

TRENDS IN USE OF REPAIR CENTRES

INPUT

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TRENDS IN USE OF REPAIR CENTRES
TITLE

FE/1982
E14

FE/1982
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F-ED4

TRENDS IN USE OF REPAIR CENTRES

SEPTEMBER 1982



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I INTRODUCTION

I INTRODUCTION

A. PURPOSE

- This report is produced as part of INPUT'S 1982 European Field Service Programme, and was chosen as a result of extensive client interest.
 - A brief synopsis of repair centre evolution is included.
 - Guidelines for establishing repair centres are addressed.
 - Each field service organisation has its own rationale for establishing repair centres, which the report examines.
 - Relationships of repair centres to other field service and company divisions are examined.
 - Repair centre characteristics and functions are enumerated.
 - The range of repair work includes many common (and a few uncommon) tasks.
 - Controls and procedures for operating repair centres are noted.
 - Organisational and administrative characteristics reveal the business aspects of repair centres.

- Personnel issues and typical organisational structures are analysed.
- Financial elements of the repair activity are examined, including estimated cost benefits derived from repair centres.
- Vendor profiles of diverse repair centre operations are presented.
- The future for repair centres is discussed in view of current operating goals, plans, measures, and new opportunities.

B. SCOPE

- Research for this study was accomplished through direct contact with repair centre managers, or other field service executives with jurisdiction over repair centre activity.
- A total of 15 vendors with significant activities in repair centres were interviewed for this report.
- The vendors canvassed represent a cross section of large and small systems and third-party maintenance firms, as well as United States-based and Europe-based companies.
 - The questionnaire used to develop findings in this report is included in the Appendix.
 - A summary of respondents representing large and small vendors is shown in Exhibits I-1 and I-2.
 - Countries represented in this report include:
 - United Kingdom.

EXHIBIT I-1

SUMMARY OF RESPONDENTS BY TYPE

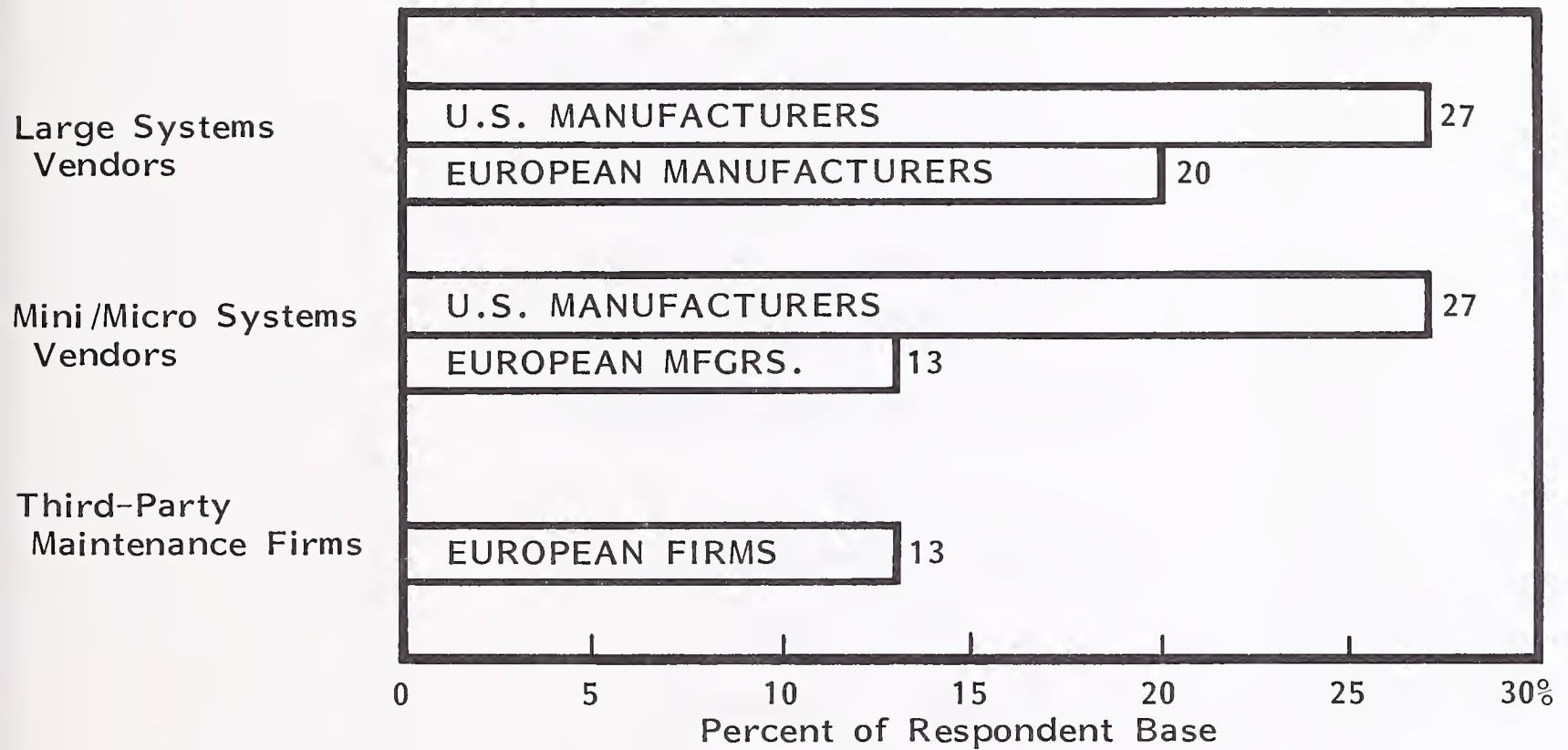


EXHIBIT 1-2

SUMMARY OF RESPONDENTS BY COMPANY

RESPONDENTS

EAS Wordplex

Burroughs

Computer Technology

Exxon Office Systems

General Computer Systems

Hamilton Rentals

Honeywell Information Systems

Intel

International Computers Limited

Perkin Elmer

Philips Data Systems

Plessey Controls

Prime Computer

Rediffusion Computers

Storage Technology

- . France.
- . Germany.
- . Sweden.
- . Belgium.
- . Holland.
- . United States.

