.12 Office Practices

Marshall-Eclipse is fortunate in having a top-notch and experienced secretarial staff. While centralization of clerical effort is not warranted or recommended, some form of organized training in basic company secretarial practices is needed. At present new secretarial personnel are checked out by one of the senior secretaries. Efficiency could be improved and the break-in period reduced by simple indoctrination training.

Perhaps a start would be the formation of an "inter-departmental task team" of the senior secretaries. They would meet and agree on standard correspondence practices and related matters. These would take the form of

a short "secretary's handbook". This group should have written responsibilities to recommend and develop efficient secretarial practices. There is plenty of room for improvement even in such routine matters as filling out forms. A team like this should be able to resolve many problems of small functional groups in different offices doing practically parallel jobs. Paper work simplification and office methods and standards should be a continuing job. Some very good work has been done - and is being done - on both form design and in adapting punched card procedures for the issuance of 20 per cent credits. The latter should save the company many dollars in rebate credits as well as labor.

4.13 Data Processing

So far, the emphasis in data processing has been on payroll and cost accounting. Consideration should be given to shifting the emphasis to improvement of the information Management needs to operate the company. A start has been made with the plans for adapting requisitioning and billing to punched-card operations.

A complete analysis should be made of what the needs of management are. Then the company report system should be analyzed and overhauled. The data processing system then should be designed to provide the kind and quantity of reports required to furnish needed information. Management must place major importance on the increased control and flexibility inherent in a data processing system.

Use of data processing should be aimed at improving the basic operational functions of Marshall-Eclipse. For instance, an effort is being made to make a sales analysis by territory using part number summary

cards. When order processing and billing are fully adapted to punched cards, sales cards can then be designed to give sales analyses by salesmen, size of shipment, customer or by any factor that Management thinks necessary.

At present, forecast information is of little value in production planning. As more and better data become available, the company will be able to make and use valid analyses of trends, markets, effects of competition, etc.

Certain aspects of production planning lend themselves to punched cards. Materials, labor and operation data may be pre-punched for each product to simplify the planning job. Better scheduling would result from better production planning. Better machine utilization, higher efficiency and reduction of follow-up expediting costs would be the result.

Inventory management should be a priority objective for the data processing system. This can be brought about by using punched cards to handle issues from stock, items on current and back order, receipts into stock and credits and returns.

A good data processing system should make evaluation of the company's operations easier. Problems requiring attention can be pointed out as they happen rather than later. Up-to-date information can be furnished at any time required.

Other companies have found that, as they expand the data processing function, the organizational problem requires Management attention. Cutting across departmental lines and the coordination required between all departments of the company requires a "neutral" approach. Also a planner should

be free to plan and develop the program without having to "fight fires" as they come up in his department. Further, Marshall-Eclipse is thinking of a computer in the future. Experience of others seems to indicate that a three to four year full time planning period for such an installation is not out of line! For these reasons a separate functional unit to plan and organize the data processing system should be considered.

A written proposal should be submitted to Management for approval of a basic system design. It should cover all elements of the proposed system, the essential purpose of the program and the expected result. The scope of the program should be clearly identified. A time table should be laid out for approval with project schedules, estimated project completion dates and the dates of the phasing in of the required changes.

Immediate action should be taken to improve the tabulating room in accordance with plans which have already been prepared. It is too small, too noisy, too crowded and there is insufficient storage and file space. Sound deadening material should definitely be installed.

4.14 Budgeting

The annual budget serves as a profit plan for the period October 1 through the following September 30. Preparation takes about a month and a half. This budget, adjusted as necessary to reflect unforeseen changes such as higher labor rates, serves as the basis for subsequent review of profit performance.

A production budget is also prepared for the same period based on estimated production. It is phrased primarily in units of direct labor hours.

The sales budget and sales forecast is prepared at the same time. Each zone manager and salesman is responsible for preparation of a forecast. Forecasts are not broken down by product or by months.

Methods to improve budgeting procedures are under study and the revision of the present budget is expected. At the present time budget objectives are not written and no formal policy guidance is given. There are no budget instructions which spell out deadlines for various components, assign responsibilities for preparation, prescribe the form or describe the over-all budget pattern.

4.15 Traffic

The Traffic Manager reports to the Comptroller and is responsible for the direction of transportation activities and distribution functions.

Transportation activities are those associated with rates, routing, modes of transportation, etc. Good cost control exists concerning freight rates and charges although it is becoming more and more a time consuming job to keep up with the rapid changes in transportation. Freight costs have been kept in line and, in some cases, reduced, during a period of rising prices in transportation.

Freight bills are audited for proper rates and charges. At one time, traffic audited freight allowances, charges and equalizations on invoices, but this procedure has been stopped. It appears inconsistent to audit freight bills, but to disregard freight charges and allowances when they appear on an invoice.

Distribution functions are those of shipping, packaging, carton manufacturing, pre-coating, trucking, material handling, warehousing and

receiving. Materials handling as used herein means the transportation of material within the plant - from freight car or delivery truck to storage, to the production line, and from the end of the production line through packing, storage and shipping. The job description for the Traffic Manager further details the responsibilities within each function, but it is understood that this job description has not been approved by top management.

Traffic is a part of what may be called the "Materials Management" function. Basically, this means controlling the flow of materials into, through and out of the plant, and being responsible for it in those stages. There are two approaches to the over-all problem of controlling the flow and quantity of material:

1. In favor of grouping the means for coordinating the planning and control problem under one head, and giving him the responsibility for complete materials management.

2. In favor of a decentralized arrangement built around the concept of participation in various aspects of the problem by all supervisors who are affected.

The choice depends largely on the size of the company, type of production, qualifications of personnel, top management concepts, etc., vis a vis the major principles of organization.

What works today may not work tomorrow - at least not as well. Most studies agree that as companies grow, as production demands approach plant capacity, and as inventories and material handling become major considerations from a cost standpoint, consolidation of control and supervision generally becomes more desirable.

Also as data processing procedures are developed and perfected, materials and production means can be integrated to a much higher degree than before. A single department might be in a better position to make faster and better use of the information from such a system.

Traffic is, at present, a more or less autonomous section within the Comptroller's department. The advantage of this organization is difficult to see. One of the reasons given was that traffic functions, like those of accounting, cut across departmental lines of authority and require constant supervision from a cost standpoint. This is true, but that objective is not being met. At present, costs generated in the above functions seem to be allocated to a miscellany of departments without much rhyme or reason.

A recommendation for a change in the Marshall-Eclipse organization which reflects an approach to integrated materials management, and consequantly removes Traffic from the Comptroller's Department is further discussed in Chapter 12.

As an organization grows, the responsibilities and functions of units are often altered to meet changing conditions. Temporary activities may be added which become permanent, practices are established without proper evaluation and necessary procedures may become dormant. Overlapping areas of responsibility become gray areas. This is apparently the case in Traffic. Regardless of Traffic's place in the organization, the job description and functional organization should be immediately reviewed and the responsibilities assigned where indicated. Gray areas of overlapping responsibility such as those in inventory, stenciling, and packing of finished goods, should be resolved. For example, the chief inspector of quality

control and the Traffic Manager appear to have similar job descriptions here. However, the pre-coating operation appears to be well placed for over-all efficiency, even though it is more properly a manufacturing function.

Once the organization has been resolved, more attention should be given to the activities under the control of traffic and the cost generated by these activities. Cost centers of material handling expenses should be determined and factory expense pertaining to traffic functions should be gathered. Analysis of the flow of materials, organization for material handling, and the material handling expense will suggest areas where material handling costs are unsatisfactory or excessive in proportion to activities serviced.

A material handling improvement program should be instituted. The first step should be a plant-wide layout to develop a picture of the plant's material handling system as a unit. This should be followed by material handling area studies which systematically analyze each situation for potential improvements. A complete and thorough study of this area is considered imperative.

Approximately 70 per cent of the service sales rebuilder's stock is located in the Ryan Warehouse. It is a normal procedure to take 200 to 300 cartons to the warehouse and, while there, to pick up 200 or 300 cartons which might have been brought down a day or two before. Service sales stock is widely scattered. Part of the stock is located within the Shipping Department, part at the Ryan Warehouse and another part in a section of the plant which is separated from shipping. All stock in all locations

is handled by hand, primarily because of lack of room for the operation of mechanical equipment.

In the interests of better industrial relations, some consideration might be given to the personnel structure. For instance, the shipping and receiving "department" is headed by an assistant general foreman. It has been pointed out to the writer that other "departments" of comparable size and responsibility are headed by general foremen.

Internal transportation problems need to be resolved. A written procedure should be agreed upon and instituted.

Proposals made in the past with the aim of improving materials handling in the company appear to have been shelved without proper evaluation. These proposals should be given a proper engineering and feasibility study and then either put into effect or discarded, once and for all.

4.16 Recommendations Summary

1. Develop standard cost data based on a methods and standard study.
2. Educate production personnel as to the meaning of variances and use them as control devices as well as purely accounting devices.
3. Relieve the Factory Manager of pricing responsibility. Assign primary coordination of pricing policy to the Comptroller.
4. Assign to the Personnel Manager responsibility for the Employee Magazine.
5. Assign to the Personnel Manager responsibility for the administration of exempt personnel.
6. Develop a central reports and records control system for the entire Division.

7. Organize Data Processing planning responsibilities into a separate functional unit. Develop a written plan for expanding Data Processing with emphasis on the Managerial Information aspect. Provide proper working spaces and conditions for Data Processing machines and personnel.

8. Determine and charge costs of office service to users. Put office services on a budget.

9. Standardize secretarial practices and provide indoctrination training for new office personnel.

10. Issue budget instructions with advent of new budgeting procedures.

11. Remove Traffic from the Comptroller's Department. Reorganize the functions as illustrated in the proposed organization chart in Chapter 12.

12. Institute a plant wide materials handling improvement program and methods study, beginning with layout.

CHAPTER 5

PURCHASING

5.1 General

Purchasing is well managed and performs its mission quite effectively. Its operating expense ratio (value of goods purchased over direct costs) is about 1.2. This is slightly higher than the national average of processed raw materials industries, but about average for a company this size. The purchasing personnel ratio (number of personnel in purchasing divided by total employees) is about 0.6, also about average. These comparisons are from a recent AMA survey. These ratios are not arbitrary standards, but they give a fair indication of general efficiency.

The Director of Purchasing measures the effectiveness of his department by whether or not each buyer saves twice his salary in purchases every year. Individual cases of savings are reported and records of totals are accumulated.

5.2 Objectives

The Purchasing Department is ready for expanded company operations. The Director estimates he will be able to handle 40% more work with the same personnel. This estimate seems quite reasonable. Recent research indicates that purchasing expense ratios and personnel ratios drop slightly as companies grow. Planning and development of procedures for integrating purchasing into the punch card system have been completed.

5.3 Organization and Inventory Policy

The inventory objective of the company varies slightly from time

to time, but generally it is about two months supply-on-hand, or a turnover of six. This rate is established by The Bendix Corporation for over-all inventory - raw materials, work in process, and finished goods.

Purchasing's goal is 1.8 months supply-on-hand of major raw materials. Based on a cost of possession of 20 per cent annually, this gives a 6.6 turnover rate and a 3 per cent cost of possession. Cost of possession is an estimate which embraces space cost, insurance, taxes, handling, interest and capital cost.

While it may be practical to discuss inventory in terms of "number of months supply", that is, physical quantities, the question of the proper amount of inventory resolves itself into a matter of dollars. Too much or too little inventory costs money. Corporate inventory policy is outside the scope of this study, but Marshall-Eclipse inventory policy should be to provide for uninterrupted operation of the plant at the anticipated rate of production, with reasonable insurance against material shortage and excess stocks at that rate of production, bearing in mind the desirability of maintaining a proper balance between raw materials, work in-process, and finished goods.

These objectives appear to be consistently met as far as raw materials inventories are concerned. The ramifications of inventory policy, however, affect all operations of the company - financial, manufacturing, and sales. For this reason, inventory policy demands attention by top management and requires appreciation of its significance.

Inventory policy should not be undertaken from a purely departmental approach, nor should it be simply a matter of secondary responsibility

of some one department. Broad over-all policy should be decided by top management, based on the combined judgements of the Comptroller, the Sales Manager, the Production Planner, the Factory Manager and the Purchasing Director. This is due to the necessity for closely coordinating the raw materials, in-process, and finished goods inventories with one another and with the future plans of the company.

The responsibility for administering this policy should be specifically assigned. Inventory is a matter of sufficient importance to be made the primary, if not the sole, responsibility of some one person.

This individual should be a member of the company's general top management group, the department heads. He should be in a position to be familiar, not only with the company's future plans as to production and sales, but with the thinking that lies behind those plans.

Basic data required for inventory control must come from the using departments. All that need be expected of them is accurate and timely data concerning their requirements, with the actual control of inventory left in other hands. If all the controllable factors of inventory control are dealt with as parts of the same problem, there will be maximum assurance that each is considered in relation to the other, and to the best interests of the company.

Purchasing is presently concerned with procurement only. Consideration should be given to an organization which would also integrate the traffic function. The traffic function includes receiving, package design, warehousing, traffic control and shipping.

According to the AMA, a similar organization is used in about 25 per cent of all companies. Better than half have one or more of the above functions besides procurement tied in with the purchasing function.

A proposal for organizing Purchasing and Traffic under one head is discussed in Chapter 12.

5.4 Raw Materials Purchases

Initially, blanket orders based on the yearly production forecast are placed with major suppliers. Every week the Director gets a raw materials inventory report and a forecast of the materials requirements for the next four weeks. The report is made up by the Raw Materials Inventory Supervisor, who prepares his forecast from what production information he has. This report is the basis for raw materials ordering during the period covered. Specific quantities from the blanket orders are ordered released by this means.

5.5 Other Purchases

When a department requires an item which must be purchased, a requisition is made up and submitted to purchasing. Punched cards will soon be used for this purpose.

The requisitions go to the buyer in Purchasing who handles the type of material desired. A pre-signed purchase order is prepared and dispatched, with a copy to the Director at the end of the day for information. Strict accounting for purchase orders is maintained.

Traveling requisitions are used for high usage items and for items which are ordered periodically. While this system is quite efficient, more

emphasis should be given to reorder quantities from an economic lot size standpoint, particularly on the items which are on traveling requisitions. A program should be instituted where each buyer analyzes the standard re-order quantity listed on traveling requisitions. Use of a simple tabulation or a nomograph (which can be either developed or found in the literature) to apply economic lot size formulas to these recurring items can prevent permanent and costly affection for some such specific quantity as "10", a "dozen", or "a three-months supply". Judgement must be exercised, of course, by the buyer, but an analysis of this sort takes little time, and may pay handsomely.

No formal policy exists on procedures for procurement of major equipment except that any capital expenditures over $10,000 must be approved by The Bendix Corporation. There is no formal committee structure within the company to evaluate proposals for major equipment purchases. The Director of Purchasing, however, would normally sit on an ad-hoc committee formed to consider make-or-buy and lease-or-buy matters.

Unpriced orders are used when necessary. There is no established policy as to the limit or maximum value permitted.

5.6 Value Analysis and Cost Reduction

There is no formal cost reduction program. There are no value analysis procedures established. The members of the Purchasing Department are familiar with the general aspects of value analysis but have not applied the technique to any company products. Cost analysis of vendor's products is not made. Formal vendor ratings are not used.

5.7 Personnel

There is no formal training program for buyers, but there is a good library of professional books available. The department subscribes to several trade journals, magazines and professional society publications. Job descriptions are being developed as this is written. The department has adequate depth in trained manpower.

5.8 Purchasing Manual

No purchasing policy or procedure manual exists. The Division is reaching a size where a good management practices dictate the writing of a simple manual which covers the important points of the company purchasing policy. It could be written in such a manner that those wishing to order through the purchasing department might use it for reference and so that salesmen and vendors might use it, if so desired. It need only contain a few pages and deal with what the company buys and who does the buying.

Examples of purchasing manuals may be found in NAPA or AMA publications. Most of them detail the purchasing authority and state the exceptions thereto, such as advertising, special equipment, etc. A statement of limitations or circumstances under which the company may be bound or committed by an order or contract is usually included. Some mention of the responsibility of purchasing to balance the factors of price, delivery date, quality and quantity is recommended. Also a statement of the function of purchasing as a service to other departments may be included. A reference to the extent of purchasing authority to question or change specifications in order to gain the best over-all advantage is

sometimes helpful. The Director's policy that no salesman should be kept waiting over 20 minutes without being seen or given a firm appointment is excellent company relations and should be published.

5.9 Recommendations Summary

1. That the Purchasing and inventory control functions be organized as described in Chapter 12.

2. That a standard procedure for analyzing orders with respect to economic order quantity be established.

3. That a simple purchasing manual be prepared.

CHAPTER 6

SALES

6.1 General Sales Organization

The sales organization of the Marshall-Eclipse Division is separated into three departments, each with a Sales Manager directly responsible to the General Manager. The sales force varies in size from one man in Chemical Sales to 17 men in Aftermarket Sales. Headquarters for Aftermarket and Chemical Sales is located at the parent division whereas the Original Equipment Sales Manager and sales force are located in Detroit, to be near the source of orders and changing requirements.

The organization as it stands appears to be sound with very little overlapping of responsibilities, product lines, or territories. It is functionally suited to the needs of customers that it serves. However, there should be one person, possibly a Director of Marketing, to direct all marketing efforts. This would reduce the number of people reporting to the General Manager and relieve him of the burden of marketing details that could best be handled by someone with more time to devote to the job and in closer contact with the daily problems. This move has been contemplated by the General Manager and is being considered for implementation in the future.

One item that will influence any future decisions regarding expansion or changes in the sales organization is the recent formation of the Bendix Automotive Service (BAS) to market all Bendix replacement products from all Bendix Divisions. The Marshall-Eclipse Division is

the only one remaining outside this organization and independently marketing its Aftermarket products. This position is by choice of this Division based on the belief that, by operating separately it can place more emphasis on its product, adapt faster to changes in the market and, in general, sell more brake linings than if they were being sold in conjunction with other products.

At the present the BAS commercial expense rate is about two-thirds of this Division for Aftermarket Sales.