- Presentation of the material in this study differs in format from previous INPUT studies.
- Client comments on this report are invited.

II EXECUTIVE SUMMARY

II EXECUTIVE SUMMARY

A. CONCLUSIONS

I. DEFINITION

- A repair centre, as defined in this report, is "any location, other than a customer site, where maintenance is performed on inoperative systems, system components, or system assemblies."

2. THE TRENDS TOWARDS REPAIR CENTRES

- There is a growing trend by system manufacturers, respondents to this annual INPUT survey, to expand the use of repair centres. Forty percent of the respondents to this survey are taking action to increase or to improve their repair centre capabilities.
- The primary impetus for system manufacturers to enlarge and improve repair centre capabilities is to reduce the cost of maintenance to the customer, to improve customer service and satisfaction, and to keep pace with a rapidly expanding and changing technology.
- The primary impetus for establishing repair centres originally was technology:
 - Electronic circuit boards can be easily swapped at the customer site.

- Replaceable chips, now less expensive, can be inventoried at remote repair centre locations.
- Diagnostic test equipment has become available which is more accurate (and more portable) than ever before.

3. CHARACTERISTICS OF REPAIR CENTRES

- Repair centres provide both internal repair services (i.e., repair services to in-house field engineers) and external repair services (i.e., to customers).
 - The main internal services are mechanical and electrical repairs, which include board diagnosis and repair, and chip replacement, as shown in Exhibit II-1.
 - Other common internal services include modifications, warranty maintenance, and exchange programmes.
- External maintenance operations include repair activities directed specifically at customers, without involving any internal field service operation.
 - This would be the case if a customer contacted the repair centre directly rather than the manufacturer.
 - External operations are relatively small so far.
 - Examples of some of the functions performed as external operations are included in Exhibit II-1.
- Repair centres provide maintenance for specific components such as sealed disk units, other vendors' equipment, newly released equipment, and low volume products. The normal disposition of these products is to return them to the manufacturer.