6.2 Aftermarket Sales

6.2.1 Organization

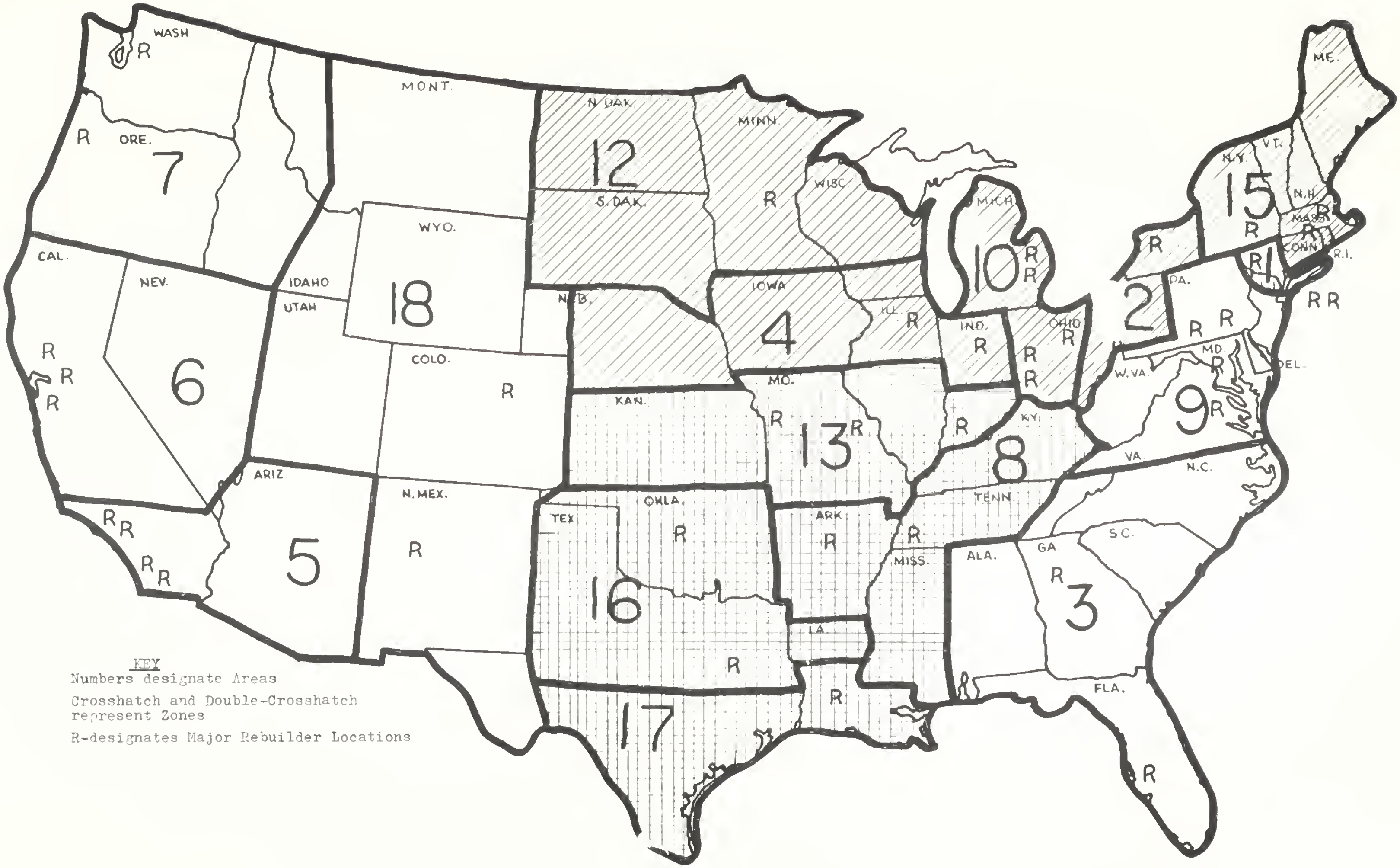
The Aftermarket Sales Department is functionally organized into a smooth operating force with clear cut, understood, and delegated responsibilities. The Manager is assisted locally by two assistants. One is responsible for advertising, merchandising, sales promotion, organizing and coordinating shows and exhibits, and conducting market research. This assistant also acts for the Sales Manager in his absence. The other assistant functions as office manager, a position which includes inventory control, budgeting, statistics and the daily routine of clerical functions. There is one Service Technician who writes technical bulletins, trouble-shoots customer problems and conducts clinics for rebuilders and service personnel throughout the country. All of the assistants are well versed, not only in their own particular responsibilities, but in the general operation of the department. This leads to smooth operation and definite continuity in the absence of the Manager or an assistant. Written

job descriptions are maintained on all personnel in the office but are not available for the Salesmen and Zone Managers.

6.2.2 Sales Force and Territories

The field sales force consists of 17 salesmen, two of whom are designated as Zone Managers. The areas of responsibility for each salesman are outlined in Figure 6-1, with the cross hatched and double cross hatched areas representing a combination of areas into zones with a manager for each zone. The remaining areas are each covered by a salesman reporting directly to the Division Sales Manager. The areas covered by each salesman have been established around the national and local marketing centers with each area determined by business potential, density and travel limitations. The coverage in general is adequate but is considered to be spread a little thin in the West and Northwest. With thin coverage the obvious tendency is to concentrate on the dense areas which produce the most business and resulting commissions, and consequently leaves a minimum of time for "beating the bushes" for the smaller accounts.

The present goal of the Sales Manager is to organize the now existing areas into five zones with a Zone Manager for each and to increase the total sales force to 25 or 30 including the zone managers. Not only would this give proper coverage to all areas, but there would be many other advantages accruing from such a move. The Division Sales Manager would have only five field representatives reporting directly instead of the present large number of salesmen. This would decrease the administrative problems of the Manager and the salesmen and bring the Division Manager into closer contact with his field representatives. Presently the cost



KEY
Numbers designate Areas
Crosshatch and Double-Crosshatch represent Zones
R-designates Major Rebuilder Locations

Fig. 6-1 AFTERMARKET SALES TERRITORIES AND REBUILDER LOCATIONS

of contacting each salesman personally, either in the field or at the Division, is prohibitive in terms of dollars and time, and is limited to about once every two years. With five Zone Managers, meetings could be held more often and at much less expense. Consolidation into zones would also allow one man, the Zone Manager, to act as a special representative on customer problems and difficult accounts in each zone and free the salesman to be more active in promoting old, and discovering new, accounts.

6.2.3 Training

No formal training program exists for salesmen. In general, when a new salesman is added, an attempt is made to hire someone with previous experience in Sales, particularly sales of Automotive parts, although recently some have been hired with neither of these qualifications. Time permitting, the salesman is brought into the plant for a short period to familiarize him with the processes and technical problems involved in the manufacture of brake linings. After this, he is assigned to a sales area. If the area happens to be a part of the two zones now existing, he is trained in the field under the supervision of the Zone Manager. If not, the Assistant Sales Manager from the division goes "on the road" with him for a period of about two weeks, after which, he is on his own.

This system is somewhat inadequate and haphazard. Even if a new salesman has a background in sales and automotive products, more time should be spent with him and written material should be available to him on the technical aspects of manufacturing and application of the product. He should also be thoroughly indoctrinated in company objectives and

policies and have access to written material for refreshing when necessary. A salesman of brake linings must be more than an order taker. He must be able to independently represent the company in a wide area, be on the alert for new customers and be able to advise old customers on technical problems. He must promote the existing products and keep the company advised on prospects or desires for new products in the field. A formal training program administered at the Division level and conducted both at the Division and in the field by the Zone Managers with a "Salesmans Handbook" (now in preparation) containing necessary policy statements and technical information, would do much to ensure the accomplishment of company objectives, promote the Bendix product line and, most of all, sell Marshall-Eclipse Brake Linings.

6.2.4 Promotion and Customer Service

These functions are handled jointly by the Salesmen, Zone Managers, Division Sales Manager, his assistant and the Service Technician. The Salesmen and Zone Managers are active in looking for, and signing up, new rebuilders and then assisting the rebuilder in finding distributors for his product. They furnish "packaged" promotional material and technical information. The Service Technician does considerable traveling around the country trouble-shooting customer problems and conducting Brake Clinics. The clinic consists of a lecture and discussion period on the correct methods and procedures involved in re-lining automotive brakes and is accompanied by a twenty-minute movie produced solely for Bendix. The clinic is presented to all types of personnel involved in brake lining, from the rebuilder to the mechanic. The costs

are shared by the rebuilder and Bendix. The Division Sales Manager is very active in field work and personally contacts or visits troublesome accounts and new prospects, both for assistance and evaluation. The customer service function is considered to be adequate and well organized, particularly in the coverage made by the Service Technician, who is apparently well qualified and doing an excellent job. Advertising and promotion will be discussed further in a later section.

6.2.5 Compensation

Salesmen's salaries, commissions and benefits are established at the Division level by the Sales Manager with the General Manager's approval. The base salary is determined on the basis of background and experience and is considered to be in line with other salaries in similar fields. A commission is paid on sales and, in the two consolidated zones, is shared between the salesmen and the zone manager. This commission is considered to be a little low, particularly in the zones where it must be shared, and it is recommended that a modest increase be made. The Division Sales Manager is aware of this condition and concurs in the recommendation.

6.2.6 Reports

The reports required from salesmen are: (1) A daily report listing the calls made and quantities sold of each product and any pertinent remarks, (2) a weekly expense report listing all expenses incurred (a reimbursement check is mailed to each salesman immediately upon the receipt of this report), (3) a Salesman's Route List which is submitted weekly and indicates the itinerary of the salesman for the coming ten days. This is

used primarily as an aid in contacting the salesmen and for mail forwarding.

The weekly expense report and route list are adequate in form, frequency and content. It is felt that the "Daily Report" should be replaced by a "Call Report." The prime functions of a salesman's call report should not be to keep the home office advised of the calls made, quantities sold, etc. This information is necessary but can be obtained from the salesmen's orders. Such a report has a far more important function in reporting on trends. It is vitally important that information be fed continuously from the field concerning customer reactions. If a problem exists in one area and not another, then it may be considered an isolated case which requires only local action. If field reports indicate trends in all areas, then perhaps a manufacturing or quality control problem exists. Conversely, if customer acceptance and reaction are particularly good on a line, this too should be known. The customer is the only real source of such information and the salesman, through his report, is the least expensive method of collecting and forwarding this information.

The present report is completed at the end of the day and requires a summarization of calls, quantities sold and has a section for remarks. By the time the salesman fills this out the information is "cold" and in the process of summarizing, information is generally left out. The proposed "Call Report" would be on a card, suitable for filing. It would contain the same information relative to type customer, quantities, etc. now reported; however, it would be filled out immediately after each call. The information to be placed in the remarks section must be specified to the salesman, by the home office, and should include anything that will indicate

present or future problems. This data could be coded to facilitate filing, collating, and eventual processing by machine equipment. One other bit of information that could be used by the home office in spotting trends and forecasting sales would be a notation as to the present stock of Bendix and competitors' products on hand.

As a follow up on such reporting, a weekly "flyer" or news-sheet could be prepared and forwarded to all salesmen. This would serve to keep them informed of trends, developments in other areas, as well as headquarters, and tend to establish the feeling of "belonging" to the Marshall-Eclipse Division instead of being independent salesmen. One successful organization, using this method, picks the best "quotes" from the call reports and reprints them in the flyer. This gives a personal touch, enhances the feeling of "belonging" and helps insure the interest of the salesmen in his report.

6.2.7 Special Accounts

One unexplored source of sales with a great potential is the various military installations throughout the country. At the present, no active selling or contacts are made with these installations by the Aftermarket Sales Force. Occasional invitations for bids are received by the Comptroller but this business is not actively sought by the Division. This is apparently due to an unfortunate experience in the past with a military bid. Some contact is maintained in the Detroit area by the OEM sales force. Due to the specialized nature of military bids, services, and packaging, it is recommended that one sales representative attached to the Division office, be added to act as a "Special Accounts Representative"

to become familiar with the procedures required for making and fulfilling military bids and to make calls on military installations. This salesman would also be utilized on other specialized accounts such as private brand negotiations and possibly relieve the Sales Manager of some of his travels.

Export sales of Marshall-Eclipse products are made by the Bendix International Division in New York. The Marshall-Eclipse Division ships and bills directly to Bendix International for further shipment. No direct overseas shipments are made by Marshall-Eclipse.

6.2.8 Product Distribution

The passenger car brake linings sold by Aftermarket Sales are distributed primarily through rebuilders. This accounts for approximately 70 per cent of Aftermarket sales, of which 80 per cent are undrilled segments for bonding. The Marshall-Eclipse Division does not market a complete bonded passenger car shoe as some other suppliers of brake linings do. However, the Automotive Division at South Bend purchases some linings and markets a complete product for original equipment and the aftermarket. The local reasons are well founded and based on the high freight costs incurred in shipping the bonded shoe and lining around the country, a reluctance to go into the bonding business and the resulting competition with the sister division at South Bend.

The rebuilder, after bonding the lining to locally procured shoes, may distribute his product under the Bendix label or as a private brand. At the present time this Division has only two small private brand accounts. The rebuilder may sell to a distributor, associate distributor (which is nothing

more than a low-volume distributor), fleet operator, garage or dealer, all for further distribution or ultimate installation. Sales of drilled linings for riveting to shoes, woven linings and truck blocks are made directly to the distributors for further distribution along the same lines as above. The distributor may, in instances approved by the Division, discount some sales to associate distributors. This discount is rebated to the distributor by the Division and saves the Division from shipping small orders direct to small distributors. The channels of distribution are shown graphically in Figure 6-2 and a typical distribution illustrated in Figure 6-3, which also shows the location of the major rebuilding accounts.

An effort is made to limit the number of rebuilders in an area so that there will be a minimum of competition between rebuilders handling Bendix products. As an example there would be 2 or 3 rebuilders in the Albany-Schenectady-Troy area and 3 or 4 in Metropolitan New York. Over 60 rebuilders are on contract with approximately 30 of them in the "Very Active" category. The volume of business of various rebuilders might vary from $10,000 to $100,000 annually.

Three different forms of contracts or "sale agreements" are used for the Rebuilder, Distributor, and Associate Distributor. These contracts are primarily for information and to establish the terms of the agreement between the parties. They have little legal value nor do they limit the area in which a dealer might operate.

As mentioned above, this Division carries only two small private brand accounts. A private brand involves selling a product to a rebuilder who in turn bonds the lining to a shoe and packages and markets it under

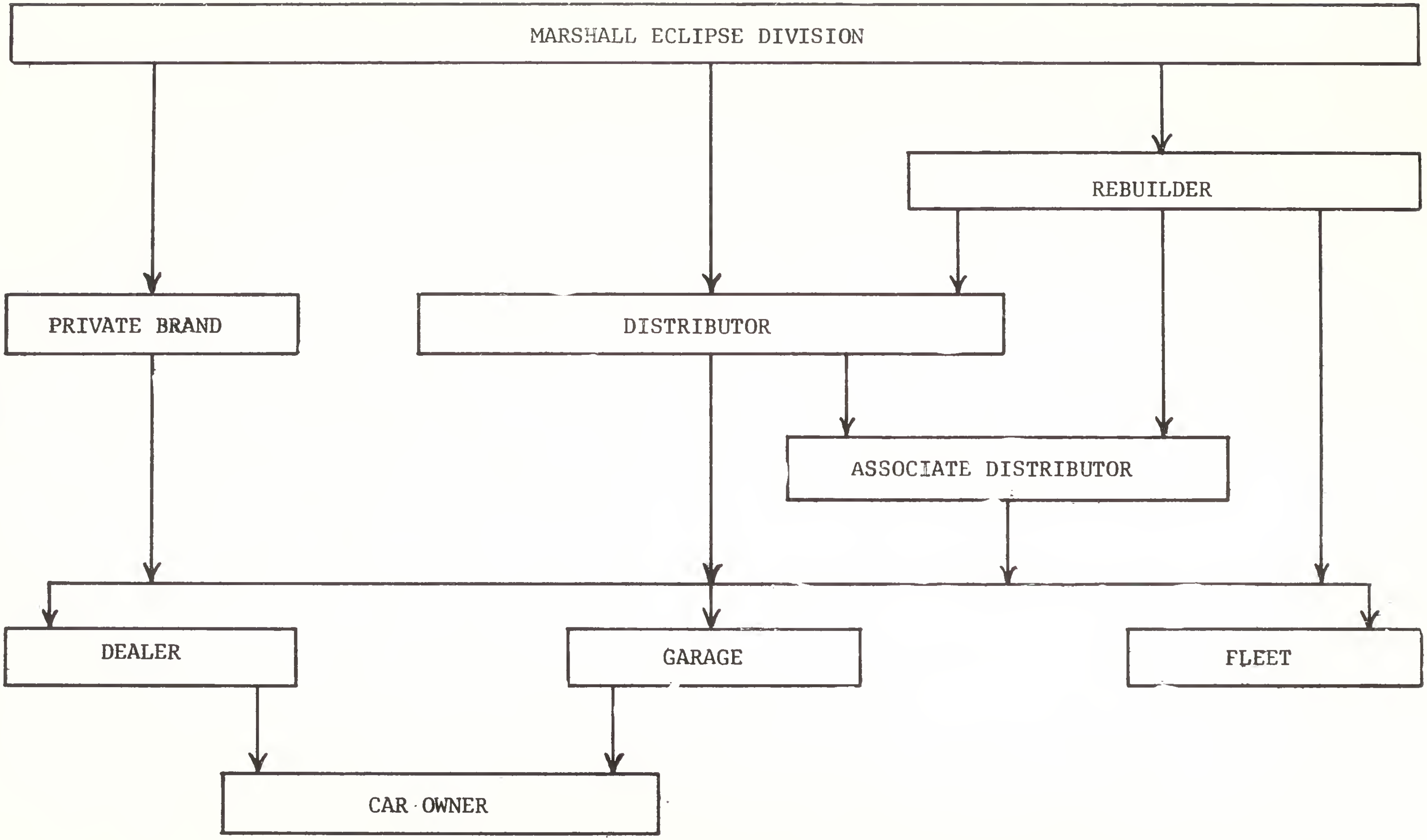


Fig. 6-2 REPLACEMENT SALES CHANNELS OF DISTRIBUTION

Fig. 6-3 AFTERMARKET SALES - TYPICAL DISTRIBUTION

his own label. The lack of private brand accounts is based on the inability to reduce the selling price to a level that would be competitive with other suppliers and still maintain the quality product desired. There is also the legal aspect of being able to justify a reduction in net price based on merchandising and manufacturing as required by the Robinson-Patman Act. The required reduction to make this Division competitive cannot now be justified. Another consideration is the technical problem involved with the Division's desire that a private brand not be capable of being identified as a Bendix product. One suggested solution to this was to manufacture the lining in a color not now produced by Bendix. This problem involved finding a proper dye and eliminating the added expense incurred to clean out machines to run a different colored product. The solutions to these have not been found and apparently are not being too actively pursued. As a result another good source of after-market sales is being by-passed.