EXHIBIT II-1

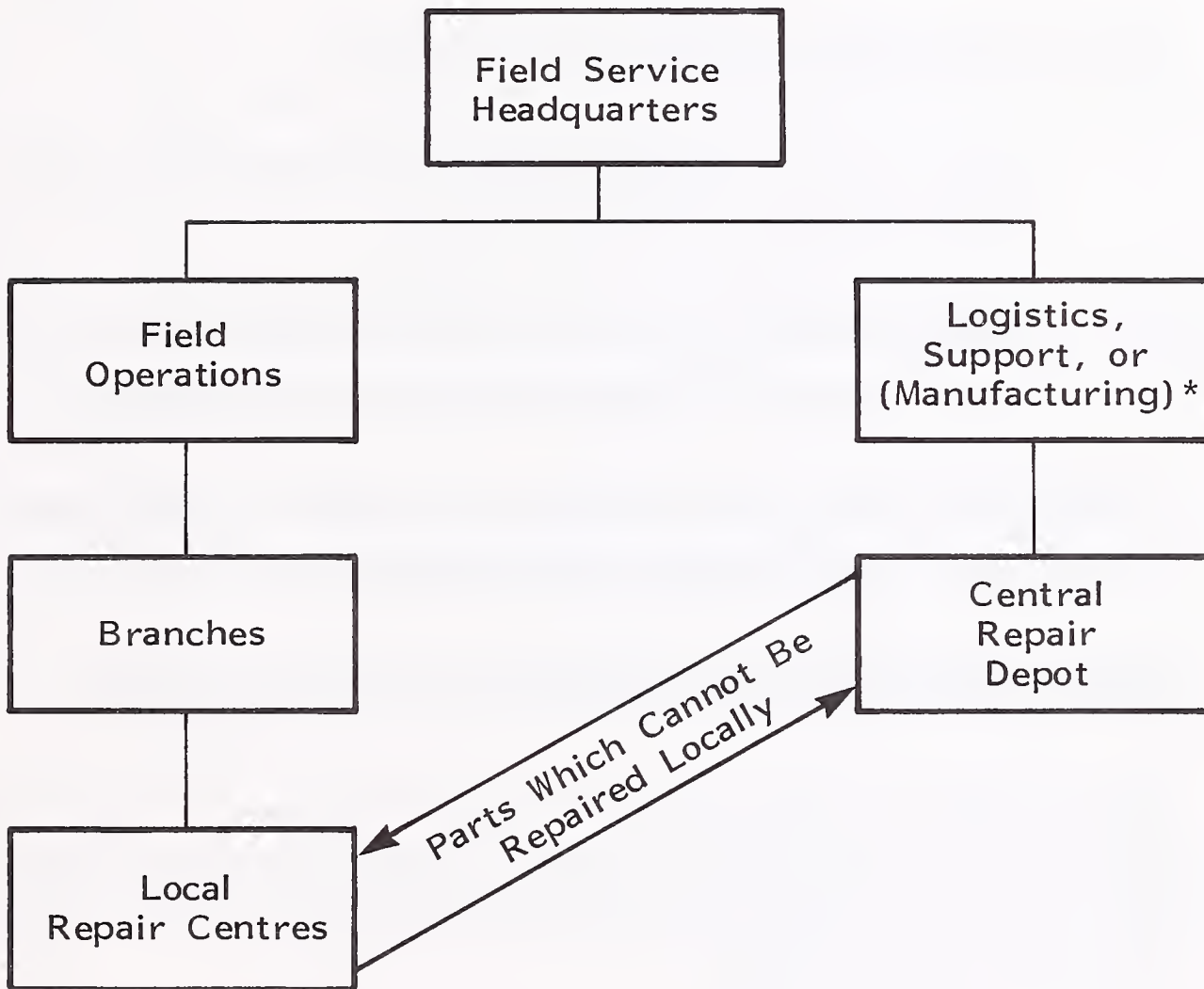
FUNCTIONS PERFORMED BY REPAIR CENTRES

REPAIR SERVICE	FUNCTIONS	FREQUENCY
<p>Internal Services (Repairs provided to in-house personnel only, i.e., field engineers)</p>	<ul style="list-style-type: none"> ● Mechanical/Electrical Repairs <ul style="list-style-type: none"> - Board Diagnosis and Repair - Chip Replacement ● Modifications ● Warranty ● Exchange Program ● Cosmetic Overhaul ● Refurbishment ● Commissioning 	<p>Most Common Most Common Most Common Common Common Common Rare Rare Rare</p>
<p>External Services (Services provided directly by repair centres to customers)</p>	<ul style="list-style-type: none"> ● Repairs ● Exchanges ● Spare Parts Sales ● Modifications ● Acceptance Testing ● Third-Party Maintenance 	<p>Rare Rare Rare Rare Rare Rare</p>

- First phase "repair" often means swapping good parts and components for bad ones, rather than actual intervention on the failed part/component.
 - The repair centre function is therefore often heavily involved in inventory and delivery functions.
 - On the other hand, second phase (defective part/component) repairs do take place at the repair centre and are carried out by specialist field engineers not involved in field operations (board swapping or on-call activities).
 - This second phase repair function provides the main challenge and work satisfaction for technical employees at the repair centre. However it is a function that is frequently absorbed by the central repair depot, rather than being available at the local repair centre.
- Most repair centres operate in conjunction with an established sales office(s).
 - Repair centres, like sales offices, are located near major customer populations to provide responsive maintenance.
 - For example, repair centres are set close to customers in an effort to improve parts turnaround time; i.e., the elapsed time between the request for assistance and the delivery of an operative replacement.
- Organisational structures for repair centres vary. They are discussed in detail in Section VI of this report.
 - The most typical organisational structure adopted by manufacturers is shown in Exhibit II-2.

EXHIBIT II-2

TYPICAL REPAIR CENTRE ORGANISATION CHART



*Manufacturing does not usually report to field service.

- Typically repair centres are autonomous entities, colocated with a sales office.
- Repairs are made locally, when possible, or returned to a central repair depot if required.
- Both the local repair centre and the central repair depot report to the headquarters field service organisation.
- Repair centre personnel typically are in demand.
 - Attrition is low although opportunities for promotion to other technical positions are high in a better economy.
 - Centre personnel are not normally unionised, yet this is a major concern of management, reflected in all matters of personnel.
- These characteristics of repair centres lead quite naturally to some distinct advantages and disadvantages for the maintenance function.

4. ADVANTAGES AND DISADVANTAGES OF REPAIR CENTRES

- Repair centres provide real opportunities for cost savings through reduction of spare parts float (an advantage that contributes to their development). Spare parts float is the extra spare parts inventory in transit either "to" or "from" the part's source of supply.
- Since they are close to customer sites, repair centres have meant quicker and often more reliable repairs. This in turn can reduce the labour content in the maintenance function, which is a major goal of systems manufacturers.
- It is a strongly held view that repair centres can accomplish this goal more readily than the manufacturing company's maintenance group.

- Quicker and better repairs also impact customers positively by reducing their maintenance outlay costs and increasing their satisfaction levels.
- Repair centres provide the advantage of more flexibility and improved turnaround time. On-site repairs, which are time consuming and disruptive, are eliminated as the true repair (as opposed to the part swap) takes place at the centre.
 - The repair centre provides an exchange part or a loaner part to obviate the lengthy turnaround time.
 - Reducing turnaround time is a major goal and advantage of repair centres. Exchange parts are preferred to loaners as the latter require a return visit to the customer site.
- Manufacturing units also benefit from repair centres as the parts/component repair function is delegated to the remote centre.
 - Inherent delays in making repairs at the manufacturing site are eliminated.
 - A real-time priority system at the repair centres has replaced the unfortunate apathy which once existed at the manufacturing centre.
- In Europe, repair centres offer the additional advantage of providing local repair in each country where the vendor markets his products. This clearly reduces the delays in customs, and duty expense associated with parts crossing country borders, and the shipping costs associated with the longer distances.
- Repair centres, in Europe and North America, provide greater management responsibility and accountability at lower organisational levels, a desirable decentralisation.

- Greater local autonomy is an expressed goal of the repair centre management interviewed for this INPUT survey.
- Autonomy results in more job satisfaction and greater personal security according to respondents to the survey.
- Finally, repair centres are good business.
 - Respondents to this survey indicated that repair centres, as described above, save an estimated 40% of the total annual field service budget.
 - This is due to the reduction in labour content, reduction in spare parts float, and reduction in mailing and incidental expenses associated with a larger centralised maintenance function.
- Furthermore, only one insignificant disadvantage was reported. Most respondent repair centre managers feel that they receive inadequate support from the manufacturing sector of the company.
 - Company field engineers, it is believed, do not adequately describe the customer's problem, thereby causing undue time for repairs.
 - The communications between United States manufacturers and their European support centres should be improved.
 - Competing priorities, such as efforts to incorporate central dispatch and other centralised field service systems and procedures in the local repair centre management, interfere with the normal operations of the repair centre.
- The advantages of repair centres greatly outweigh the disadvantages according to this survey, yet certain key issues must be evaluated.