Some drilled linings are sold to small jobbers from commercial warehouses where a stock is maintained by Bendix and handled on a commission basis by the warehouser. These warehouses are located in Chicago, San Francisco, Dallas and Atlanta and contain a very small portion of the over-all inventory. They are used only for stocking drilled linings and as such serve a small segment of the market. The present thinking is to abolish them and fill these orders through the distributors and associates.

Pre-cementing of linings for rebuilders is done for four accounts. The cementing is actually done by members of the traffic section and is done to order. No linings are kept in stock already cemented. The job of pre-

cementing is not particularly desired due to the time loss, delay in order filling, interruption of scheduled work and high cost. The ultimate aim is to discontinue this practice and it is actively discouraged now by charging a high price.

6.2.9 Inventory Control

Inventory control of finished materials is handled within the aftermarket sales office. A very effective, simple and accurate system has been developed and serves at all times to keep the sales staff aware of the stock level. A stock control card and a job order card are maintained in a tub file on each active stock number. Entries are made for each addition to, or withdrawal from, stock so that a current level is always available on the stock control card. A predetermined re-order point is posted on each card. When the stock level approaches or reaches this point the "Job Order Card", filed behind each stock card, is pulled and sent to Manufacturing with a quantity desired indicated. This saves the trouble and expense of writing a job order for each new order. Manufacturing copies the required information for scheduling purposes, initials the card and returns it to Sales. As a follow up, a copy of the weekly schedule of material in production for Aftermarket Sales is furnished by Production Control. Completion notices are also submitted when material is finished and placed in stock. An annual inventory, held in July, is taken to reconcile the actual stock on hand with the amount shown on the cards.

The re-order point is based on a 3-months supply computed from past sales records and experience. It takes approximately 6 weeks from the time most orders are entered until the finished material is placed in

stock, so the normal minimum stock level is about a 6-weeks supply. However, there are numerous instances where over six months are required to obtain finished material from Manufacturing. At the present time there are orders outstanding from July of 1961. It is estimated that if a six-week delivery could be reasonably guaranteed that the present stock of linings required to fill Aftermarket Sales orders could be reduced by one-half, thereby greatly reducing the storage space required, work involved in stocking the material and capital tied up in inventory.

The present system of determining the re-order point is based entirely on past experience. Along with the recommendation contained elsewhere in this report that inventory control be centralized in one department, it is further recommended that consideration be given to using economic lot size or a similar scientific method of determining the re-order points and quantity.

As stated at the beginning, this system is simple, accurate and effective and it requires one person to maintain. When the projected data processing system is completed by the Division, it is anticipated that the Inventory Control System will be changed so that it, too, can be handled by this system. Presently about 5000 cards are being kept manually. The data processing system will relieve much of the tedious work and provide faster and more accurate compiling of reports.

6.2.10 Shipping

The Shipping section is operated by the Traffic Manager under the direction of the Comptroller and, although not a part of the Sales Department, it services and is partially paid for by Sales. The functions

of the Traffic Section will be discussed elsewhere in this report but the relation of the cost of this operation to Sales needs to be discussed at this point.

The present method of warehousing, stocking and order filling is antiquated, obsolete and overly expensive. This burdens the Sales Department unnecessarily with high costs. The three storage areas are widely separated. This situation creates considerable extra travel and ties up equipment unnecessarily in warehousing, order filling, and shifting stocks from one area to another. A consolidated storage area should be provided so that once an item is finished it can be placed in stock with a minimum of movement and left there until required to fill an order. The transportation from the stock bin to the packaging and shipping area should be held to a minimum. A more efficient system of materials handling and bin arrangement should be developed so that empty trips of fork lifts and transporters are minimized and the transportation of stock to fill orders can be expedited. In short, the whole function of warehousing, order filling and shipping needs a thorough study by qualified materials handling personnel. No doubt considerable improvements could be made with existing space, equipment and personnel.

The Traffic Manager is apparently quite active, and successful, in shopping for the best rates, consolidating shipments and obtaining commodity rates, all in the interest of reducing freight costs. This saving is passed on to the customers and helps Marshall-Eclipse maintain a competitive position in the Market.

6.2.11 Advertising and Promotion

In promoting replacement sales of brake linings the primary audience is a rather narrow segment of the automotive trade. It consists of the Rebuilder, Distributor, Installer and Fleet owner. An attempt is also made to make the automobile driving public aware of the Bendix name in the hope that they will specify Bendix linings when ordering service. As a result of the restricted audience the majority of advertising is limited to the various automotive trade journals.

The Marshall-Eclipse Division deals directly with an advertising agency, retained by the corporation in Detroit, in developing and placing its advertising. The majority of the advertisements have been of the "crash or wreck scene" or of testimonials by users of Bendix products. These ads in general connect the product with the Bendix Corporation and the Marshall-Eclipse Division.

Another form of promotion is the "dealer aids", or "dealer package", which contains displays, pamphlets and literature with information for the distributor and for further distribution to customers. These are distributed by the sales force and by mail.

There appears to be a further need to reach the ultimate consumer of the major portion of the sales -- the passenger car owner and driver. To accomplish this, one form of promotional effort that has been used successfully by other distributors of automotive products is "point of sale" advertising. This consists of newspaper and magazine advertising to make the customer aware of potential braking problems, the need to have brakes serviced and relined prior to actual failure and, of course, point

them toward asking for the Bendix product. At present, technical assistance, sales assistance and advertising is provided to, or aimed at, all levels of consumption except for the final and largest consumer -- the passenger car owner. This information is displayed graphically in Figure 6-4. All of the Technical assistance and advertising helps each level of distribution in selling or servicing the next lower level until the final distribution level is reached, but nothing reaches the passenger car owner. A throw-away pamphlet or hand-out made available to the dealers, garage owners and all installers, either directly through sales calls or passed through the distribution channels, would give the installer some material to work with in promoting brake jobs to customers that come in for other types of work.

One interesting promotional feature is the obsolescence policy practiced with the dealers. It is a quarterly allowance based on a percentage of the dealers' purchases. If a given lining is obsolete to the customer but still an active number to Bendix, then it may, within the above limitations, be returned for credit less the freight and handling charges. If the material is considered obsolete to Bendix and the customer, it is the customer's loss.

This Division sponsors exhibits in about three major auto shows each year: One on the West Coast, East Coast and in the Mid-West. They are normally attended by the Sales Manager and/or his Assistants plus the Service Technician.

One other form of promotion is the Brake Clinic, conducted by the Service Technician, discussed in an earlier section.

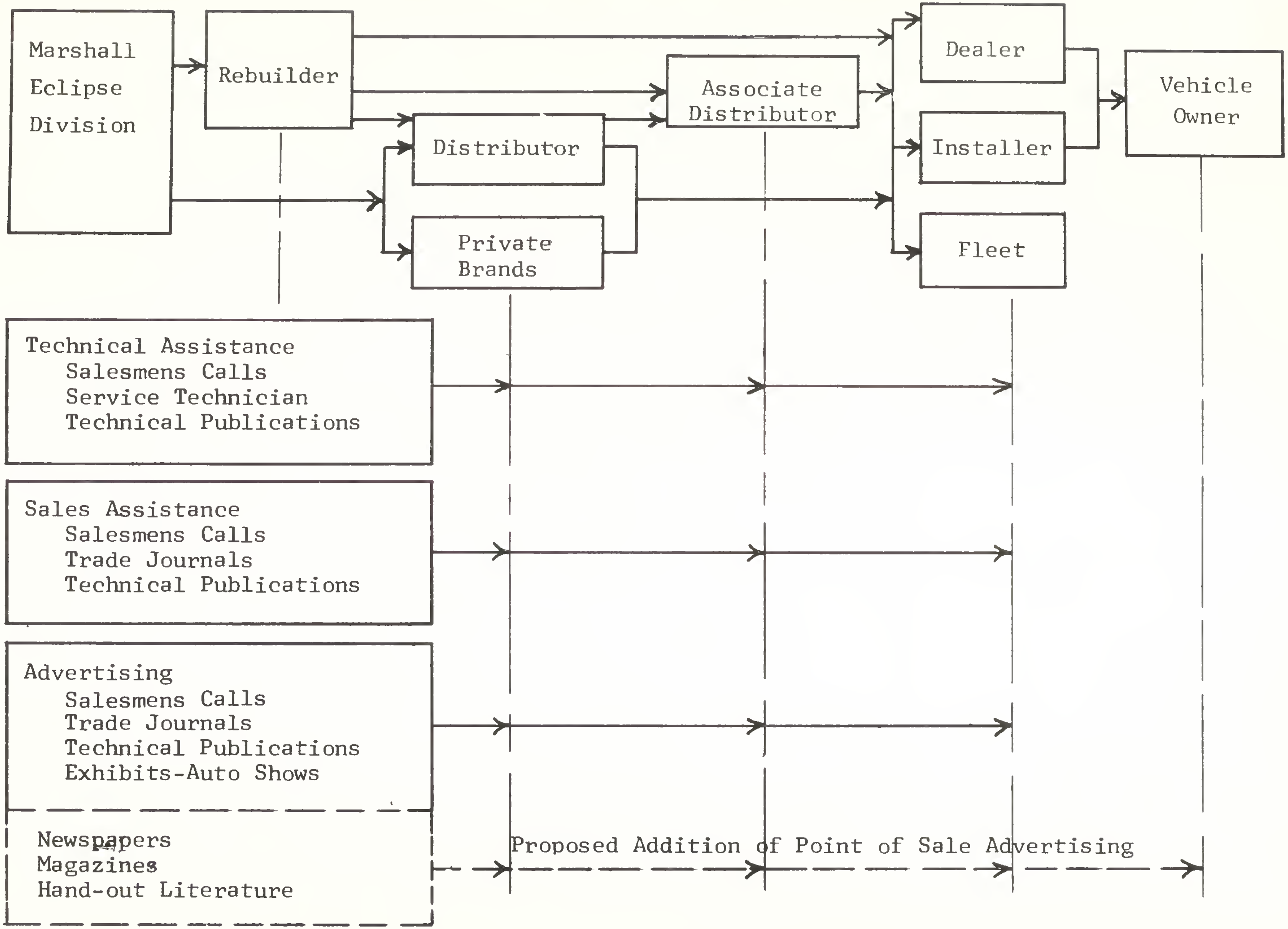


Fig. 6-4 MARSHALL ECLIPSE DIVISION - PROMOTIONAL EFFORTS

The advertising budget is determined at the Division level and approved at corporate level. There is a recently appointed Director of Advertising and Publicity at the corporate level to coordinate and give assistance to the various Bendix Divisions. He is presently engaged in a project to standardize the packaging design for all divisions.

The advertising budget averages approximately five percent of the aftermarket sales volume.

6.2.12 Market Analysis

This Division's estimate of the market potential for Aftermarket Sales varies from 50 to 70 million dollars and its current market share is less than three percent. Current plans for increasing this share to ten percent within the next five years are underway. This is to be accomplished by addition of salesmen and reorganization of the sales force under Zone Managers as discussed earlier. Concurrent with this would be a more intensive advertising campaign with particular emphasis on intermediate truck linings and heavy duty brake blocks. Also included is research on more effective and less expensive methods of producing all products, particularly truck blocks.

Market analysis, product studies, consumer studies and area potentials are being given minor consideration now in favor of expanding and re-organizing the sales force. An annual sales forecast is prepared, and revised monthly for the current and subsequent month. This forecast is based on historical data primarily and is tempered with knowledge of competitive action, economic trends and other information gleaned from the trade journals. The prime basis currently used for determining sales

potential and comparing salesmen's performance between areas is the passenger car and truck registration published in "Motor Trading Area Sales Guide", broken down into the 601 trading areas and zones. An annual comparison, on a percentage basis, is made and forwarded to the Salesmen and Zone Managers.

6.3 Original Equipment Sales

Original Equipment Sales are normally generated by a new braking problem, posed either by the automobile manufacturer or the brake manufacturer. The OEM Sales Force in Detroit maintains contact with both and acts as liaison between them and Product Engineering at the Division level. Once a solution has been found that is satisfactory and approved by the automobile manufacturer, the automobile manufacturer will specify to the brake supplier which brake linings will be used. The majority of OEM linings are of the bonded type. Very few drilled linings are being delivered as original equipment.

OEM sales comprise over three-fourths of the dollar volume of sales of this Division and represent over fifty percent of the total market for original equipment brake linings. This is a strong indication of a high quality, well engineered product with a good reputation. The only problem here is that these sales are spread over a very few customers and a loss or cutback by any one of them could cause serious repercussions with Division sales, manufacturing and employment.

This Division has not sold truck blocks as original equipment in the past due to a strong hold on the market by a competitor and local dissatisfaction with the product. A satisfactory product has now been engi-

neered and steps are underway to place it on the original equipment market.

Although cerametalix elements for aircraft brakes are manufactured by this Division, it acts only as a captive producer. The actual marketing is done by the Bendix Aerospace Division.

6.4 Chemical Sales

The manufacture of synthetic resin by this Division was originally undertaken because of dissatisfaction with the commercially procured product. As a result a plant was installed with a capacity exceeding that of local requirements.

The Sales Force for resin is composed of one man traveling the Eastern Seaboard and into Detroit. There is considerable unused capacity in the present manufacturing installation after the local and outside requirements have been met. This capacity could possibly be further utilized by adding to the Sales Force and covering more territory with the product. Another, and vital, reason for expanding is that no organization should be built around one individual because of the possibility of sickness, accidents or promotion.

One possible potential source of sales outlets for this product would be the Zone Managers, in the Aftermarket Sales Organization, once this Department has completed its re-organization. This would give a very effective coverage without the expense of additional sales personnel.

6.5 Recommendations Summary

The original concept of Aftermarket Sales for this Division, that of "entering the market to dispose of the overflow of OEM production", seems

to have lasted to this day and has affected many decisions concerning the sales activities and policies governing the Aftermarket Department. Many reasons have been offered for the small share of the market now held by Aftermarket Sales, when in fact, the real reasons seem to lie in the preoccupation of the Division with OEM sales to the detriment of all other marketing activities. Granted, the OEM contracts are large and provide the major portion of the income at a comparatively low commercial expense rate, but the concentration of business in a few large customers could place the Division in a precarious position, considering the volatile nature of the automobile market.

The following recommendations are offered to assist in improving the marketing organization and market structure:

1. Combine the present Sales Departments into one Marketing Department, under a Director responsible to the General Manager. This would consolidate the advertising, statistical, inventory and clerical functions and relieve the General Manager of unnecessary administrative details.

2. Increase the awareness of the tremendous Aftermarket potential and hasten the re-organization of the field sales force, including the hiring of additional salesmen and the appointment of Zone Managers, in order to obtain a reasonable share of the market and lower the dependency on OEM sales.

3. Consider the possibility of using "Manufacturers Agents" in some areas where the business potential does not now warrant the time of Bendix salesmen.

4. Develop a formal training program for salesmen to ensure the proper representation of the Division in the field and increase the volume of sales

and quality of customer assistance.

5. Increase the sales commission to provide more incentive to independent salesmen, particularly where the commission must be shared with the Zone Manager.

6. Investigate the feasibility of appointing a "Special Accounts" Salesman to obtain business from Military Installations.

7. Review the current attitude on Private Brand accounts, particularly the feeling that a product to be sold under a private label must be completely differentiated from the Bendix product. If this requirement is valid, then actively pursue a program to solve the engineering and manufacturing problems associated with this product.

8. Conduct a thorough study of the materials handling methods used in stocking, warehousing and order filling with a view toward reducing the burden in this area.

9. Expand the Chemical Sales Force to provide more area coverage and eliminate the dangers inherent in a "one man department."

10. Emphasize, to Manufacturing, the need of filling Aftermarket orders within a reasonable time in order to reduce inventory, backorders and customer disappointments.

11. Increase advertising to include "Point of Sale" advertising to reach the passenger car operator.

12. Instigate salesmen's "Call Report" and inform salesmen of information desired from the field.

CHAPTER 7

QUALITY CONTROL

7.1 General

As was discussed in Chapter 2, Existing Organization, the Quality Control Department has five basic functions:

1. Receiving inspection
2. Tool inspection
3. Process control
4. Finished goods inspection
5. Finished goods inventory of O.E.M. brake linings

These five functions are carried out in five sections within the department:

1. Brake Lining & Cerametalix Finished Goods Inspection
2. Cerametalix Materials Receiving Inspection
3. Cerametalix Materials Process Control
4. Brake Lining Materials Receiving Inspection
5. Tool Inspection

Also mentioned in Chapter 2 was the fact that Quality Control does not have equal responsibility for the above functions in all product areas. This situation is not evident in any written organization manual or other instruction from top management. The absence of such written functions and responsibilities is considered detrimental to good management practice.

It is a well-recognized management principle that efficient operation of a complex business is best accomplished when all levels of management have a crystal-clear understanding of their duties and the limits of their

responsibilities, and that the most effective way to achieve this understanding is by committing these duties and responsibilities to paper. Once written, it is not intended that organizational functions remain permanent for all time, for through the years businesses change, and as they change so do the areas of responsibility of organizational units. Thus, it is incumbent upon both top management and lower level managers to take notice of such changes as they occur, and to revise written instructions accordingly. The responsibilities of top management in this regard have been discussed in paragraph 2.2 and will not be further discussed here.

In a firm the size of Marshall-Eclipse, it would be appropriate to extend the requirement discussed above to the second level of management, that is, at least down to the sectional level. As of the present time, the Quality Control Manager has not set forth the areas of responsibility of the individual sections within his department. It is recommended that this be accomplished, so that personnel assigned to various sections will have a clear knowledge of what their section is expected to contribute to the organization.

In addition to knowing the exact functions of their organizational units, it is important that individuals understand what they are expected to do to enable their organizational unit to accomplish its functions. The medium by which this understanding is most often conveyed is the individual job description. At the present time, job descriptions are in the process of being written for upper levels of management personnel at Marshall-Eclipse. In the Quality Control Department, job descriptions have been

written for the Quality Control Manager, the Chief Inspector, and the Assistant Foreman. However, the descriptions have not yet been finished and approved.

Regarding the situation mentioned earlier, that Quality Control does not, in fact, have equal responsibilities in all product areas, it was noted that the Quality Control Manager's job description does not clearly indicate this fact. Exclusion of the chemical product area has been implied by the words, "Organic & Cerametallic Departments", parenthetically included in the job title. However, the subsequent listing of functions and responsibilities does not make clear the differences in responsibilities between the organic and cerametalix departments. Quite to the contrary, the job description as written leads one to believe that responsibilites in each area are equal. It is recommended that this job description be re-written so as to accurately reflect the existing duties and responsibilities of the Quality Control Manager in the organic and cerametalix product areas, and further, that if any doubt or question exists, the General Manager be contacted for discussion and approval.

7.2 Discussion of Basic Functions

Figure 7-1 is offered (see next page) as a summary of quality control responsibilities in each product area. It is emphasized that the information presented reflects the authors' impressions gained from interviews with various persons in various departments, and was not obtained from any written source. Abbreviations in the product columns indicate which department is believed to have primary responsibility for the adjacent function:

FUNCTION	PRODUCT AREA		
	ORGANIC	CHEMICAL	CERAMETALIX
Receiving inspection:			
Raw materials	Q.C.	Q.C./MFG.	Q.C.
Parts, Hardware	N/A	N/A	Q.C.
Tool Inspection			
Initial: all new tools, etc.	Q.C.	N/A	Q.C.
Recurring: tools, dies, jigs, castings, fixtures, etc.	None	N/A	Q.C.
Instruments & controls	P&M Eng.	Outside	Q.C.
Process Control	MFG.	MFG.	Q.C.
Finished goods inspection	Q.C.	MFG.	Q.C.
Finished goods inventory	Q.C. & Aftermkt. Sales	MFG.	MFG.

Key:

Q.C.	Quality Control Dept.
MFG.	Manufacturing Dept.
P&M Engr.	Plant & Manufacturing Engineering Dept.
Outside	Outside instrument manufacturers
N/A	Not applicable

FIGURE 7-1
QUALITY CONTROL RESPONSIBILITIES

7.2.1 Receiving Inspection

This function is accomplished, as described in Chapter 2, by two men: one in the Cerametalix Materials Receiving Inspection section and one in the Brake Lining Materials Receiving Inspection section.

7.2.2 Tool Inspection

The basic objective of the tool inspection function is to ensure that all tools, jigs, fixtures, etc., which, in their normal application affect the quality of the product, are received and maintained in accordance

with their operating specifications. New tools, jigs, fixtures, and measuring instruments, whether purchased, or made in the plant, are inspected by Quality Control. This is done for both the organic and the cerametalix departments.

Continuing in-use inspection of these items, however, is a different matter. For cerametalix products, the Quality Control Department maintains strict procedures to ensure that all tools, dies, etc., which are used in the cerametalix manufacturing process, are operating within their specification limits at all times. This is not so in the organic department. Here, tools, jigs, etc., are checked only when trouble occurs somewhere in the process, and it is usually the foreman who does the checking.

The authors have no argument with the position that the foreman should be responsible for the quality of his portion of the manufacturing operation, but it is believed that a service function, not the foreman, should be responsible for ensuring that the machinery and equipment with which the foreman must work are in proper operating condition. Certainly, under this premise, the foreman must be responsible for notifying the proper persons when something goes wrong, but it is to his advantage to have the burden of continuous policing of the accuracy of his equipment shifted to a service organization in much the same manner as is preventative maintenance. The natural organization to accomplish this service is the Quality Control Department. Accordingly, it is recommended that responsibility for continuous in-use inspection of tools, jigs, and fixtures in the organic department be given to the Quality Control Department.

The preceding paragraphs were concerned with the accuracy of tools and fixtures used to manufacture the product. Of equal concern are those tools, fixtures and other measuring instruments used for inspection of the product. Inspection instruments should be accurate in their calibration and adjustment. This means that each instrument should be checked and calibrated at regular intervals, depending on the frequency and severity of use. It is important that both inspecting, or quality control instruments, and working, or operating instruments, be calibrated to the same standard of accuracy. This is necessary to prevent work being passed by an operator and rejected by the inspector, or vice versa.

The foregoing applies both to measuring instruments, such as micrometers, which provide quantitative information, and gages, such as go/no-go fixtures which are strictly qualifying devices. Both are vital to the manufacturing operation, and proper inspection and calibration of each type must not be overlooked.

Again, in the cerametalix department, inspection of measuring instruments and gages for use by inspectors and operators is under strict control by the Q.C. Department. For example, all micrometers used in the cerametalix operation are removed from use and inspected weekly. Thus, there is little chance for a micrometer to lose its accuracy without being discovered before damage can result. In the organic department, measuring instruments and gages are removed from use only when in obvious need of repair; thus, there is ample opportunity for such instruments to become inaccurate and cause considerable damage before being discovered. In addition, it was noted that micrometers used in the organic department

are not issued or maintained by the Quality Control Department. Rather, a Manufacturing Supervisor has this responsibility. This example illustrates the general lack of Quality Control Department responsibility in the organic brake lining area. To remedy this situation, it is recommended that the same control procedures being used for instruments and gages in the cerametalix department be applied to the organic department, and that this be made a responsibility of the Quality Control Department.

In the organic area, critical instruments and automatic controls, such as those which regulate temperatures of ovens and pressures of presses, are checked by the Plant and Manufacturing Engineering Department. In the cerametalix department, they are checked by Quality Control. Here again, in deference to the principle that anything which affects the quality of the product should be the concern of the Quality Control Department, it is recommended that the Q.C. Department be made responsible for this function in both the organic and the cerametalix areas.

7.2.3 Process Control and Finished Goods Inspection

Process control and finished goods inspection often attempt to achieve the same goal, and so they are discussed together in this section. It is difficult to discuss inspection and quality control without common understanding, or at least common agreement, of what the words mean. Therefore, before going further, the authors will define their concept of inspection, quality control, and process control.

7.2.3.1 Definitions

"Inspection" alone, as in finished goods inspection, is a screening

operation. Its function is to separate the product into two classes: accept and reject. Inspection adds nothing to the value of the product since it is concerned only with "go" or "no-go" in accordance with established specifications. Hence, inspection doesn't improve product quality, nor does it reduce the number of rejects since no corrective action is implied. It does ensure, however, that the customer gets products of the specified quality. Thus it creates for the manufacturer a good reputation for a quality product -- a factor of extreme importance to Marshall-Eclipse because of the competitive nature of its business. However, this reputation is often earned at the expense of the abnormally high cost of rejected units, that is, the manufacturer isn't protected against the expense of 100 per cent inspection, many rejections, and the resultant effect of restricted production.

On the other hand, "quality control", as a system, includes inspection, analysis, and correction. In the optimum system, quality control inspects small portions of the product at various stages of production, analyzes the quality of those portions, and makes the results of the analysis known to line supervision so that corrective action may be taken. Quality control, then, includes partial inspection, but follows with purposeful intent to find the cause of discrepancies and take immediate corrective action. Long-range benefits to be expected from quality control are reduced rejections, maximum production from available manufacturing facilities, reduced manufacturing costs, and improved employee morale from the elimination of disagreements over rejection rates.

"Process control" can be said to be that portion of quality control

involving analysis and correction. That is, it attempts to control the product at the source of production so that departures from the quality standard can be corrected before defective products are produced.

7.2.3.2 Discussion

Marshall-Eclipse prides itself on the quality of its product. That this pride is justified is made apparent by the Division's ability to maintain a 50 per cent share of the original equipment manufacturing (O.E.M.) brake lining market. In a market as competitive as automotive brake linings, this is no mean accomplishment. To maintain its high quality standard, Marshall-Eclipse relies on both quality control systems and 100 per cent finished goods inspection. Management has decreed that to maintain the quality of its products, every piece of brake lining, whether organic or cerametalix, shall be visually inspected for defects before being shipped to the customer. All pieces with even the slightest apparent defect are rejected, either to scrap, or to salvage for rework.

It is always difficult to sort out the functions of quality control and process control and assign responsibility for them to the appropriate unit within the organization, for these functions usually overlap in several departments. Responsibility for quality control and process control are shared in any organization with an adequate system, and properly so. In general, at Marshall-Eclipse, quality control is the joint responsibility of the Manufacturing, Quality Control, Product Engineering, and Plant and Manufacturing Engineering Departments. At this point the authors again resort to separation of the cerametalix and organic departments, for quality and process control are different in each.

7.2.3.3 Cerametalix Quality Control

There are two types of cerametalix products: Aircraft, or high temperature, and automotive, or low temperature. Quality is first considered in the design of the product, a function of Product Engineering. In aircraft cerametalix, this is accomplished by the Bendix Aerospace Division in South Bend, Indiana. The Product Engineering Department at Marshall-Eclipse acts in the capacity of "resident engineer" for Bendix Products Aerospace Division as far as aircraft cerametalix is concerned. As for automotive cerametalix, design engineering is accomplished by the Product Engineering Department at Marshall-Eclipse, where every effort is made to design quality into the product. Quality standards and specifications for both categories of cerametalix products are reflected in the drawings, specifications, and bills of materials prepared and issued by Product Engineering to all interested departments.

The Plant and Manufacturing Engineering Department has the methods engineering function. This department takes appropriate information from the design drawings and specifications and prepares detailed manufacturing instructions for use by the Manufacturing Department. The processes prescribed by these instructions are designed to ensure that quality standards can be met with existing equipment and man-power, or, when necessary, new equipment is designed.

The Manufacturing Department is responsible for operating the machines and equipment in a manner such that each piece of the product coming through the line will conform to quality specifications.

The Quality Control Department polices the entire manufacturing

process to ensure that quality standards are, in fact, being met. Their function includes sampling inspection of all in-process goods, and 100 per cent finished goods inspection at the end of the line. In addition, as previously discussed, the Q.C. Department conducts initial and recurring inspection of all tools, jigs, fixtures, instruments, and gages associated with the cerametalix process.

The cerametalix process control function is shared between the Quality Control and Manufacturing Departments. Quality Control analyzes defects in an effort to determine their cause, and Manufacturing attempts to eliminate the causes. Both departments coordinate with Plant and Manufacturing Engineering and Product Engineering as necessary to accomplish their quality control functions. Q.C. techniques in process control include "first piece" inspection, and "patrol" inspection. The objective: To prevent production of an excessive amount of defective units which will later be rejected at some inspection point.

In "first piece" inspection, a Q.C. inspector attends the manufacture of the first piece of each new production lot throughout the entire process. He carefully checks this first piece at each stage of the operation to ensure that quality standards are being maintained. In "patrol" inspection, Q.C. inspectors follow Military Standard 105-A sampling plans and subject sampled pieces to various quality checks.

During both "first piece" and "patrol" inspections there are quality factors, other than product characteristics, which can be observed and corrected or reported by the inspectors. For information and use as desired, these factors include:

1. Operator safety, fatigue, and welfare.

2. Proper adjustment and lubrication of tools and machinery.

3. Full operator understanding of his job.

4. Tool wear during operation.

5. Possibility of parts damage by material-handling devices.

In essence, over-all quality control of cerametalix products is accomplished almost exclusively by the "method of variables," as opposed to the "method of attributes." By the method of variables," Q.C. measures the product to determine exactly how close-to or far-from quality standard the product is being manufactured, as opposed to the "attributes" method, which is simply a go-no-go situation without measurement. The complete "method of variables" includes recording the measurements, which Marshall-Eclipse does, and continuous statistical analysis of the measurements, which Marshall-Eclipse does not do. Statistical methods are utilized only when setting new standards or when troubles arise which do not have readily apparent solutions. It is recommended that Q.C. seriously consider adopting a continuing system of statistical quality control, for such a system can often point the way to trouble in time to avoid damage.

7.2.3.4 Organic Lining Quality Control

Quality and process control methods and responsibilities in the organic department differ considerably from those in the Cerametalix Department. Responsibility for quality begins, as before, with the Product Engineering Department, where quality is designed into the product. The next step, preparation of detailed manufacturing instructions by the Plant and Manufacturing Engineering Department, however, seems to have been eliminated.

It appears that the methods engineering function, with all its quality aspects, rests with Product Engineering, because development of organic brake linings is so closely allied to the manufacturing process.

Well-defined Q.C. Department responsibilities in the organic area are limited to raw materials inspection, new tools inspection, and finished goods inspection. The Q.C. Department does not conduct "first piece" and "patrol" inspections, nor does it perform periodic inspections of tools, jigs, fixtures, instruments, and gages used in the organic process. As mentioned previously, the Plant and Manufacturing Engineering Department periodically inspects oven and press controls and regulating devices.

It appears that the lion's share of responsibility for the quality or organic products rests with foremen and supervisors in the Manufacturing Department. As mentioned earlier in this chapter, this is as it should be. In the authors' views, the basic responsibilities of a foreman are threefold: (1) To train, help, guide, and lead the workers in his group, (2) to get out production with a specified quality, and (3) to hold down costs. Leadership or supervisory functions are at the head of the list, for without effective leadership the foreman will be unable to accomplish his other two functions in a satisfactory manner.

Maintenance of quality, then, is not a function of inspection. It is the foreman's job. At Marshall-Eclipse, in the organic department, foremen accomplish this by periodic checking of temperatures, pressures, tolerances, and operator performance throughout the manufacturing process. The multitude of required checks constitute a time-consuming burden which can detract from the foreman's knottiest problem, that of ensuring that

each of his operators is producing a quality product. For it is the foreman who teaches or instructs how the work is to be done, and he is responsible for discipline. He is the one who shapes the attitudes of his people toward quality, and their attitudes are the basic determinants of the quality they will turn out. The quality the foreman gets, then, is a result of proper instruction, proper discipline, and the attitudes of his people toward quality.

The Q.C. Department can be of great assistance to the foreman. By assuming many of the foreman's present inspection duties, Q.C. can leave him with more time to devote to his leadership and training functions. Q.C. can point out steps in the process that are going wrong, and can detect tools, gages, machines, and operators that are slipping off standard. Then, with timely notice, the foreman can institute action to correct the situation. It is recommended, then, that the Manufacturing foremen be relieved of their responsibilities for most of the quality checks in the manufacturing process, and that these responsibilities be assigned to the Quality Control Department, much in the same manner as in the Cerametalix Department.

There are two other checks on quality at Marshall-Eclipse that are worthy of mention. First, the Product Engineering Laboratory makes unscheduled visits to the plant, picks random samples of finished organic linings, tests these samples for specific gravity and Gogan hardness, and gives each sample a dynamometer test. The laboratory tries to select one sample of each major mix formula and lining thickness each month. This is an additional step in the quality process to ensure that organic products coming off the line today are the same as those first sold to the customer months or years ago.

Second, Marshall-Eclipse has recognized the advantage of quality testing the product under conditions which duplicate those of customer use. To exploit this advantage, the firm maintains the largest automobile fleet of any brake lining manufacturer. The cars are used to test the performance of organic linings under actual and test road conditions. The things learned in this manner have proven to be of inestimable value to Marshall-Eclipse in maintaining its position in the market.

7.2.4 Finished Goods Inventory of O.E.M. Brake Linings

One of the secondary functions of the Brake Lining and Cerametalix Finished Goods Inspection Section is the taking of a weekly inventory of O.E.M. finished organic brake linings awaiting shipment. Other responsibilities of this same section are the stenciling, marking, and packing of all organic lining products, O.E.M. and aftermarket, as well as cerametalix products. In conjunction with these additional functions, the Q.C. Chief Inspector is responsible for maintaining an inventory of rivets, cartons, marking equipment, and packaging supplies, and the Q.C. Assistant Foreman is responsible for making weekly shipping schedules by customer and daily shipping schedules by part number, both with the assistance of Production Control. In addition, the Assistant Foreman must make out delivery tickets when material is shipped.

The authors believe that all of the functions mentioned above are properly the province of other departments, not of the Quality Control Department. Such functions would be better assigned to traffic or shipping sections; accordingly, it is recommended that these responsibilities be removed from the Quality Control Department and placed elsewhere, as appropriate.

While observing the finished goods inventory method, the authors noted practices which raise doubt as to even the necessity of a weekly finished goods inventory. There is a point in the packaging process where a presumably accurate count is made of all finished O.E.M. brake linings. This is where the packers remove the linings from the stenciling table and place them into shipping containers. At this point, each packer maintains a count, by part number, of the linings which she places in the shipping cartons. She records this count, again by part number, on a time card. It would appear relatively simple to extract inventory information from these cards, maintain a running inventory by comparing this information with shipping records, and thus, eliminate the necessity for a weekly finished goods count. Accordingly, it is recommended that the present finished goods inventory system be examined with the object of establishing a running inventory system and eliminating the weekly inventory count.

7.2.5 Quality Control in the Chemical Product Area

Quality control of chemical products has been purposely omitted from the previous discussions. This is because of the nature of the products and processes involved. The nature of any chemical process is such that the majority of effort is usually concentrated in chemical experimentation and in designing the process equipment and machinery necessary to produce the end product. And, in the chemical area, design of the product is by necessity closely linked to design of the equipment which will produce the product. Once the equipment is designed, built, installed, and in operation, the attention necessary to assure proper operation of the system requires relatively few personnel.

At Marshall-Eclipse, quality control responsibility for chemical products is shared between the Product Engineering and the Manufacturing Departments. The Chemical Products Section of Product Engineering is responsible for designing the product and designing the process which will assure that the finished product will have the desired quality. The Chemical Products Section of the Manufacturing Department is responsible for process control, and for preparing detailed process instructions for use by operators of the equipment. The Quality Control Department inspects incoming chemical resins used in the organic brake lining process, and the Manufacturing Department inspects all other chemical raw materials. Outside instrument manufacturers periodically inspect control instruments for accuracy and calibration, and the Manufacturing Department is responsible for finished goods inspection.

No issue is taken with the foregoing system as it now exists, because to transfer some of the quality functions to the Quality Control Department would very likely involve the hiring of additional personnel with considerable knowledge in the chemical area. Thus, a premium price would probably have to be paid for their services. On the other hand, should the production of chemical products increase to the point where more personnel would have to be hired in either the Product Engineering or the Manufacturing Departments, or should replacement of any of the present key personnel become necessary in the future, it is recommended that consideration be given to shifting some of the responsibilities for quality control to the Quality Control Department at that time.

7.3 Conclusions

During the investigation of the quality control functions at Marshall-Eclipse, it quickly became evident that the Q.C. Department did not have equal responsibilities in all product areas. Main interest from that point was centered on discovering whether there were good reasons for this division of responsibilities. The authors' over-all conclusions are (1) that quality control of cerametalix products exemplifies most of the best in contemporary Q.C. techniques, (2) that there is good reason for separation of the Q.C. function in the chemical products area, and (3) that concrete reasons for separation of Q.C. in the organic products area are lacking. The authors wish to discuss conclusions (1) and (3) a bit further.

In the cerametalix area, responsibilities for quality control among the various departments seem well-defined and well-organized. And, in passing, it is suggested that Marshall-Eclipse define these various responsibilities in writing to help clarify the interrelationships in the minds of all concerned, and to serve as a firm foundation upon which future changes can be based.