5. KEY ISSUES

- A major issue today in maintenance concerns centralisation of the repair function as opposed to decentralisation with remote repair centres.
 - The trend is toward decentralisation.
 - Proponents of centralisation believe that quality can best be controlled centrally.
 - However, manufacturers who operate centralised maintenance facilities usually use outside vendors (i.e., test houses, OEMs, and distributors) heavily, merely acting as clearing houses to subcontract repairs.
- A related issue is desirability of being an independent remote repair location versus a part of an interconnected repair network.
 - European repair centres are generally independent units, rather than a mode of a repair network, to avoid dependence on parts from location in a foreign country.
 - North American repair centres tend to be network-oriented for inventory sharing to avoid multiple parts inventory, inventory control, and management overhead.
- The final issue is the degree to which repair centres adopt productivity standards.
 - Few centres have adequate standards today, reflecting the infancy of this concept.

- The issue to be resolved is the extent to which standardisation can be reasonably imposed, without creating the administrative bottlenecks which necessitated the repair centre concept in the first place.
- The trends are clear and the need for repair centres established, based on the advantages inherent in the concept and the resolution of major issues that can be achieved.

6. THE OUTLOOK FOR REPAIR CENTRES

- Repair centres will continue to increase in size and absolute numbers as more manufacturers embrace the concept.
- This growth reflects the inherent advantages to remote repair centres.
 - They provide real opportunities for cost control and savings through reduction of spare parts float, labour content, and shipping costs.
 - Proximity to customer sites increases maintenance response and reduces turnaround time.
 - Repair centres off-load work from the manufacturing site whose primary function is not maintenance or repair.
 - Finally, repair centres provide the opportunity to delegate greater management responsibility and accountability.
- However, no single set of repair strategy plus organisational structure was found to be common (and no set of strategy plus organisation structure seemed superior to any other).
 - Respondents clearly structured their operations as best fit their needs, and those needs vary considerably.

EXHIBIT II-3

QUOTATIONS FROM REPAIR CENTRE MANAGERS

- 'Our plan is to put a repair centre in each sales office which is located in major cities.'
- 'A broken board is an unusable asset.'
- 'It takes at least three people to open a repair centre.'
- 'The repair centre performs maintenance which previously was done on-site by field engineers.'
- 'Our field repair centres have brought about a reincarnation of diagnostics and solutions from field engineers who used to pack up the bad part, ship it to central repair, and forget about it. Every branch now has the ability to do 90% testing.'
- 'By the turn of the century, there will be no more maintenance organisations. The cost to send a field engineer out now is 100 pounds. Service then will be from computer "garages".'
- 'Costs of repairs are increasing. Hardware costs are decreasing but with more sophisticated products. Therefore we need cleverer and better field engineers to do the job.'

- INPUT sees this as a continuing trend and supports this with the relevant survey data, as shown in Exhibit II-3.
- Certain common trends, however, form the basis for establishment of repair centres regardless of company:
 - Autonomy is universally sought.
 - Customer satisfaction, in service and cost, is paramount in the decision to implement repair centres.
 - Cost improvements and labor efficiency are common corporate goals in the current economic environment.
- Finally, planning has been sporadic and, if this continues as a trend, will slow the successful implementation of repair centres.

B. RECOMMENDATIONS

- Manufacturers should continue to expand and improve repair centre operations but only with more formal, structured planning for results which can be easily measured.
 - INPUT recommends adoption of a planning philosophy using the planning parameters defined in Exhibit II-4.
 - Planning must start with stated objectives and include details on productivity, quality, systems and procedures, financial considerations, and organisation.

EXHIBIT II-4

SUGGESTED PLANNING PARAMETERS FOR REPAIR CENTRES

<u>PLANNING PARAMETER</u>	<u>MEASURE</u>
1. Primary Objectives	
A. Customer Satisfaction	- Survey
B. Field Support	- Survey
2. Productivity	
A. Turnaround Time	- Elapsed Time Per Unit
B. Repair Standards	- Diagnostic, Repair and Test Time Per Unit (Excluding Modifications)
C. Optimise Parts Pipeline	- Inventory System
3. Quality	- Repeat Calls, No-Trouble-Found, DOA's
4. Systems and Procedures	- Minimal Manual or Automated Tracking System
5. Financial	
A. Capital Equipment	- Planning Based on Productivity and Needs
B. Expenses	- Tracking System
C. Revenue	- Tracking System
6. Organisational	
A. Autonomy	- Degree of Dependence
B. Centralised versus Decentralised Repair	- Company Objectives, Costs

- Repair centres should be considered as profit centres:
 - The "product line" should be increased to include the following:
 - Product upgrades.
 - Supplies and accessories.
 - Spare parts.
 - Site preparation.
 - Disaster recovery.
 - Software maintenance.
 - Carry-in repair.
 - The repair centre's proximity to the customer enhances its sales potential.
- Repair centres should increase their technical resources and capabilities to accommodate the rapidly growing microcomputer as a source of additional revenue:
 - Direct customer-to-repair centre relationships present opportunities for sales of spare parts and other services.
 - In addition, third-party maintenance of microprocessors represents a significant business opportunity.
- Repair centres should market special test procedures and equipment, which they have developed, to other firms requiring similar testing capabilities.

- INPUT recommends viewing repair centres as focal points for field service job enrichment and skill transference:
 - With better test equipment available at reasonable costs, diagnostics and problem solving can revitalise a technically motivated field engineer.
 - Less experienced or junior field engineers can then function as board swappers, while learning the skills of the more experienced engineers operating at the same location.

- INPUT recommends that repair centres emphasise standardisation of repair procedures to achieve greater cost savings and reduce turnaround time.
 - Work standards, such as units repaired per period, represent a basis to measure performance and make productivity improvements.
 - Measurement systems must be implemented to accomplish this recommendation successfully.