In the organic area, the existing concentration of quality control functions in the Manufacturing Department has been attributed by company personnel to (1) the much wider tolerances of organic products as compared to cerametalix products, (2) the management view that total responsibility for producing the product, which includes quality control, should rest with the foreman, and (3) that scrap-loss ratios are as low as can be expected, and the addition of Q.C. inspectors to the organic line would not result in

appreciable savings. In the authors' views, this condition in the organic department is more adequately ascribed to historical precedent and general resistance to change. Brake linings have been produced in this fashion for many years. Marshall-Eclipse is viewed by the parent corporation as an outstanding profit-contributor, and, therefore, it is easy to rationalize away any changes of improvements in existing methods and processes.

Basically, it is the authors' position that the policing function of quality control should never be subjugated to the control of the manufacturing or producing unit. Adoption of this view requires complete and continuing support of top management. It is workable only when quality standards are such that they are realistic and acceptable to Engineering, Sales, Manufacturing, and Quality Control, as well as to the all-important customer. What is needed is a realistic appreciation of the possible benefits to be derived from extending the responsibility of the Q.C. Department deeper into the organic brake lining area.

To be sure, taking this step will require additional personnel at increased cost. But, as the authors see it, direct cost savings in two areas, as well as indirect benefits in another area, could very well pay for the extra costs in a relatively short time. First, consider the scrap situation in organic linings. Current organic scrap levels are running at about 2-1/2 per cent for O.E.M. products and about 4-1/2 per cent for service products. Admittedly, these are low rates, but translated into terms of dollars, the annual scrap loss amounted to approximately $225,000 in fiscal 1960 and about $200,000 in fiscal 1961. If these amounts could be halved by the addition of six or seven inspectors, the benefits are

obvious.

Second, consider the approximate cost of operating a 100 per cent inspection team. In payroll alone, for about 26 persons, this approaches $112,000 per year. One of the benefits of quality control, as opposed to simple inspection, is that the need for 100 per cent inspection can often be made to disappear. Thus, if installation of a quality system in the organic department could eliminate the need for complete final inspection, there are additional savings to be realized.

One of the reasons given for the necessity of 100 per cent inspection is that the nature of the organic manufacturing process is such that many defects remain hidden until all final grinding operations are completed. This leads to the third, somewhat indirect benefit, that a quality control system can be expected to lead to the discovery of better production methods, and that such methods can be expected to remove some of the causes of hidden defects.

In summary, the recommendation to extend quality control into the organic department is not based in accurately-stated, immediately obvious cost considerations. To accumulate such cost information would have required more time than the authors had at their disposal. However, it is suggested that this area be examined in detail with the view of adopting the recommendation. It is top management's responsibility to decide whether quality is to be controlled or whether the product is to be made and subjected to later inspection for quality. Thus, top management must lend its full support and cooperation to any program designed to study the situation and come up with recommendations.

7.4 Recommendations Summary

1. Set forth, in writing, the responsibilities of the individual Sections within the Quality Control Department.

2. Re-write the Quality Control Manager's job description to reflect his actual existing duties and responsibilities in the cerametalix and organic departments.

3. Establish periodic in-use inspection of tools, jigs, and fixtures used in the organic department, and make the Quality Control Department responsible.

4. Make the inspection and control of measuring instruments and gages used in the organic department a function of the Quality Control Department.

5. Transfer the responsibility for periodic checking of critical instruments and controls in the organic department from Plant and Manufacturing Engineering to the Quality Control Department.

6. Adopt a continuing system of statistical quality control methods.

7. Transfer the responsibility for quality checks in the organic department from the Manufacturing foreman to the Quality Control Department.

8. Transfer the Q.C. Department responsibilities for finished goods inventory, stencilling, packing and related functions to another section.

9. Replace the present weekly inventory of finished O.E.M. brake linings with a running inventory system.

10. If chemical production increases to the point where more personnel are needed, or, if it becomes necessary to replace any existing key personnel in the chemical area, consider shifting some of the responsibilities for quality control from the Manufacturing Department to the Quality Control Department.

11. If the foregoing recommendations are adopted, eliminate the present organization structure and substitute the following in its place:

1. Establish two major sections within the department: the Inspection Section and the Quality Control Section.

2. Let the Inspection Section be responsible for all product inspections in the organic, cerametalix, and chemical departments, to include sub-sections of Receiving Inspection (raw materials, parts and components), Patrol or Floor Inspection, and Finished Goods Inspection (sampling, rather than 100 per cent).

3. Let the Quality Control Section be responsible for Tool, Gage, Instrument, and Controls Inspection, Process Control, and Statistical Analysis in all three product areas.

CHAPTER 8

PRODUCT ENGINEERING

8.1 General

The basic function of the Product Engineering Department is to establish and administer engineering policies, programs and budgets for the approval of the General Manager, in accordance with Division and Corporation policies.

The department is guided in its work by direction and assistance from The Bendix Corporation central engineering department, from the Division General Manager, and, internally, by directives from the department head, the Director of Product Engineering. Corporate goals, objectives and engineering policies are promulgated in writing; however, these are broadly stated and Marshall-Eclipse has considerable freedom in the pursuit of its objectives. Division goals and policies are not often set forth in writing, but are, for the most part, promulgated orally at formal and informal meetings. Neither are the functions and responsibilities of the Product Engineering Department set forth in a Division organization manual. In this respect, attention is invited to the well-recognized management tenet that written goals, policies, functions and responsibilities, along with personal discussion of these between top management and department heads, help to ensure that all levels of management have a clear understanding of their duties and responsibilities.

Within the Product Engineering Department, that this tenet has been recognized is evidenced by an organization manual, in which appear department and section organization charts, personnel assignments, budget and project allocations, and over-all goals, functions, and general policies of

the department. It is recommended that similar manuals be prepared to describe the functions and policies of each section within the department.

8.2 Section Organization and Functions

The Product Engineering Department is subdivided into three Sections: Automotive Products, Cerametalix Products, and Chemical Products. Each section is headed by a Chief Engineer. Total personnel complement of the department is 53, nine of whom, including the Director, are graduate engineers.

8.2.1 Automotive Products Section

This section is staffed with 28 people, two of whom are graduate engineers. Six additional personnel are attached to the section; however 100 per cent of their work is concerned with cerametalix products. Therefore, they will be considered as part of the manning level of the Cerametalix Products Section. There is provision in the organization chart for an Assistant Chief Engineer; however, this position is vacant at the present time because of difficulties in recruiting a person with the necessary qualifications.

Subsections within this section include a Project Staff, Compound Laboratory, Dynamometer Laboratory, and Road Test Laboratory.

The Project Staff is responsible for various programs and projects as assigned by the Director.

The Compound Laboratory is a junior edition of the organic brake lining manufacturing department. Its function is to mix experimental batches of organic lining materials and make up a suitable number of finished linings

for test purposes. The laboratory is equipped with small mixers, presses, ovens, and wet-mix extruders, and maintains a small inventory of raw materials. Wet-mix formulas are mixed and extruded here, dry formulas are mixed and sometimes pressed into small slabs. The remainder of the process -- cutting, bending, curing, grinding and drilling -- is normally done in the main plant. This is because it is difficult to reproduce in the laboratory the effect of the standard manufacturing process on the product. A lab technician usually follows a test batch through the entire manufacturing process to ensure that all specifications are being met.

The Dynamometer Laboratory tests samples of production and experimental brake linings for friction properties and wear.

The Road Test Laboratory conducts product performance tests under actual road conditions. Taking over where dynamometer test leaves off, road testing demonstrates the product characteristics with respect to noise, pedal feel or sensitivity, low versus high temperature performance, wheel pull or stability, and long-life data. Marshall-Eclipse maintains a fleet of 23 automobiles and 5 trucks, all of recent vintage. This is the largest car fleet of any brake lining manufacturer, and is held to be an important factor in the Division's large share of the O.E.M. market. To supplement its local road test program, this laboratory has one man assigned to The Bendix Corporation Jennerstown, Pennsylvania, mountain road test site where steep hill tests of heavy truck brake blocks are conducted.

There is a very close working relationship between the Automotive Products Section and the Manufacturing Department. Because the brake lining process has a large effect on the quality and performance of the product,

product development is tied closely to the manufacturing process. As a result, the end products of this section -- drawings, specifications and materials lists -- are more often than not passed directly from the Product Engineering Department to the Manufacturing Department. It is largely the function of the Manufacturing Department to fit the organic product to the manufacturing process, without the aid of the Plant and Manufacturing Engineering Department. In effect, then, the normal functions of Plant and Manufacturing Engineering, that is, methods engineering, plant and process layout, and work standards, are shared between Product Engineering and Manufacturing, with the Plant and Manufacturing Engineering Department serving only on an "as requested" basis. Because of this, Plant and Manufacturing Engineering has lost, over the years, its close contact and familiarity with organic products and processes. As a consequence, Plant and Manufacturing Engineering may not always be in a position to offer prompt and effective service when it is most urgently needed. Therefore, it is recommended that the flow of organic brake lining information between the Product Engineering and the Manufacturing Departments be altered to include the Plant and Manufacturing Department, and that the latter be expected to provide detailed process instructions to the Manufacturing Department.

8.2.2 Cerametalix Products Section

This section is staffed with 16 people, two of whom are graduate engineers. There are three subsections: Project Staff, Special Assignments, and Cerametalix Laboratory.

For low-temperature automotive cerametalix products, this section has complete responsibility for research, development, specifications, process

instructions, quality standards, and engineering releases. For high-temperature aircraft cerametalix products, responsibilities are somewhat different. In this area, the Bendix Products Aerospace Division has responsibility for research, development, specifications, quality standards, and engineering releases. From drawings, specifications and materials lists received from Bendix Products, the Cerametalix Products Section prepares process instructions for use by all other interested departments, and coordinates the over-all effort in the aircraft cerametalix product line.

The Project Staff and Special Assignments Sections work on special projects and programs under the direction of the Chief Engineer.

The Cerametalix Laboratory is equipped with the specialized equipment necessary for test and analysis of cerametalix materials, and is capable of mixing and forming small test quantities of cerametalix products. In addition, small production lots of automotive brake and clutch facing materials are often run in the laboratory.

It appears that the majority of the effort of this section is devoted to aircraft cerametalix products, to the detriment of research and development in the automotive brake and clutch product area. Under pressure from the Bendix Products Aerospace Division, this section has embarked on a comprehensive and arduous program to ensure that the final aircraft product achieves the high standard of quality required by military and commercial aircraft users. As a consequence, research and development in the automotive brake and clutch area has suffered. This area appears to offer considerable opportunities for growth and expansion, and, if such is indeed the case, it

is recommended that serious consideration be given to hiring additional personnel, either to assume part of the load in the aircraft cerametalix area, or to assist in the development of automotive cerametalix products.

8.2.3 Chemical Products Section

This section is staffed with five persons, three of whom are graduate engineers. The section has an Assistant Chief Engineer, a Project Staff, and a Chemical Laboratory.

Basically, the Chemical Products Section is responsible for the development of resin products used in the manufacture of organic brake linings, and of allied chemical products for sale to other manufacturers. The section operates on a project team basis under the direction of the Chief Engineer. The laboratory is equipped with the necessary chemical apparatus, hardware, and raw materials to simulate the existing manufacturing chemical plant in the development and test of new and existing chemical products.

The flow of information between this section and the Manufacturing Department takes a path similar to that between the Automotive Products Section and Manufacturing. That is, the Plant and Manufacturing Engineering Department is bypassed and has no responsibilities for methods, processing, or work standards. In this instance, however, the present procedure is realistic because of the low manning level required, and the specialized backgrounds reauired of persons associated with the chemical process. In the event of future expansion, however, it would be appropriate to assign methods and processing responsibilities to the Plant and Manufacturing Engineering Department.

8.2.4 Engineering Records Section

This section has two persons assigned and serves as a staff service function to the three product sections. Responsibilities include format, editing, and distribution of parts lists, engineering changes, the Engineering Manual, drawings, material lists, and process instructions. It was noted that Product Engineering does not have a centrally-located technical library. Since future expansion will bring about increased needs for technical books and publications, it is recommended that a technical library be established, and that the engineering records function be included therein.

8.3 Discussion of Over-all Functions and Policies

8.3.1 Basic Research

Basic research is non-existent at the Division level. Marshall-Eclipse relies upon the extensive research facilities of The Bendix Corporation in this respect.

8.3.2 Current Product Research and Development

This function is defined in the Department Organization Manual as follows: ". . . this covers product and process improvements, or cost reduction, on any product now made by this Division. (Modification of size or shape of an existing composition does not constitute a new product, . . ." It is further stated in the Manual that such current product programs may be requested by top Management, Sales, Production, Purchasing, or the Licensee Engineer. Sole responsibility for each program is delegated to the appropriate Chief Engineer, who is required to consult the Director

only if changes in priority, manpower, etc. are required.

Most of the efforts of the entire Product Engineering Department are concentrated on current product programs, as defined in the previous paragraph. It appears that the majority of such programs are the result of customer demands. Product Engineering personnel spend considerable time and effort trying to anticipate these demands, and, if demands come as a surprise, they waste no time in arriving at a solution to the problem. The attitude and efforts of the department in this respect have paid off, as evidenced by long-standing service to fifty percent of the original equipment automobile manufacturers. However, concentration of effort in this direction has been detrimental to new product development, as discussed in the following section.

8.3.3 New Product Development

The Organization Manual defines a new product as ". . . one which cannot be made on existing production facilities; i.e., requires a major capital expenditure." Such new product programs can be established only with the formal approval of the Product Engineering Director.

There are two aspects of the foregoing definition of a new product, which, in the authors' view, are detrimental to an aggressive new product program: First, the definition excludes all new products which possibly can be made on existing production facilities. Probably the most favored new product throughout industry is one which opens up a new market for the company and which can be produced with very small, or, ideally, with no changes or additions to present production facilities. A firm which can find one or more products of this nature usually considers itself very

fortunate. Second, the definition limits new products to those which require a major capital expenditure. In this instance, what is wrong with a new product which requires little or no capital expenditure?

Both of the foregoing points object to the limits on new ideas which the definition automatically imposes. In essence, the authors hold that any definition of a new product which includes any restrictions other than "the sky's the limit," will have a dampening effect on in-plant sources of new product ideas. Accordingly, it is recommended that the definition for a new product be changed so as to eliminate its restrictions on new ideas. Something akin to the following might be adopted: New Product: "Anything which we are not making and selling today."

Research and development pertaining to new products serve an important corporate need: To capitalize on available opportunities outside the present business and thus to provide new sources of corporate earnings. In the authors' opinion, this need is being served inadequately at Marshall-Eclipse for two reasons: First, as discussed in the previous section, the major effort in Product Engineering is aimed at solving customer problems and grievances -- in other words, "firefighting." Consequently, there is little time, money or personnel available for exploring new product ideas. Second, Marshall-Eclipse does not appear to have the climate necessary for prolific generation of new product ideas. This is partly due to the first reason, preoccupation with today's problems, and partly due to a lack of upper-level management support.

In the Product Engineering Department, the department head and the three product section chiefs have all acknowledged that the responsi-

bility for new product development is theirs. Each section chief has been given the right and privilege to embark on programs and investigations of his own choosing, within the limits of a miscellaneous budget appropriation established for this very purpose. However, all have commented upon the difficulty of pursuing new ideas because all available personnel are usually engaged in solving every-day "firefighting" problems. This situation is common today in many firms, and managers are becoming increasingly aware that new product development will suffer whenever these conditions exist. The only way to combat the problem is to establish a new product research group and arrange for it to be completely free from pressures to solve everyday problems. In some plants, this can be accomplished by diverting selected existing personnel into such a group, in others it requires that additional personnel be hired. Indications are, that at Marshall-Eclipse, the Product Engineering Department is working at nearly full capacity to solve the engineering problems which exist today, and which promise to continue into the future. If such is the true state of affairs, it is recommended that serious consideration be given to the hiring of additional engineering personnel for assignment to applied new product research.

In establishing the proper plant-wide climate for an effective new product program, two things are necessary: First, positive and visible support by top management, and second, an organization.

Top management is responsible for establishing and promulgating long-range new product goals and objectives and for laying the ground rules of the program. And, once the program is established, top management's actions must clearly indicate continuing interest and support.

As for organization of the new product function, there are many methods available, ranging from professional staff departments to single individuals holding collateral duties as new products coordinator. The general trend of industry has been to organize the new product department as a staff function reporting to top management. For companies the size of Marshall-Eclipse, new product panels have proven successful. Membership usually includes representatives from research, engineering, and sales departments, or any other department in which can be found persons with imagination and some creative ability.

The basic functions of a new product panel are often misunderstood to be research and development. These play an important role in the new product function, but only in a contributory sense. The main objectives of a new product panel should be the search for new ideas, and for new sources of ideas. The word "search" is important -- it emphasizes the point that the organization cannot sit back and just wait for ideas to come along. It must get out and "beat the bushes" in every direction in the manner of a hunter trying to flush his game.

Once the new product organization is established, top management and the new product panel can cooperate to encourage the growth of the proper climate. This is in essence a time-consuming selling job -- it cannot be done overnight. It is a long and involved process and the planning within the company is not a simple task. Company publications with articles explaining the value of new ideas, publication of company rewards, indoctrination meetings with all levels of management, etc., are all part of the necessary selling program. When the favorable climate is achieved, the free flow of new ideas is assured.

Obviously, all new ideas will not be feasible for further development. The New Product Panel should make an initial screening and select the ideas which show any promise.

The problem is then what to do with these promising ideas. One successful approach used by other companies under similar circumstances has been "product line teams". The purpose of the team is to consider specific action for developing the idea into a marketable product, and to make the necessary plans and programs to include support by engineering, manufacturing, marketing, and necessary service departments.

Some of the major responsibilities of the teams and their individual members under this concept would be to:

1. Present formal marketing plans, including the necessary analyses, forecasts, and judgments.

2. Present specifications necessary to support market plans in the areas of costs, profits, capacities, capital expenditures, processes, schedules, yields, etc.

3. Recommend and establish time schedules and actions required to carry out the plans.

4. Review the status of accepted projects, identify causes of delay and evaluate performance.

5. Make specific recommendations on matters outside the team's authority to the New Product Panel.

As can be seen from the above list of responsibilities, the team members should not be permanently assigned, but should be appointed and alternated as required. In each instance they should be selected for their

talents in the field under consideration.

These teams are action groups! They should take the idea and come up with results -- one way or the other. To do this, they must have top management support.

In consideration of the foregoing, it is recommended that a new product panel be established at Marshall-Eclipse. Should such a panel be formed, it is further recommended that, as its first effort, this panel concentrate on the selling job -- on establishing a favorable climate throughout the entire Division. Following this, one of the panel's early tasks might well be the search for a solution to one of the Division's ever-lasting problems: Disposal of scrap and dust accumulations. Several ideas have in the past been proposed as a solution to this problem; however, all have had drawbacks which made them unprofitable. A feasible solution may be lying dormant in the mind of one of the Division's 750-odd employees. The combination of top management support, aggressive organization, and favorable climate may be exactly what is needed to unearth this idea, along with the many others which may point the way to added profits for the Division.