III EVOLUTION OF REPAIR CENTRES

III EVOLUTION OF REPAIR CENTRES

A. SPARE PARTS PIPELINE

- The flow of spare parts, from source to consumer, and from new inventory to inprocess repairs, has traditionally been referred to as the "spare parts pipeline."
 - Exhibits III-1 and III-2 graphically portray this pipeline in simplified form and focus on the section of the pipeline which involves repair centres - an important element.
 - The pipeline specifically includes the following:
 - Field service spare parts inventories which are stocked in various quantities at various locations from factory or central depots to field engineers' cars.
 - Float is the quantity (and value) of parts enroute to and from the field (customer sites) and repair facilities.
- Another link in the pipeline is the factory. Spare parts are initially provisioned from the manufacturing organisation. In organisations not employing the spares centre concept, failed parts return to the factory.
- Flow is continuous from factory to service inventories when inventories plus repair-in-process fall short of meeting the demand in the field.

EXHIBIT III-1

SPARE PARTS PIPELINE PRIOR TO REPAIR CENTRES

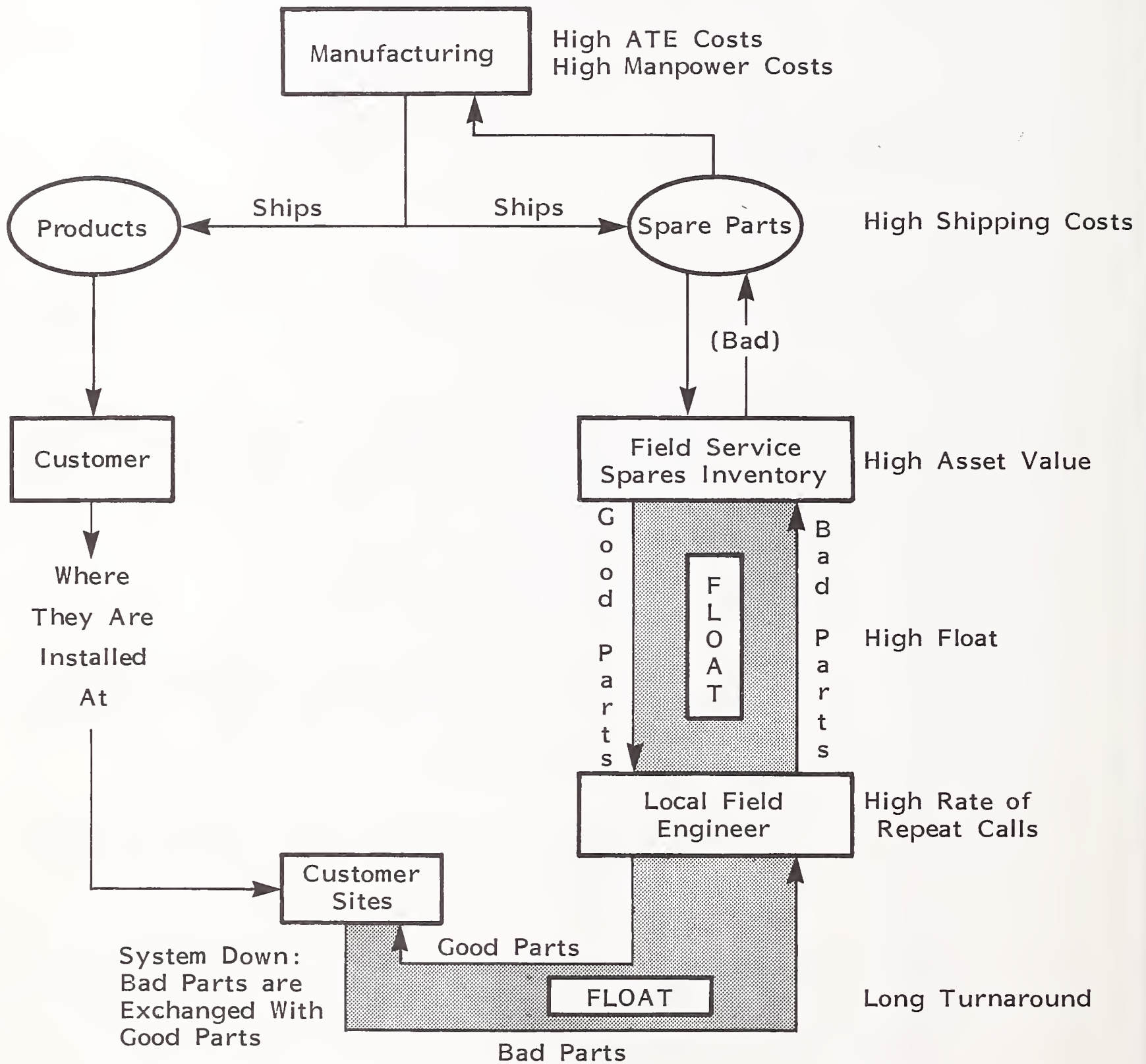
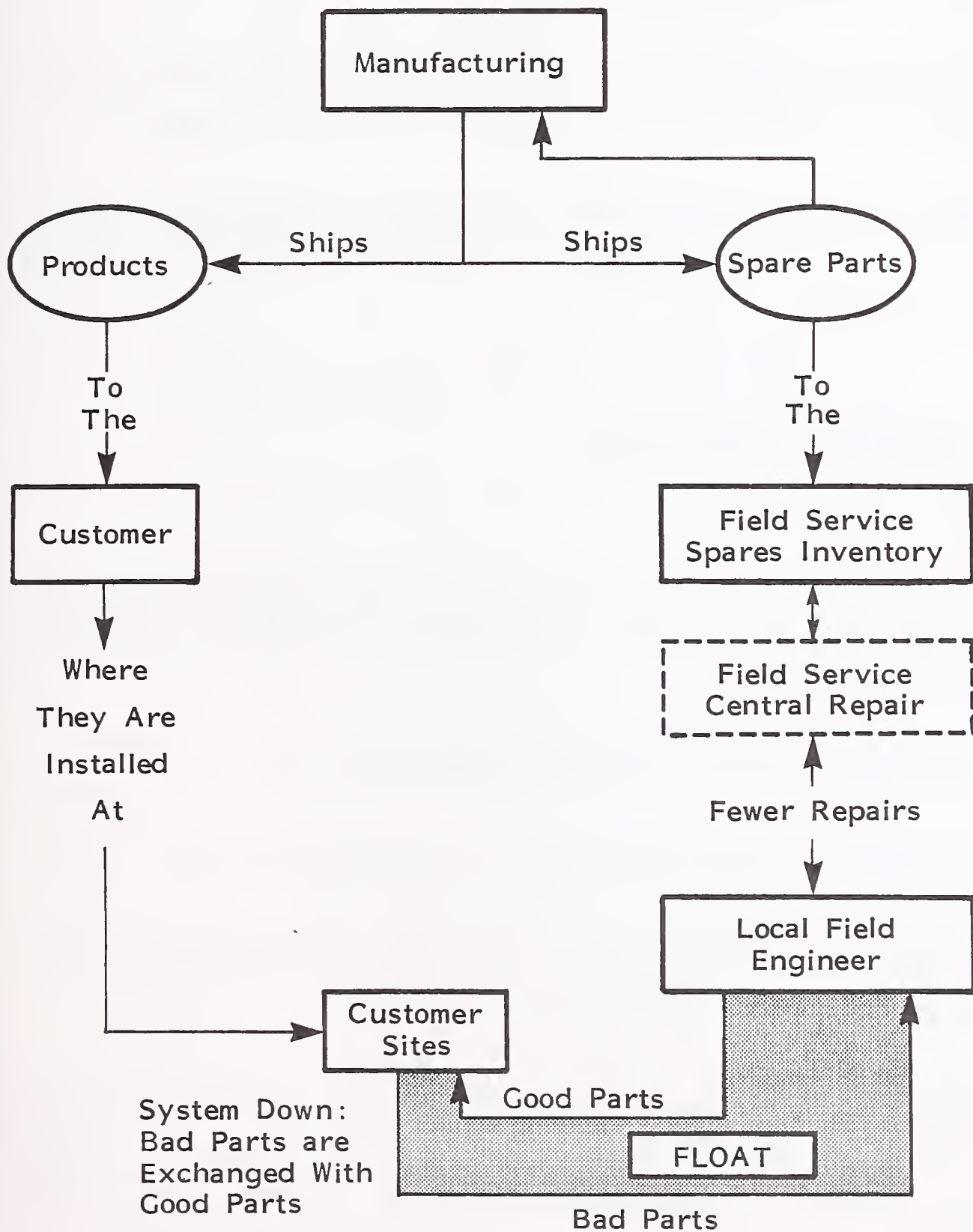