8.4 Conclusions

By and large, the authors found the Product Engineering Department to be a well organized and cooperative unit, working effectively to discharge its responsibilities and accomplish its objectives. The existence of the Department Organization Manual and well-detailed job descriptions, as far as they have gone, indicate that the upper levels of management within the department appreciate the importance of well-defined functions and responsi-

bilities and have taken the time to think-out the proper division of these functions and responsibilities and put them in writing.

It appears that the Department is doing an excellent job with product and process improvements of products now being made by the Division, that is, with their current product programs based on customer demands. Because the efforts in this direction utilize most of the existing facilities and manpower in the Department, there is insufficient research and engineering effort remaining to apply to new product programs. This circumstance, coupled with the lack of an aggressive new product development program within the Division, is viewed by the authors as a major area of concern in Product Engineering.

8.5 Recommendations Summary

1. Prepare organization manuals similar to that now in existence at the Departmental level to describe the functions, responsibilities and policies of each Product Section within the Department.
2. Alter the flow of organic brake lining information between the Product Engineering Department and the Manufacturing Department to include the Plant and Manufacturing Engineering Department, and let the latter provide detailed manufacturing instructions to the Manufacturing Department.
3. Consider increasing the professional manpower available to the Cerametalix Products Section so that additional effort can be devoted to research and development of automotive brake and clutch cerametalix products.
4. Establish a technical library, and include the engineering records function therein.
5. Change the definition of "new product" to eliminate the restrictive

terms "existing production facilities" and "major capital expenditure."

6. Consider the feasibility of hiring additional engineering personnel for exclusive assignment to applied new product research.

7. Establish a New Product Panel and give it full top management support.

terms indicating priorities [illegible]" and "major capital expenditure."

6. Consider the [illegible] of [illegible] additional engineering personnel for exclusive assignment [illegible] new project reviews.

7. Establish a [illegible] management support.

CHAPTER 9

PLANT AND MANUFACTURING ENGINEERING

9.1 General

Since there is no organizational manual and conseouently no clear demarcation of authority and responsibility, the following comments concerning the organizational role of this department are based on information received from numerous interviews with management personnel and examining historical precedent.

The Plant and Manufacturing Engineering Department is a service department which is responsible directly to the Division Manager. The department is responsible for the following functions: construction, layout, maintenance, production methods and equipment, special eouipment and tool design, drafting, tool crib and processing. Certain functions of this department are not accomplished in the same degree for each product area. Therefore, when appropriate, these functions will be further subdivided in terms of their application to cerametalix, chemical and organic products.

9.2 Construction

The primary function of this section is the supervision and administration of any construction or major expansion project within the Marshall-Eclipse Division. Since construction requires approval of corporate headquarters, the Plant Engineer is responsible for the preparation of the preliminary detailed plans for the proposed project. Thereafter, this function involves managing and contracting of an approved project and there is little chance for conflict in this area.

9.3 Plant Layout

It was noted that the organizational chart contains areas described as rearrangement and layout. The word "rearrangement" is considered synonymous with layout and therefore it will be discussed under the latter title. The objectives of plant layout are the determination of the proper quantities and relative location of production machinery and auxiliary facilities required to most economically achieve the desired production rates when conforming to the specified operation sequences, standard methods and times. This function must necessarily follow the engineering method study, since information regarding the nature of the product, production rate, sequence of operations, available facilities, standard instructions and route sheets are necessary prerequisites for efficient plant layout. The plant engineer is charged with the responsibility for this function during major construction or expansion. However, at all other times the responsibility is not clear cut nor is there any provision for continuation or follow-up on this program. It appears that a layout project can be undertaken by the department or departments concerned, or they may request the services of the Plant Engineer.

The need for continuation and follow up should be readily apparent. Unless plant layout conditions are continually reevaluated there is a danger that gradual alteration, resulting from departmental "do-it-yourself" programs or plant expansion, will result in over-all inefficiency throughout the plant. Sales volume changes, method changes, expansions and alterations can all affect location of machinery, material handling and process changes. It is easy to have changes occur so gradually that even those who are close

to the problem fail to see the need for large scale modification simply because they get accustomed to things the way they are. Unfortunately, time did not permit selecting an area that would serve as an example of this point.

9.4 Maintenance

This section is responsible for the maintenance of all buildings, grounds, machinery and plant services such as heating, ventilating, plumbing and general housekeeping. Personnel in plant maintenance frequently do minor remodeling and relocation of partitions and machines to accommodate changing layout needs. The maintenance section includes a general machine shop in which needed repair parts can be fabricated.

Actually, the maintenance function goes even further. It includes stocking repair parts, spare motors and many other maintenance materials which are necessary for accomplishing the primary maintenance function. Finally, it includes plant security, housekeeping and cleanliness, along with inspection, care, and repair of equipment and other facilities.

Plant maintenance is not only a broad function but also a very important one. When equipment is installed, it represents production capacity for the plant. However, the useful life of equipment, and consequently the extent of its productive capacity, depends on how well the unit is maintained. As the ratio of machine investment to the number of employees increases, the importance of proper maintenance likewise increases. A serious breakdown of equipment may cause an equally serious loss in production. Such idleness and production losses can only be minimized by an efficient and well balanced maintenance section.

The responsibility of this function in regard to maintenance of all land, buildings, factory equipment and facilities seems well established in most areas. A problem area appears to be differentiating between maintenance responsibility and responsibility for calibrating to adequate standards of accuracy. It was noted that in the Cerametalix Department, such things as furnace control, instrument calibration and frequency of checking these for accuracy have been placed under Quality Control. However, in the Brake Lining Department, instrumentation of ovens and presses with respect to calibration has historically been done by maintenance. It was further learned that the maintenance section receives no information on any product engineering specifications which would be required in determining frequency and accuracy of these calibration checks.

The maintenance systems employed are up-to-date and effective. Maintenance records are maintained on all major and/or critical factory equipment. Preventative maintenance records and schedules are obtained by studying equipment during operation and inspecting them thoroughly during off-hours in an attempt to analyze breakdown distributions in order to establish maintenance and inspection cycles. Large maintenance jobs in which time is a critical factor, or jobs which are beyond the scope of the section, are awarded to local area contractors.

An excellent spare parts list, with appropriate re-order points, is maintained by the section. A check of this spare parts list disclosed that it contained over 1200 separate items and that the list was kept current.

In addition to maintenance functions, this section has the

additional responsibility for housekeeping and guards. These activities are both of a routine nature. Due to the nature of the product and the fact that the Marshall-Eclipse Division has no government contracts, the latter activity is little more than a fire watch established to comply with requirements of the insurance underwriters.

9.5 Methods Engineering

In the course of investigating the Production Methods Section of this department, it was found that this section was not staffed with any permanently assigned personnel nor was there any written authority or responsibility for this function. The present title, Production Methods, appears to narrow the area of application to manufacturing methods alone. Since a better method can usually be found regardless of the area of endeavor, and since there is no reason to restrict improved techniques to factory operations, it was decided to rename this function "Methods Engineering."

The primary objective of Methods Engineering is the simplification and improvement of methods with the obvious direct benefit of cost reduction. This is accomplished by subjecting each operation to a close analysis so that every unnecessary element may be eliminated and the best and fastest possible way of doing the job may be found. Thus, Methods Engineering culminates in standardization of handling systems, equipment and tooling, working conditions, and work measurement.

It was immediately obvious that the only function that was being accomplished at Marshall-Eclipse was an attempt at standardization of equipment and tooling, and even this was accomplished to varying degrees in the

three product areas.

9.5.1 Organic

Methods Engineering in this manufacturing area was limited to initial methods study at the time the production facilities were established. Since that time the Product Engineering Department has designed new and modified brake lining to fit the existing manufacturing facilities. The result is that the Plant and Manufacturing Department is effectively by-passed and the task of modifying existing methods is left largely to the Production Department, which may consult the Plant and Manufacturing Engineering Department on technical difficulties. The practice of the Product Engineering Department in designing products to utilize present facilities is considered commendable. However, the practice of not utilizing the engineering know-how of the Plant and Manufacturing Engineering Department is considered inappropriate. Stipulation and design of new production equipment is clearly the responsibility of this section. However, subsequent modifications to existing equipment are frequently made by other departments.

9.5.2 Cerametalix

Responsibilities for Methods Engineering and equipment design in this production area, although not in writing, are well defined. The original equipment design and methods engineering studies, were accomplished by the Bendix Products Aerospace Division. Sometime later the responsibility for the manufacture of this product was passed to the Marshall-Eclipse Division as well as the responsibility for the continuation of these

activities in the aircraft and automotive Cerametalix field.

9.5.3 Chemical

Plant and Manufacturing Engineering has no responsibilities for methods or equipment design in the Chemical Production area. The methods function has historically been carried out by the Products Engineering Department in conjunction with the Chemical Manufacturing Department. Design of chemical facilities has historically been accomplished by outside consultants with Plant and Manufacturing Engineering coordinating with the Purchasing Department in procuring the equipment specified by Manufacturing and Product Engineering.

9.5.4 Discussion of Methods Engineering

The foregoing comments were concerned with only one of the four functions which are believed to be proper areas of responsibility for Methods Engineering. It is obvious that even this function is not well defined and, in fact, differs with each of the product areas.

The responsibility for standardization of working conditions and work measurement has not been assigned to this or any other department. The apparent reasoning for this could be that Marshall-Eclipse is non-union and it is feared that the use of these engineering tools would arouse the resentment and hostility of the workers. In rebuttal of this reasoning it can only be said that it is believed that the management of Marshall-Eclipse is capable of impressing the workers with the need for such a program and of convincing them of the sincerity of management and of the benefits that both the worker and the Division will derive from instituting

such a program.

The last area is that of the materials handling system. Again, the responsibility for this function could not be determined but it was understood that the accountability has historically been assigned to three departments, namely, Manufacturing, Plant Engineering and Traffic. The primary objectives of a materials handling system are the reduction of the over-all production costs by reducing the hazards to equipment, materials, and personnel and to minimize the total process time, transport distances, storages, backtracking, rehandling and idle equipment time. That there is an obvious need for the assignment of responsibility for this function is readily apparent. The necessary engineering studies to evaluate and standardize the materials handling function is clearly within the scope of the Methods Engineering section. The operational control of the materials handling system is not the responsibility of the methods group and further discussion of this subject is continued elsewhere in this report.

In the relatively short span of observation of the various manufacturing operations conducted at the Division, the impression was that at least half of these operations could be improved. Yet, if this number could be improved, then it is reasonable to assume that a larger number could be improved sufficiently to warrant the expense involved in such a program.

A manufacturing enterprise must secure maximum utilization of men, materials and machines if it is to produce goods at a price that is competitive. Better methods are an ever-present possibility and they offer the best source of competitive advantage that exists in industry

today. Therefore, business survival under the pressures of competition requires continuing emphasis on and review of methods engineering.

It should be borne in mind throughout this study that there was insufficient time and information available to make an objective analysis of the amount of endeavor that should be expended in this area. Suffice to say that it is considered absolutely necessary that this important function be staffed with competent engineers with the necessary experience if this function is to operate effectively. It is believed that there are two prime prerequisites for successful methods engineering. The first is an adequate staff with engineering know-how; the second is appreciation and strong backing by top level management.

9.6 Equipment and Tool Design

The original functions listed on the organizational chart as special Equipment and Tool Design have been combined simply because they are accomplished by the same personnel under the direct supervision of the department head. In addition to the above functions, this section is charged with the responsibilities of furnishing central drafting facilities and the operation of the Cerametalix Tool Crib. The scope and responsibilities of these additional functions will be discussed in this section.

The initial design of all equipment and tooling is a well defined responsibility of the Plant and Manufacturing Engineering Department. Needed equipment is designed and furnished to the various departments when required. However, the same limitations indicated in paragraph 9.5 apply insofar as the varying degrees of applicability to the various manufacturing

departments.

The importance of this function should not be underestimated since there are many ways of producing a product. It is of paramount importance that the methods engineer investigate and evaluate all possible production processes in order to select the proper amount and combinations of tooling that will contribute to the over-all operational efficiency of the manufacturing effort. In this connection, it was learned that neither the department nor this section was furnished information regarding the lot size of the production expected. The concept that production lot size has little to do with tool design is a common fallacy. A low production lot size may be tooled at considerably less expense than a lot size that requires high efficiency and has a large and continuing manufacturing reouirement.

Since the ultimate purpose of machine and tool design is to save time, money, and materials, the selection and the design of the necessary equipment must be considered. Obviously, close coordination with the Methods Engineering Section, Product Engineering, Quality Control and the manufacturing departments are necessary prerequisites to efficient and effective equipment and tool design.

9.6.1 Drafting

The function and responsibilities of this section are well established and clear cut. In addition to its responsibilities for tool design technology, tool cost information, and maintenance of adequate files on original tools and equipment, this section serves as a central drafting agency for the entire Marshall-Eclipse Division. The efficiency of this section is difficult to evaluate in terms of dollars and cents,

yet one gains the impression from observing its operation and hearing comments from other departments that it is, indeed, a well organized and smooth running section.

9.6.2 Tool Crib

A third function of the Equipment and Tool Design section is the operation of the Cerametalix Tool Crib. This sub-section is responsible for maintaining and issuing the necessary tools, dies, and fixtures as well as the required detailed manufacturing and routing instructions to the operating department. This appears to be an ideal organizational arrangement since it dovetails closely with the related functions of the other sections of this department, i.e., methods engineering, tool design and processing. It was noted that an excellent procedure is in effect where all tools are returned via the Quality Control Department for inspection prior to being returned to the tool crib.

Contrary to common belief, tool costs are inherently high regardless of their size or complexity. Tools represent the combined effort of methods, engineering, processing, tool design, drafting and the manufacturing agency and, as such, represent a sizable capital investment of the company. They are, therefore, certainly worthy of adequate inspection and control.

Of equal importance to management is the inspection and maintenance of these items. If tooling items were not inspected periodically and necessary repairs and maintenance made at once, there would be no assurance that required tooling was available when needed for a production run. Likewise, if tools are used when they are not adequately checked and ready, tolerances

cannot be met and the ratio of scrap can become excessive. Efficient control and use of tooling in manufacturing requires that tooling items be regularly inspected and repaired if quality is to be maintained and scrap minimized.

The control and storage exercised over Cerametalix tools is considered excellent and similar measures are encouraged for tools, dies and fixtures of all other manufacturing departments. It is realized that this change, as is true for any and all changes, will meet with some opposition and present some scheduling and manpower problems. Location, space requirements, control procedures and tool handling are ideally within the scope of the Engineering Methods function and it is this section that should be depended upon to make necessary engineering studies and suitable recommendations. Perhaps the most difficult aspect of this problem will be encountered in handling and storing the organic castings. No objection can be offered if these items are given adequate storage space in the vicinity of the bake ovens and are placed under the control of the foreman of ovens, provided that procedures are established for adequate and continuing inspection by the Quality Control Department.

9.7 Processing

The responsibility for this function is clear-cut and is evidenced by a current, but as yet unapproved, job description. The present section entitled "Cerametalix Processing" is responsible for prescribing the production process necessary to produce a product as designed. The function of processing does not include specifying all the equipment, tools, fixtures, machines and methods. These functions are performed elsewhere in

this department. Broadly stated, this section is responsible for translating the information regarding drawings, bill of materials and specifications received from the Cerametalix Products Engineering section into complete manufacturing instructions for the use of the Manufacturing department. The manufacturing instructions include routing sheets, manufacturing procedure sheets and machine layouts, as well as responsibility for personal follow-up on all initial new product runs.

As is the case with the Tool Crib, Process Engineering, Design Engineering and so many other functions of Marshall-Eclipse, the processing function is not performed in all areas. At the present it is limited to Cerametalix Processing only.

The stated reasons for this are lack of engineering know-how in the chemical area, inability to break historical precedent in the organic area and additional costs that would be required. These reasons are readily understood. However, this should not preclude management from continually evaluating the possibility of consolidating all processing under one department when sales volume would indicate that such a move would prove more economical.

It is believed that the consolidation of this function should be one of the organizational goals of the Division. If this were accomplished, it would free the manufacturing departments to concentrate on manufacturing problems.

9.8 Licensee Liaison Engineer

In attempting to analyze the established and proposed functions of this department, every effort was made to consolidate similar functions

and to avoid split responsibility. In most cases, no recommendations have been made in regard to transferring an established function from one department to another. Yet, such a proposal is deemed necessary here. The responsibilities of the Licensee Liaison Engineer involve working with foreign licensee companies and providing them with all necessary technical data and information regarding organic brake lining products necessary to carry out manufacturing operations.

The present organization chart indicates that this is an independent department head function. However, a memorandum, dated 22 February 1962 and signed by the Factory Manager, indicates that he believes the function is responsible directly to him.

Obviously, this is an engineering function which has little or nothing to do with organic manufacturing and should be placed under the Plant and Manufacturing Engineering Department. Information received indicates that this is not a full time position. Therefore, such assignment would increase the engineering personnel of the department which should have over-all responsibility for methods. This would reduce the number of personnel required to make the department effective.

9.9 Recommendations Summary

1. The Plant and Manufacturing Engineer should set forth in writing the duties and responsibilities of the individual sections within his department.

2. Plant layout, both initial and continuing, should be made the responsibility of the Plant and Manufacturing Department. Individuals in this service department, by virtue of education, training and experience, are

better qualified to make engineering studies in these areas than are individual departments. These studies should include recommendations to the General Manager concerning allocation of floor space between departments.

3. Clarify the responsibility of maintenance in regard to calibration of instrumentation of ovens and presses in the organic brake lining department. The responsibility for the maintenance of all instrumentation of manufacturing equipment is clearly the responsibility of maintenance. However, the calibration of these instruments to adequate standards of accuracy should be assigned to the Quality Control Department. This procedure would then be the same as is presently used in the Cerametalix and would standardize the procedure throughout the manufacturing departments.

4. The present production methods and equipment section should be renamed Methods Engineering.

5. The Methods Engineer should be assigned responsibility for standardization of work conditions, work measurements, and materials handling.

6. The Methods Engineering Section must be augmented with the necessary engineering personnel in order to perform its assigned responsibility.

7. The Equipment and Tool Design section should be assigned the responsibility for all design modifications to existing tools and equipment.

8. The Equipment and Tool Design section should be furnished necessary information pertaining to production lot size so that tooling design will be appropriate and economical.

9. Consideration should be given to establishing an organic tool crib so that maintenance and Quality Control inspection can be effectively accomplished.