EXHIBIT III-2

SPARE PARTS PIPELINE UTILISING REPAIR CENTRES



Repair Centres Create Less Dependence on the Factory for Repairs and Consequently:

- Reduce Manpower Costs, Repeat Calls, Turnaround Time, and Float.
- Optimises ATE Costs, Parts as Set Value.

- The trigger precipitating the flow in the spares pipeline is a failure of a component or system at the customer's site.
 - The asset value of spare parts in the pipeline represents a huge investment for most companies.
 - Depreciation of spares, organisations to manage and control spares, and repairs can represent as much as 50% of a field service budget.
- The repair function has a significant impact on this asset value and field service budget. The repair operation can regulate control of the velocity and mass of the pipeline.

B. FORCES IMPACTING THE PIPELINE

- A few years ago, when systems were not as complex as they are now, sub-assembly repairs were frequently accomplished on-site, through component replacement. Not so today:
 - Technical complexity has increased significantly.
 - Customers have become less tolerant of extended down time.
- Therefore, field service organisations have replaced component level repair strategies with the now common board swap procedure.
 - First experiences in cycling failed printed circuit boards back through the factory, manufacturing and testing, and shipping and receiving, frustrated service engineers and customers because of the longer delays.

- Repairs were "batched" into the production stream, and waited their turn despite urgent calls from the field.
- Aside from the work priority issue, most factories viewed board repair as a deterrent to selling brand new boards as spares, where the profit is more attractive (and where no repair is required). This situation has resulted in pricing policies where board repairs and/or exchanges may cost the customer nearly half the cost of a brand new board.

C. PRESSURES SPAWNED INCREASED REPAIR CENTRE ACTIVITY

- Increased pressures from both the user and vendor communities created a need for a new resource, the field service repair centre.
 - Users needed a quicker way to get their systems operational again.
 - Vendor field service groups required a greater velocity in the spares pipeline. The nearer customer sites were to spares, the better.
 - Separating repair functions from parts replacement (on the user side) and manufacture (on the vendor side) was desirable.
- Vendors gradually accepted this and began to authorise repair centres managed and controlled, almost autonomously, by field service. Factory support was nevertheless still required in some situations.
- This major change, encouraged by vendors' technological change and users' demand for higher up time, caused vendors to commit to and implement repair capabilities within field service.
 - The decisions were neither easy nor inexpensive (and, for a small proportion of vendors, still not made).

- . The upfront investments in test equipment and test programs were substantial.
- . The recurring expenditures of keeping pace with technology and expanding repair centres were and are significant.
- The current economic evaluation of repair facilities operated by field service, either as multiple networked facilities or as centralised resources, have justified the growth of repair centre activity. Section VI, including costs benefits, verifies this.

IV GUIDELINES FOR ESTABLISHING
REPAIR CENTRES

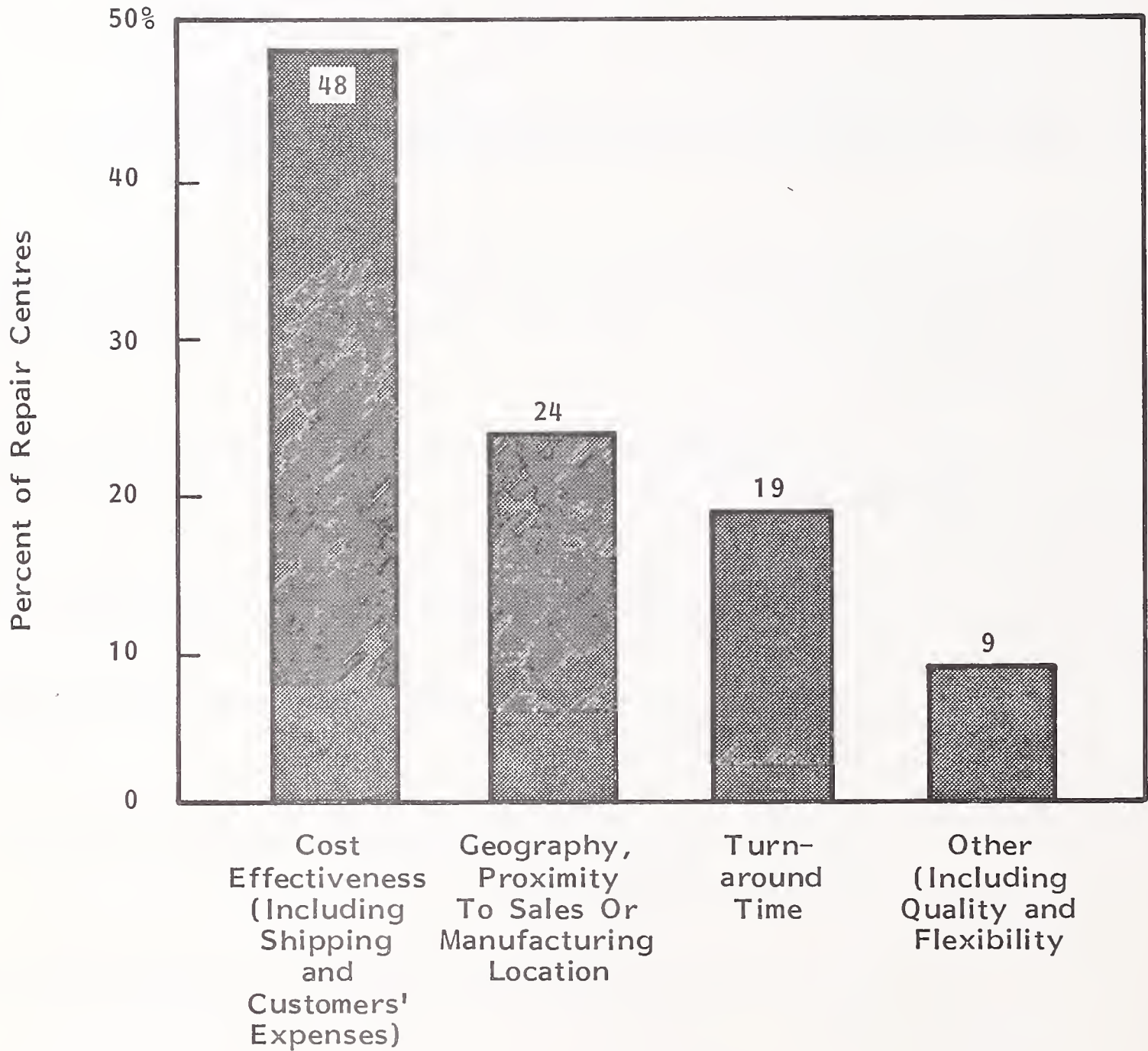
IV GUIDELINES FOR ESTABLISHING REPAIR CENTRES

A. FACTORS MOTIVATING THE ESTABLISHMENT OF REPAIR CENTRES

- Repair centres are established because of a variety of influences. These are summarised in Exhibit IV-1. They include economic, geographic, and customer satisfaction factors.
 - Forty-eight percent of repair centres are established to improve cost effectiveness.
 - Decreasing float, as described in Chapter III, is significant.
 - Avoiding or reducing duty- and customs-generated costs and delays is important.
 - Optimising resources by incorporating field engineer repairs helps increase productivity.
 - Twenty-four percent of repair centres originate for purposes relative to geography.
 - They reduce the average distance between customer site and needed part.

EXHIBIT IV-1

GUIDELINES FOR SETTING UP REPAIR CENTRES



Factors Motivating Establishing Repair Centres

- Many repair centres coexist with sales and service offices (where the repair centre is a small office or converted storage room).
 - Other repair operations originate near skills and resources, such as manufacturing locations and sources of technical talent.
- Turnaround time improvement motivates 19% of repair centre origins, according to INPUT's study.
- Miscellaneous reasons, including a drive for better quality repairs and more flexibility, also account for initiating repair centres.
- It is clear that no neat set of mathematical or statistical algorithms exists for establishing repair centres. Because of the quickly changing environment of repair activity, trial and error methods are employed in many instances.

B. REPAIR CENTRE NETWORKS

- The number of repair centres in Europe varies proportionately to the marketing and service functions of each company.
 - Some firms have as many as 20 in Europe and as many as 10 in one country.
 - When more than one country is involved these repair centres are typically not interconnected by network operations.
 - Duty and customs considerations require individual, independent repair centres within each country.

- Repair centres within the same country are usually tied to each other, for improved parts and labour usage.
- Location of these repair facilities is largely a function of where each firm's products are sold.
 - Primarily, repair centres are established in each country where products are marketed for the reasons cited above.
- However, one large computer vendor has opted to centralise all repair activity into one area near Brussels. This central facility actually does very little physical repair work, but acts as a repair centre clearing house for subcontracting repairs to various test houses, OEMs, and suppliers.
- Exhibit IV-2 shows that slightly more than half of the respondent vendors interconnect their repair centres, and the other half operate their repair centres as separate entities.
- Repair centres are logically linked in a number of ways.
 - Repair centres in countries without autonomous repair capability are commonly linked.
 - If a finished (repaired) part is needed in one country to fill the pipeline, but is temporarily unavailable, another repair facility in a different country will fill the order.
 - Other repair centres are logically linked by product line. One area, responsible for small systems, shares repair skills and parts (where possible) with a repair centre supporting large systems.
- Specific repair centre locations as represented by respondents to this survey are noted in Exhibit IV-3.