10. The present processing section should be enlarged to include processing responsibility for all products manufactured by Marshall-Eclipse.

11. The Licensee Liaison Engineer function should be transferred to the Plant and Manufacturing Engineering Department.

12. This Department should be augmented with adequate engineering personnel in order to effectively carry out their assigned responsibilities.

10. The present processing section should be enlarged to include processing responsibility for all products manufactured by Marshall-Eclipse.

11. The licensee liaison engineer function should be transferred to the Plant and Manufacturing Engineering Department.

12. This Department should be staffed with adequate engineering personnel in order to effectively carry out its assigned responsibilities.

CHAPTER 10

MANUFACTURING

10.1 General

An understanding of the Division's growth is necessary to understand the underlying reasons for the method of operations existing in the Manufacturing Department today. The meaning of this statement will be clarified as the philosophy of operation is reviewed. This philosophy derives from the cardinal rule that the customers' demands will be met. There is no doubt that this rule is realistic, and is the common purpose of the entire Manufacturing Department. However, there is some question whether the goal inherent in this rule is met consistently and at minimum costs to the Division.

The basis for this observation is three-fold: (1) The growth of the manufacturing function appears to have overshadowed the growth of supporting service and staff organization within the Division because of an autonomy which has placed manufacturing in total control of its method of operation; (2) failure of top management to make periodic, critical analyses and appraisals of the manufacturing operations; and (3) the effect of total freedom from the pressures of a union contract on the method of operations.

It will be recalled that this Division, of all the Divisions of the corporation, is unique in this latter regard. The preservation of this single status -- a non-union shop -- is reflected in the manner in which the Division has evolved and the mode of operation it has adopted. For example, it is strongly suspected that the rather apparent lack of engineering methods and standards has been deferred, in part, to preclude any

possible alienation of the workers. In the event that this suspicion lacks foundation, management must then take the responsibility for the absence of these vital management tools so essential for measuring and controlling labor costs. No other conclusion can be made in light of the availability of technically trained personnel within manufacturing, and other departments of the Division, who have long recognized the need for methods improvements, but who have not been utilized for this purpose.

10.2 Background

Historically, the manufacture of brake linings was accomplished almost entirely by manual labor and, as was pointed out during the many interviews conducted, by those individuals who today are filling management and top supervisory positions in the Manufacturing Department. As the product found expanding markets, the labor force and manufacturing facilities increased, but the functions necessary to support manufacturing, such as purchasing, accounting, inventory control, personnel, etc., remained ancillary, under the control of manufacturing. The throes of expansion and competition in the industry eventually gave birth to distinct service and staff levels simply because manufacturing had progressed into an unwieldy operation: the Factory Manager needed assistance. Thus the evolution of such functions as Comptroller, Sales, Plant and Manufacturing Engineering, Purchasing, Quality Control and Product Engineering.

Although these special functions were elevated to departmental level and assigned commensurate responsibilities, manufacturing, because of an historical precedent which attached to it, has been slow to relinquish certain functions which properly attach to, and could better be performed

by, these departments. For example, the two individuals who are assigned responsibility for production (Factory Manager, and the Assistant Factory Manager - Cerametalix) spend a good portion of their time personally pricing the products and maintaining communications with customers. Again, the Production Control Manager for organic brake lining is charged by the Factory Manager for the maintenance of realistic and current methods and standards, while the General Manager has assigned these same responsibilities to the Plant and Manufacturing Engineering Department.

The obvious consequence is diffusion of responsibility. With respect to current and meaningful methods and standards, there are none. Neither has there been any harmonious effort to solve this problem by the departments concerned. There is the added danger that, so long as manufacturing retains functions which should be performed by other departments, the managerial function in manufacturing may be slighted.

Here it is well to point out that the findings herein may appear to ignore the implications of an "informal organization" structure. Nonetheless, the findings reflect the principle that authority must accompany responsibility and top management must exercise controls for the periodic accounting of performance by lower level management. Regardless of the benefits that accrue from the informal organization, top management must utilize the formal structure as the primary means of control. Relinquishing this control is abdication of authority.

There is, therefore, a need for revitalizing the formal organization by redefining departmental responsibilities and assigning commensurate authority. At the outset of such a redefinition of responsibilities, there is

also the need to analyze, organize and systematize the Manufacturing Department for optimum operation. In this regard, it is considered that there is a requirement for the full-time employment of a methods engineering function over a protracted period of time.

This action is considered all the more urgent in light of the increasing competition in the brake lining industry. Another reason is the mounting pressures for unionization. The freedom of operation which exists today in manufacturing with respect to the many and varied assignments the workers may be detailed to perform, albeit compatible with good and fair management-worker relationships, nonetheless would be curtailed at the outset by a union contract. Workers would undoubtedly assume narrower job classifications, become more specialized in their individual positions, and the current use of workers in several positions would be reduced to the bounds of their respective job classifications. Moreover, the impact of any union contract would certainly extend to the customers, particularly the large volume customers, manifesting itself in reduced orders as a precaution against work stoppages.

These are sobering observations and undoubtedly of grave concern to management. Continuity of profits, therefore, demands a plan of coordinated industrial management in order that the various components of the Division may attain their highest efficiency. The house must be put in order. It is considered, therefore, that the first step in this direction is the establishment of a Methods Engineering Unit, properly staffed, to begin the aforementioned study. It is also recommended that, because talents for such a function now exist in Plant and Manufacturing Engineering,

the Methods Engineering Section should be made an organizational entity of that department.

10.3 Production Control

Earlier, it was stated that organic brake lining is the major manufacturing function. This stems from the fact that the Division enjoys several of the major accounts of the new automobile industry. Since the company does enjoy such large volume orders for a line of products, which in the main follow repetitive processes, it would seem that the Production Control Department would be operating with planning and control tools available through statistical analysis. Unfortunately, the wealth of data which has resulted from these orders over the years, has not been analyzed for this purpose. As a consequence, there is very little production planning or production control in manufacturing. The production process is initiated and kept in motion through weekly scheduling.

This scheduling system depends upon a firm customer release schedule, normally of a six-week duration. A weekly physical inventory of all materials, raw, in-process, and finished, is taken every Friday. If necessary, this inventory extends through Saturday, at time-and-one-half pay rate for the personnel involved. This count is used by the Production Control Clerk on Monday morning to enter into the Production Control Book a "balance due" for each customer. This balance is carried, or identified, by the customer and factory lining identification number. The Production Control Manager and the Production Control Supervisor divide total requirements (per individual size) by the number of weeks remaining through the third week of the month in which shipments are to be made. The result is the weekly

production that will be scheduled.

Next the total linings required are analyzed for increases or decreases in quantity and number of "mixes" and formulations. These data are reflected on a Weekly Schedule Revision which will assist the mixing rooms in scheduling their work, and are also forwarded to the Raw Materials Control Supervisor to assist him in maintaining operating raw material inventories.

Production for the ensuing week is now analyzed in terms of factory manpower and machine requirements. There arises the obvious question concerning the effect on worker morale in a system of production scheduling which proceeds on a weekly basis. As a matter of observed fact, the production schedule does not arrive on the factory floor with regularity so that there are times when the General Foremen are faced with the undesirable situation of having to give lay-off notices only a few days in advance of their effective dates.

The production schedule is now received by the General Foreman in charge of the ovens who prepares the Oven Schedule. All processing of the linings, before the bake process, takes its cue from the oven schedule because the ovens represent the critical station in the whole process. This is due to the fact that conveyors carrying the linings through the bake process move at fixed speed. Moreover, since each oven is "loaded" with a mixture of lining sizes requiring their respective castings, interruptions to the conveyor cycle, for casting change over, could contribute to production lag if care in the preparation of the oven schedule is not exercised. The critical scheduling function at this point is further complicated by

virtue of the fact that some 100 different sizes of linings are processed each week.

Schedules are now made to feed the ovens with linings fabricated by three processes: extruded, pressed and compression molded. Each process is scheduled for the output calculated to meet the requirements as specified by the customer. It is through these three schedules that work-in-process, before the oven operation, is controlled.

Due to certain processing requirements, it takes a minimum of three days for material from the wet mix operations to reach the cure ovens. Because of this lag, care is exercised to adjust the in-process inventories in an attempt to insure that at no time does this inventory exceed one week scheduled capacity for the ovens. Unfortunately the attempt fails in its purpose, and in consequence, there is a constant pressure to delay the mixing, extruding, and molding processes when the in-process inventory builds up beyond the oven capacity. The reverse pressure applies when, because of the "accordion effect" on the original production schedule, shipping dates loom up and necessitate "crash" measures to meet them. The result of these situations is further evidenced in the breakdown of control of in-process inventory graphically portrayed by the maze of book trucks, containing in-process linings, which congest the aisles and work areas surrounding the ovens, benders, and grinders. It is not uncommon, for example, for a supervisor to spend five or ten minutes searching for a particular book truck containing lining which must be processed through to meet a shipping schedule.

Although there is an annual sales projection, it appears that the

value of such a projection is not utilized by manufacturing except to forecast, in a broad sense, the personnel requirements for the ensuing year. As noted previously, it also appears that personnel requirements are not determined until the weekly schedule is analyzed. Neither is there any analysis made of the actual production from year to year in relation to the beginning of the year sales forecast. In actuality, no statistical or other projective type of short-range or long-range studies have been made to gather the basic data permitting the separation of the constant from the variable information. Had there been a program of historical production analysis, there would be a Production Control System in being, more responsive to customer order changes, minimizing after-the-fact schedule revisions, and insuring greater economy of operation.

It is interesting to note that this repetitive volume represents about 80% of the plant production and breaks down into relatively few factory part numbers. A logical question arises as to why, then, is it necessary to go through the rigors of a weekly schedule?

The points advanced in support of this weekly production scheduling system are as follows: (1) greater flexibility in meeting customer demands; (2) greater flexibility in scheduling; (3) reduced raw materials, in-process, and finished goods inventory; and (4) long standing policy to keep finished goods inventories to an absolute minimum. The explanation of these advantages proceed along the following lines: (1) historically, customers have contributed to the problems of scheduling because of the many changes (increases or decreases) to their

orders, sometimes on a day-to-day basis. Unless scheduling is responsive to this sort of demand, it is feared that the customer will find other sources of supply; (2) the weekly production schedule permits changes in individual orders without major disruption to the overall schedule; (3) the obvious advantage, therefore, is greater customer satisfaction and reduced inventories; and (4) the weekly schedule is necessary to compensate for the delay in receipt of orders for service linings destined to the original equipment customers. These orders must be processed through the corporation main offices and the "paper process" at that level has been responsible for cutting the manufacturing lead time by as much as 30 days.

To repeat, the advantages inherent in large repetitive orders discount the arguments. A cardinal rule of production scheduling is that the frozen or firm schedule should always be equal to or greater than, but never less than, the manufacturing cycle of the end product being scheduled. With all the aforementioned changes to the schedule, there cannot be avoided at times customer demand for early shipment which is, in fact, less than the manufacturing cycle. The net result is either a further revision to the schedule or manufacturing necessarily must resort to a six-day week to meet commitments. This is the consequence of a too stringent policy regarding minimum raw materials and finished goods inventories. This policy adversely affects the flexibility of scheduling. However, a production plan allowing an inventory for projected sales levels would obviate the necessity for frequent schedule revisions and crash projects to meet customer requirements.

The matter of delay in the receipt of service orders occasioned

by the processing time at the corporation level, is inexcusable, particularly since this processing is accomplished by data processing equipment. The effect on the manufacturing effort and control procedures is obviously detrimental. Certainly, some procedure should be established whereby the Division will be notified within three or four days at most, of the pending order. This situation begs the question as to why the matter should not have been resolved long before it became to be accepted as standard procedure. That this situation precludes any planning by the Production Control Manager and the consequences of lost lead time on the schedule need no further comment.

Finally, with respect to the claim that the weekly schedule permits greater responsiveness to customer demands, it is conceded that, providing manufacturing proceeds as planned for each week, customer orders will be met. However, difficulty is encountered in meeting shipping dates as evidenced by the fact that the Quality Control Supervisor, who is responsible for the preparation of the customer order for shipment, is forced to leaves "notes" for the off-shift superintendents setting forth the urgency to finish the listed factory numbers in order to meet the shipping deadline on the following day!

A great portion of production planning should be accomplished before any orders are received or accepted. This requires the characteristic tools of scientific production planning such as sales forecasts, historical production data reduced to meaningful curves and charts for the conduct of a statistical analysis of trends, economic lot sizes, production peak and slack periods, etc. Such studies will separate the all-important variable data from the constant data for further analysis. The constant

data isolated may then be used over and over again on repeat orders. Load forecasting, the forecasting of incoming orders, would prove a valuable product of such a study.

Considering that repeat and high volume orders account for about 80% of total production, the above-mentioned analysis should be combined with a Product Engineering study with a view toward the extension of production schedules beyond the current weekly method. This study envisions the analysis of sales trends to arrive at general size linings for quantity production runs through the oven cure process. This study also suggests variety reduction and economic lot size production runs. The grinding, drilling and other finishing operations would be undertaken on receipt of the firm customer order.

An immediate advantage of this method is the fact that there will be a semi-finished inventory which will insure responsiveness to heavy customer demand. This method should also reduce the effect of the many changes to orders which cause scheduling disruptions and obviate the necessity for brush fire tactics in order to meet shipping dates. Finally, this method will lessen, if not remove the inherent disadvantage of the critical oven cycle which hampers the present method of production scheduling.

Obviously, implementation of this recommendation requires the stocking of an in-process inventory. But there is nothing intrinsically wrong with such an inventory providing the net result is reduced manufacturing costs and/or better service to the customer. These are the factors which must be weighed in the process of any such study as is recommended. Provided general linings could be made as suggested, there is no question

that the resulting in-process inventory will be fluid through frequent turnover.

The discussion to this point on Production Control has pointed up the need for planning of production in order that the facilities and the manpower may be used to the utmost advantage of the Division. But no amount of such planning will come to fruition unless the entire manufacturing process and supporting divisional functions have been systematized through engineered methods and standards. It is with this thought in mind that the recommendation is made for a detailed methods study. This recommendation is considered all the more urgent for adoption in light of the After Market potential for increased sales. More immediately, however, the methods study would improve current operations by establishing meaningful standards for control of the manufacturing function. The fact that the present methods can be credited with contributing to profits proves nothing; the search for better ways of doing the job should never end.

Accordingly, a second reason is advanced for the establishment of a Methods Engineering Section. This unit should replace the existing Production Methods Unit, under the Plant and Manufacturing Engineering Department. Its function should be expanded to encompass methods improvements in any area of the Division. In the process of revising the function of this unit, it is incumbent upon top management to set forth detailed responsibilities and the commensurate authority to the Plant and Manufacturing Engineering Department Head, in order that he may effectively guide the Methods Engineering Section.

10.4 Raw Materials

It was stated earlier that a weekly inventory is taken which includes an inventory of raw materials. No day-to-day receipts or disbursements of raw materials are made by the warehouse personnel who deliver these materials into the production stream. Comparison of on-hand materials levels with required materials levels for the ensuing week depends upon this weekly physical inventory. It should be noted at this point that no use is made of this inventory count for any appraisal of actual production. The fact of the matter is that no such control feature is used. This method of inventory management has several weaknesses. The first is the obvious added cost of the physical inventory every week. Second, there are no use-data studies for control or appraisal purposes to evaluate manufacturing performance. Third, the existing system of materials control does not have any built-in accountability measures.

It is considered that immediate gains would be realized with the installation of a relatively simple inventory method using stock cards to reflect material balances, minimum reorder points, and such other data as they occur. At the end of a designated control period, the balance on each stock card would be transferred to Inventory Report Sheets for delivery to the Raw Materials Control Supervisor. The following advantages will accrue:

1. Elimination of the weekly cost of the physical inventory.

2. Disclosure of slow-moving items.

3. Permit the supervisor to make random checks of recorded stock quantities with actual on-hand quantities.

4. Signal over or understocked conditions in relation to current and projected demand.

5. Facilitate periodic inventory valuation.

It is of primary importance that inventory control, including all its various phases, be closely integrated with production control. This is fundamental, since all manufacturing inventory is either directly or indirectly generated by scheduling a function of production. From the foregoing, it is obvious that production planning, scheduling, and dispatching are so interrelated with inventory control, that the grouping of these functions under a single manager may be desirable. The organization of such a department and the advantages that will accrue are treated in other sections of this report.

10.5 Licensee Liaison Engineer

There is a lack of formal, written procedural operating instructions covering the methods and processes for the manufacture of the organic division products. This same deficiency exists with respect to flow process charts. These data are required by the Licensee Liaison Engineer in order that he may effectively perform his function of furnishing technical data to the foreign licensees. In order to accumulate this information, he must call upon the experience of factory personnel who have been on the job these many years, Product Engineering and Plant and Manufacturing Engineering.

Obviously, final verification of this information must take place before mailing to the foreign manufacturer. It is considered that both the collation and verification of these data are properly a function of engineering. Due to the close cooperation that must exist between Methods Engineering

and the Liaison Engineer, the transfer of the Licensee Liaison Engineer to Plant and Manufacturing Engineering Department should also be accomplished.

10.5 Recommendations Summary

1. Redefine the responsibilities of the Factory Manager. Remove all functions presently assigned which take his time away from full-time management of the Manufacturing Department. Since the removal of these functions from the Factory Manager will necessarily require that they be assigned to other Department Heads, responsibilities so assigned must be accompanied by clear-cut commensurate authority to preclude overlapping, usurpation, or abdication of this authority.

2. Institute a vigorous program for plant-wide methods improvement study.

3. Change existing Production Methods Unit in Plant and Manufacturing Engineering to a properly staffed Methods Engineering Section, and implement 2. above as the first priority.

4. Conduct an analytical study of historical production data and investigate feasibility of extending production schedule beyond the present weekly schedule.

5. Conduct a study to determine the feasibility and economic implications of manufacturing general size brake linings.

6. Investigate the feasibility of a semi-finished goods inventory for the high volume and repetitive lining orders.

7. Modify the Raw Material Inventory Control System to permit a record control, vice the existing method utilizing a physical weekly inventory.

8. Transfer Licensee Liaison Engineer function to Plant and Manufacturing Engineering.

CHAPTER 11

CERAMETALIX MANUFACTURING

11.1 General

The Cerametalix Manufacturing Department, as a separate entity within the Division organization, has existed for approximately one year. Originally an integral function of Manufacturing, the separation was deemed necessary because of the different processes involved, engineering requirements, and quality control dictates of aviation products.

Methods and procedures for manufacturing the Cerametalix products were provided by the Bendix Products Aerospace Division and that division has been the major customer for the products. The Department has not experienced the problems associated with expansion as have the other departments of the Division.

The responsibilities for engineering, quality control, and manufacturing of Cerametalix products are well defined functionally. The coordination of effort between the Cerametalix Manufacturing Department and the three departments providing technical services and inspection operations is both effective and desirable.

It is appreciated that the present organization is working satisfactorily and raises the question of whether one should make recommendations to change existing procedures. However, certain matters of organization and functional procedures are of questionable effectiveness and new approaches or methods might be considered. Each area shall be discussed in some detail as it now exists or as a functional operation is now performed and recommendations stated.

11.2 Organization

The separation of Cerametalix Manufacturing from Manufacturing was based on a requirement for quality control. A functional organization was needed to insure exactness in engineering in the manufacture of quality products. The support provided by Product Engineering, Plant and Manufacturing Engineering, and the Quality Control Departments is effective. The necessity for quality control and the supporting engineering assistance is no less important but the need for separation of the manufacturing operations has been eliminated.

At such time as the services provided Cerametalix Manufacturing by the departments named can be effectively coordinated with Manufacturing, Cerametalix Manufacturing should become an integral part of the major manufacturing department.

The present organization establishes a line of authority from Cerametalix Manufacturing to the General Manager. In this plan, the title of Assistant Factory Manager is inappropriate and misleading. Manager, Cerametalix Manufacturing, is more definitive and removes the implication of subordination to the Factory Manager.

11.3 Duties of Assistant Factory Manager

The Assistant Factory Manager is quite fortunate in being unencumbered by much of the related service and engineering responsibilities, allowing him to devote his efforts to manufacturing. In this regard two items should be considered. First, he should be removed from the pricing business in contact with customers. Meeting production standards in cost, quantity, and quality should be his contribution to profits. Second, the

depth of managerial experience in Cerametalix Manufacturing is not satisfactory. A need exists for managerial training of competent personnel to have lateral understanding of what is happening in the Marshall-Eclipse Division. Cerametalix Manufacturing may well be the most prepared in this respect because of the interrelationship existing with other departments; however, the focal point of management is the Assistant Factory Manager and his absence would create a vacuum in directorship.

Another consideration is the ability of any manager to devote some portion of his time to evaluation of past and present operations, and planning for the future. Only in this fashion can the manager accomplish his planning function, a responsibility inherent in his position.

11.4 Methods

This survey was not limited to, or intended as, a work measurement or methods study and no quantitative measures of analysis were attempted. Realizing this limitation, there are areas where methods analysis could improve the existing procedures. As an example, in following through the process flow of one product, the distance travelled by the materials after the mixing operation to final inspection was 245 feet between operations. In addition, the transportation between operations was by manual means and each piece was manually taken from or placed in a book cart or box 9 times.

Methods study, considering the procedures, men, and equipment to obtain optimum utilization of the aggregate, should be accomplished as a part of a Division plan.

11.4.1 Raw Materials Inventory

The present system of raw materials inventory control is based on

reorder levels and a weekly physical inventory. The inventories made weekly serve as notice for the Purchasing Department to reorder raw materials. Initial and cursory appraisal indicate that it is a satisfactory method for present production levels, though uneconomical and lacking in measures for accountability. The system ignores available records which could be used for inventory control.

The system of raw materials inventory control recommended would utilize available materials receipt records and records of mixes, or disbursements, to maintain running inventories. Certain advantages which should accrue with only slightly greater processing of available records are:

1. Reduced inventories would be "red-flagged" as they occur and not after the fact;

2. Man hours devoted to physical inventory would be reduced;

3. A capability for daily notices of requirements to the Purchasing Department, if desirable, would be realized;

4. Effective control would continue even though increased production levels required a more rapid turnover rate of raw materials, and

5. The development of a system to work in each manufacturing function separately, which could be utilized in a centralized raw material inventory function serving both manufacturing departments or an integrated department at a later time.

Until such a system has proved workable, and to reduce the risk of clerical errors, one-fourth the total list of raw materials could be

physically inventoried weekly, allowing a physical count of each item once per month.

11.4.2 Finished Stock Inventory

Presently, a weekly inventory of finished stock acts as a starting point for weekly production schedules or revisions. A lack of management control exists in the system since deviation from production standards are not evident until inventories have been made. The determination of the causes of such deviations is then complicated by the time elapsed.

A method using production records at various functional operations to check scheduled production should be more effective as a control device. The anticipated workload of maintaining running inventories of stock is considered smaller than taking the weekly physical count.

The system would be applicable, again, to a centralized production control function as foreseen in the future.

11.5 Recommendations Summary

The following recommendations are listed in a preferred sequence of accomplishment:

1. Assign a title to the person responsible for the manufacture of Cerametalix products something other than Assistant Factory Manager.
2. Place in training, or utilize, some person associated with Cerametalix manufacturing, to gain some depth of knowledge within the Department.
3. Remove all functions, not associated with manufacturing, from the responsibilities assigned to the Department Manager. The requirement for records keeping to give price quotations is one of these functions.

4. Institute a vigorous program for plant-wide methods study and implementation of improved methods.

5. Revise raw materials inventory control procedures by taking advantage of available records to maintain perpetual inventories.

6. Revise stock inventory procedures to provide useful information to production control and scheduling personnel on a continuing basis.

7. Integrate the Cerametalix Manufacturing Department with the Manufacturing Department as a long term plan. This recommendation is contingent upon the effective utilization, by the Manufacturing Department, of services which can and should be provided by the Plant and Manufacturing Engineering and Quality Control Departments.

8. Recommendations 5 and 6 above are considered only temporary measures. A centralized raw materials inventory and stock control function is envisioned at a later date.

CHAPTER 12

PROPOSED ORGANIZATION

12.1 General

This chapter shows effect of the previous recommendations on the existing organization. The result is a plan for a change in the organization of Marshall-Eclipse. Change is nothing new. At the beginning of the study in February the authors were told that the existing organization chart was "not up to date". It was dated January, 1962!

Change has been called the only constant in company organization structure. A company's chart, according to one observer, represents merely one stage in an ever evolving organization plan. As companies increase in size and complexity, they tend to follow a somewhat similar organizational pattern. The elements of this pattern are all related. They are all a part of the answer to the question: "How can one man -- the General Manager -- manage to manage a larger and more complex enterprise?"

The answers appear to lie in the application of the principles of organization to the particular circumstances of the company. The body of principles that have been developed by students of organization and operating companies is very large. The following eleven appear to apply particularly to Marshall-Eclipse.

Principles of Organization

Objectives

1. The objectives of the enterprise and its component elements should be clearly defined and stated in writing. The organization should be kept simple and flexible.

Activities and Grouping of Activities

2. The responsibilities assigned to a position should be confined as far as possible to the performance of a single leading function.

3. Functions should be assigned to organizational units on the basis of homogeneity of objective to achieve most efficient and economic operation.

Authority

4. There should be clear lines of authority running from the top to the bottom of the organization, and accountability from bottom to top.

5. The responsibility and authority of each position should be clearly defined in writing.

6. Accountability should always be coupled with corresponding authority.

7. Authority to take or initiate action should be delegated as close to the scene of action as possible.

8. The number of levels of authority should be kept to a minimum.

Relationships

9. There is a limit to the number of positions that can be effectively supervised by a single individual.

10. Everyone in the organization should report to only one supervisor.

11. The accountability of higher authority for the acts of its subordinates is absolute.

Most of these principles need no further elaboration. Mostly they are guides rather than dogma. Admittedly, the principle that "everyone . . . should report to only one supervisor" is inflexible, but principles such as "there is a limit as to the number of positions which can be effectively supervised by one individual" are matters of judgement to be applied as seen fit by management.

None of the principles are mutually exclusive. Given a number of people to do a given job, a limited span of control calls for more levels of organization and vice versa. Where compromises have been worked out they have been made with the best judgement of the requirements of the company.

12.2 The Organization Plan

Each of the organizational concepts and principles above has been carefully considered in relation to the existing organization at Marshall-Eclipse. In some areas the proposed changes in organization are major. In others, there is little or no change.

The steps and priorities which were taken in developing the proposed organization are as follows:

12.2.1 Determination of Objectives

The objectives of the company were stated by the General Manager in conference. They were:

1. The company intends to double its sales volume and increase its personnel 50 per cent in the foreseeable future.

2. The company is chemically oriented and seeks new products which are of such a nature that they cannot be competitively produced by

"garage shop" industry.

3. The company will expand Aftermarket Sales to exploit the growing replacement market and to reduce its dependence on OEM sales.

4. The company will predicate its personnel policies on, and direct its labor relations efforts to maintaining a non-union status. This is considered a vitally important asset, particularly for continued OEM sales.

These objectives are not in writing, nor do they appear to be generally known and understood by personnel within the company. Neither are they complete or all inclusive. They are, however, the basis for the planned organization.

The objectives of the company should be further defined, expanded and written down.

12.2.2 Analysis of the Existing Organization

The preceding chapters serve as our analysis of the present organization. The findings have been measured against the stated principles of organization. Using the insight gained from this analysis, the ideas for the next step were developed.

12.2.3 The Long Term "Ideal" Structure

This is a wholly impersonal plan drawn up to approximate the structure best suited to meet the company's objectives. It is "ideal" only in the sense that it is a structural goal recommended for the company to work toward. The authors do not equate the "ideal" with the "perfect" plan.

This plan is impersonal in that existing personalities, existing assignments of responsibility and authority, and existing reporting relationships have been disregarded.

Thus, the only elements that were brought to bear on its construction were the objectives of the company, the principles of organization, the analysis of the existing organization, and our own judgement. This is the organization structure judged most desirable to meet the company's objectives. This plan does not have a set target date. It is set up as a plan to accomplish in the forseeable future -- which may be two or three months from now or four or five years from now as determined by the General Manager.

Our plan is in the form of an organization chart. Immediately apparent is the reduction in the number of departments within the Division. This reduced "span of control" for the General Manager was accomplished by combining the existing sales departments into the Marketing Department; by integrating Cerametalix Manufacturing within the Manufacturing Department; and by combining the functions of the Purchasing Department with the production control and traffic functions into a Manufacturing Services Department.

The establishment of the Marketing Department and the absorption of Cerametalix Manufacturing by the Manufacturing Department are instances of "closing ranks" rather than major organizational changes. Discussion of these modifications, and of recommendations pertinent to individual departments, has appeared previously in this report.

So far, traffic, purchasing, production planning, and inventory control have been considered separately; their close interdependence has certainly not escaped the reader's attention. We propose that they not be considered as four distinct functions, but rather as the four main elements of the Manufacturing Services Department. Together they define the patterns of the several interrelated activities of the Department.

Some explanation of the reasons for forming the Manufacturing Services Department is appropriate at this point. The objective is to control the flow and amount of materials through the plant from purchasing to finished goods shipment. The manager of the Manufacturing Services Department would be responsible for materials management and production planning and control.

To fulfill these responsibilities, the Department is shown divided into three sections only to indicate functional homogeniety. The Purchasing Section retains its well established functions. The Traffic Section would include the staff functions of rate analysis, carrier selection, freight audits, etc., and the operational services of receiving, warehousing, and shipping. The Production Control Section entails production planning through forecasts and order control, scheduling, and inventory control.

In effect, a nerve center for production would exist in the Division. The Department would provide materials for manufacturing,

plan production, and handle the physical distribution of the finished products in coordination with manufacturing and sales requirements.

The advantages to be gained by establishing the Manufacturing Services Department are:

1. Simplification of the organization and better definition of responsibilities.

2. Accountability of one person to the General Manager for effectively performing these sequential and interrelated functions.

3. Establishment of a control center for physical distribution costs -- costs that seriously affect profits.

4. Relief for the factory supervisory personnel from functions which detract from attention to supervision of production lines.

5. Assignment of responsibility to one individual for administration of inventory policy.

6. Establishment of a more flexible organization structure better able to cope with planned expansion.

12.2.4 The Organization Chart

The organization chart shows the primary functions of each major department. In some cases, these functions have been further amplified. The overall chart, however, is functional. It is shown in Figure 12-1.

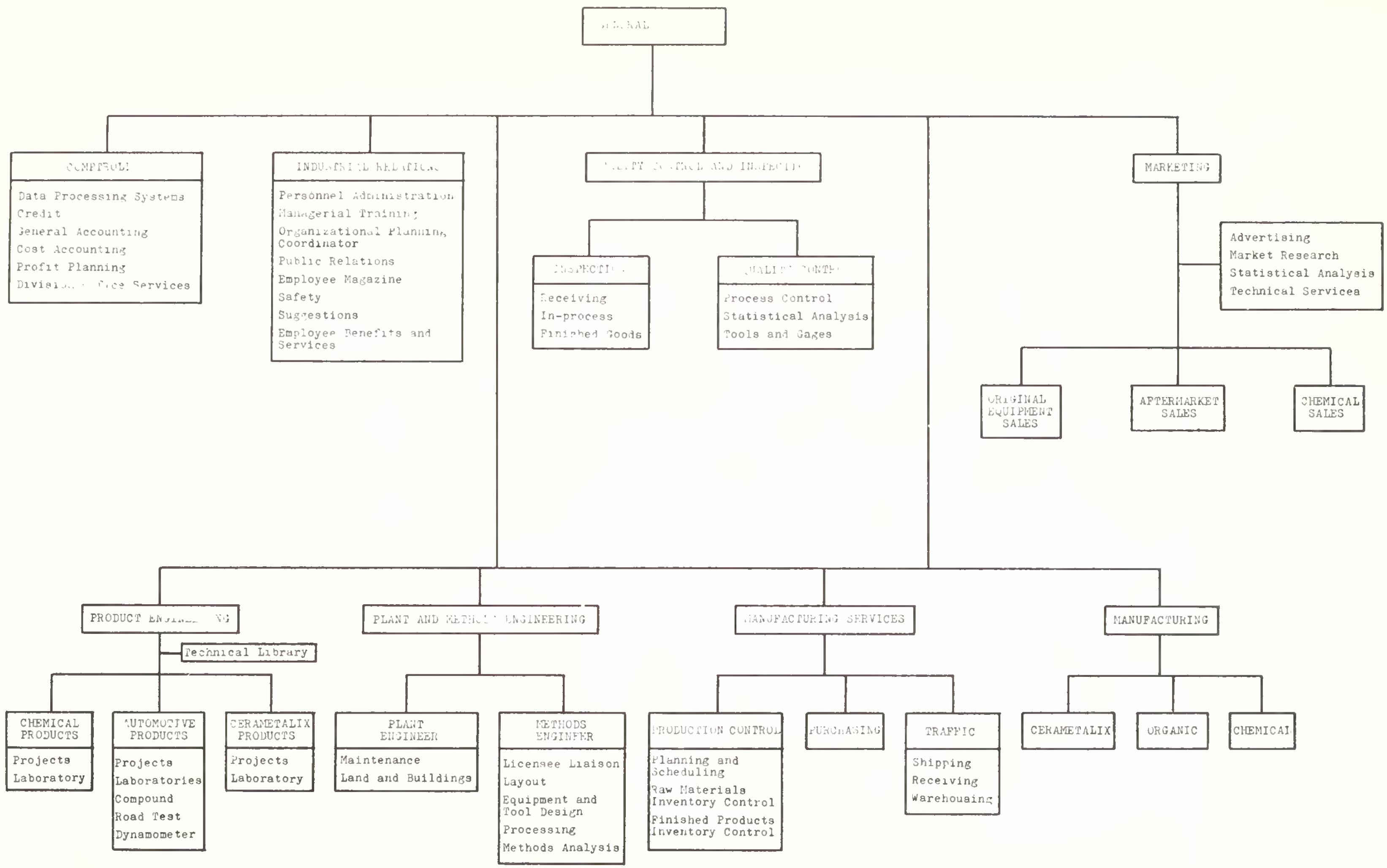


Fig. 12-1 MARSHALL-ECLIPSE DIVISION - PROPOSED ORGANIZATION

12.3 Line and Staff Relationships

The line departments of the company are Manufacturing and Sales. They are directly responsible to the General Manager for accomplishing the objectives of the company.

Personnel, Comptroller, Manufacturing Services, the Engineering Departments and Quality Control may be classified as staff departments. Their job is to help the line departments accomplish the company objectives. They are the supporting elements -- the people who provide service to the line.

The organization as proposed should provide adequate staff services for the company in line with its present objectives. No requirement for personal staff or staff assistants is indicated at this time. Line assistants within individual departments may be required, particularly in manufacturing where someone must act in place of the Factory Manager when he is absent. For example, the off-shift superintendents would be considered line assistants.

Staff assistants are one method of handling part of the General Manager's task when the press of duties prevents him from devoting proper time and attention to the managerial functions of over-all planning and control. A staff assistant or "assistant to" would take some of the load from the General Manager but would have no authority over the Department heads. He would serve principally as an advisor and aide to the General Manager.

A line assistant to the General Manager, however, would help him carry out the whole range of his responsibilities and would act in

his place when required. He would have line authority in this capacity and could act as the chief operating officer or chief administrative officer of the Division, as desired.

A third approach to the problem is to reduce the General Manager's span of control, to group activities under him with the aim of better performance with less top management supervision, and to establish clear and definite lines of authority and responsibility. This third approach is the one we have chosen.

12.4 Committees

The reader will note that little has been said about committees. Opinions on committees vary, and are usually strongly held and stoutly defended. One side holds that committees are an effective aid to management. The other takes the stand that committees are the most effective means of wrecking the entire organization.

It is the view of the authors that committees can be a very useful, efficient and effective part of management. However, at the present time the authors can see no need for formal committees in the Marshall-Eclipse Division, except as noted below. The present policy of fairly regular meetings of the department heads seems effective and should be continued. This method should serve adequately through the period envisioned by this report.

The exception should be in the new product area. Here the effects of constructive action by aggressive committees make consideration of standing committees advisable. It has been noted that a new product type of committee has been tried before by the Division, without

much success. The vital importance of new products, however, should make action in this area imperative. The New Product Panel and "product line team" concept has been used with success by other companies under similar circumstances, and is definitely recommended.

12.5 A Method of Change

Here we are confronted with reality in terms of existing personalities and facilities. The problem is how to get from the existing organization to the ideal. Most organization planners agree that gradual change to bring the existing organization into conformity with the ideal is most desirable. The time period involved depends upon the degree of difference which exists between what the company has and what it is shooting for.

Implementation involves the actual personnel changes, the re-grouping of activities, and the changes in responsibility and authority called for by the plan. Organization changes as they occur should be carefully reviewed to see that they are in conformity with the long range plan.

Finally, the "ideal" is seldom attained. For through constant re-evaluation and adaptation, the company may find that as it approaches the ideal, it too has become another step on the road to another ideal plan.