EXHIBIT IV-2

REPAIR CENTRES: NETWORKS OR SEPARATE ENTITIES?

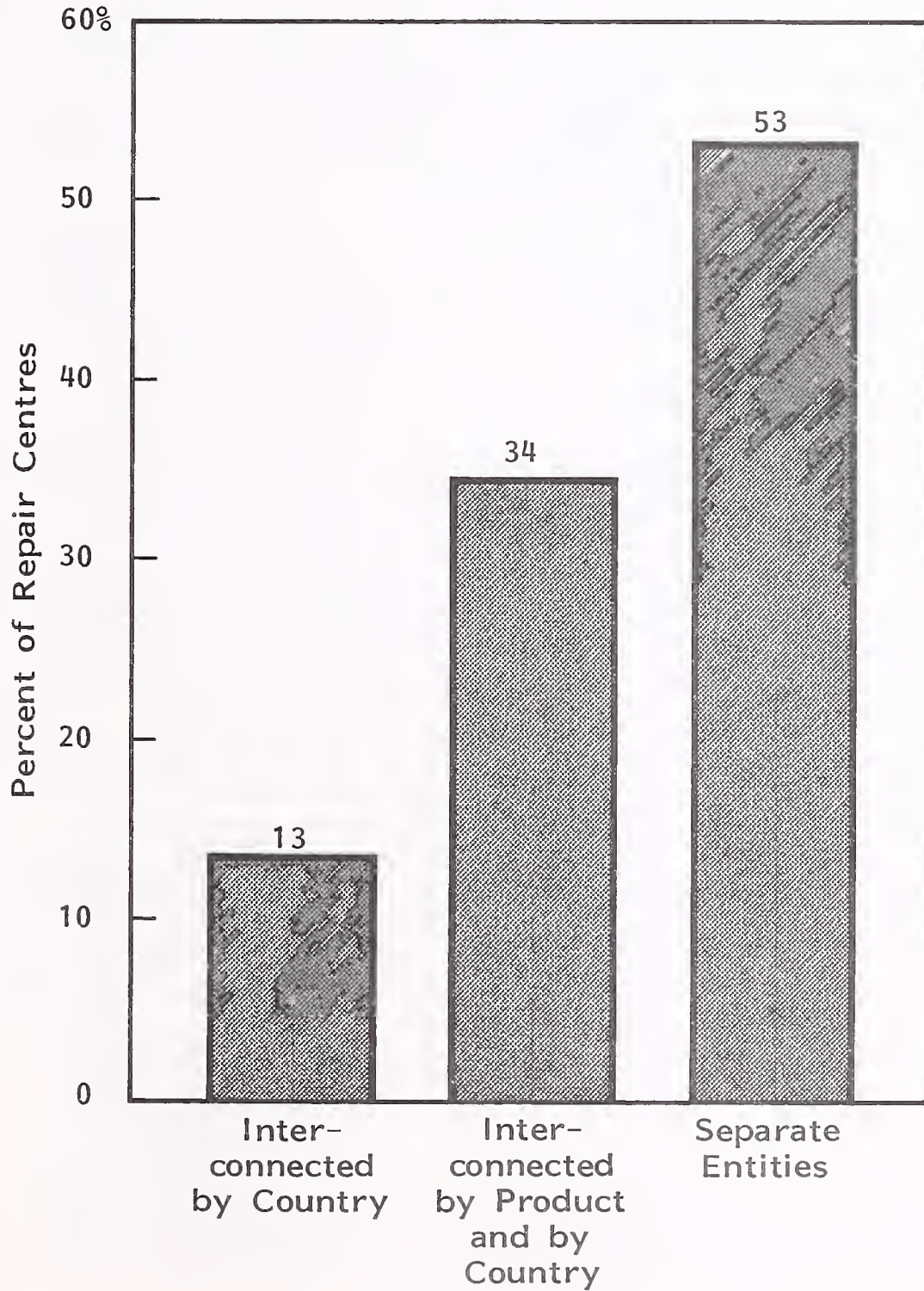


EXHIBIT IV-3

REPAIR CENTRE LOCATIONS

EUROPE		UNITED KINGDOM ONLY
Countries	Cities	Cities
Germany	Frankfurt, Dusseldorf	Aberdeen
Ireland	Dublin	Birmingham
Holland	Amsterdam	Blackpool
France	Paris	Bristol
Belgium	Brussels	Crawley
Spain	Madrid	Edinburgh
Sweden	Stockholm	Glasgow
		Hemel Hempstead
		Hounslow
		Kingston
		Leeds
		Letchworth
		London
		Manchester
		Slough
		Staffordshire
		Stevenage
		Swindon
		Whitburn
		Withenshaw

- Physical sizes of typical repair centres range from 250 square feet to 6,000 square feet, as shown in Exhibit IV-4. The average size is 2,500 square feet.
- This space is adequate for approximately 10 technicians, benches, test equipment, and inventory stocking.
 - A typical field repair centre may accommodate ten separate work stations, but these are not continuously manned by dedicated repairmen.
 - These "stations" are often the extent of the field engineer's desk and working space, occupied only when service technicians are not on-site making customer calls.
- All but one respondent indicated that their repair centres shared building space with other departments (usually sales).
- The exception repair centre was reported to be in a separate building.
- Exhibit IV-5 summarises the relationships of colocated repair centres.
- Repair centres which are colocated with sales offices may occupy more expensive floor space than is required. Currently, however, this apparent expense is rationalised by the continuity:
 - The sales offices offer a single customer contact point. Communications are improved.
 - Sales offices provide management for both sales and repair centre activities.
- One firm is including a repair centre facility in each new lease it considers.

EXHIBIT IV-4

PHYSICAL SIZES OF TYPICAL REPAIR CENTRES
(square feet)

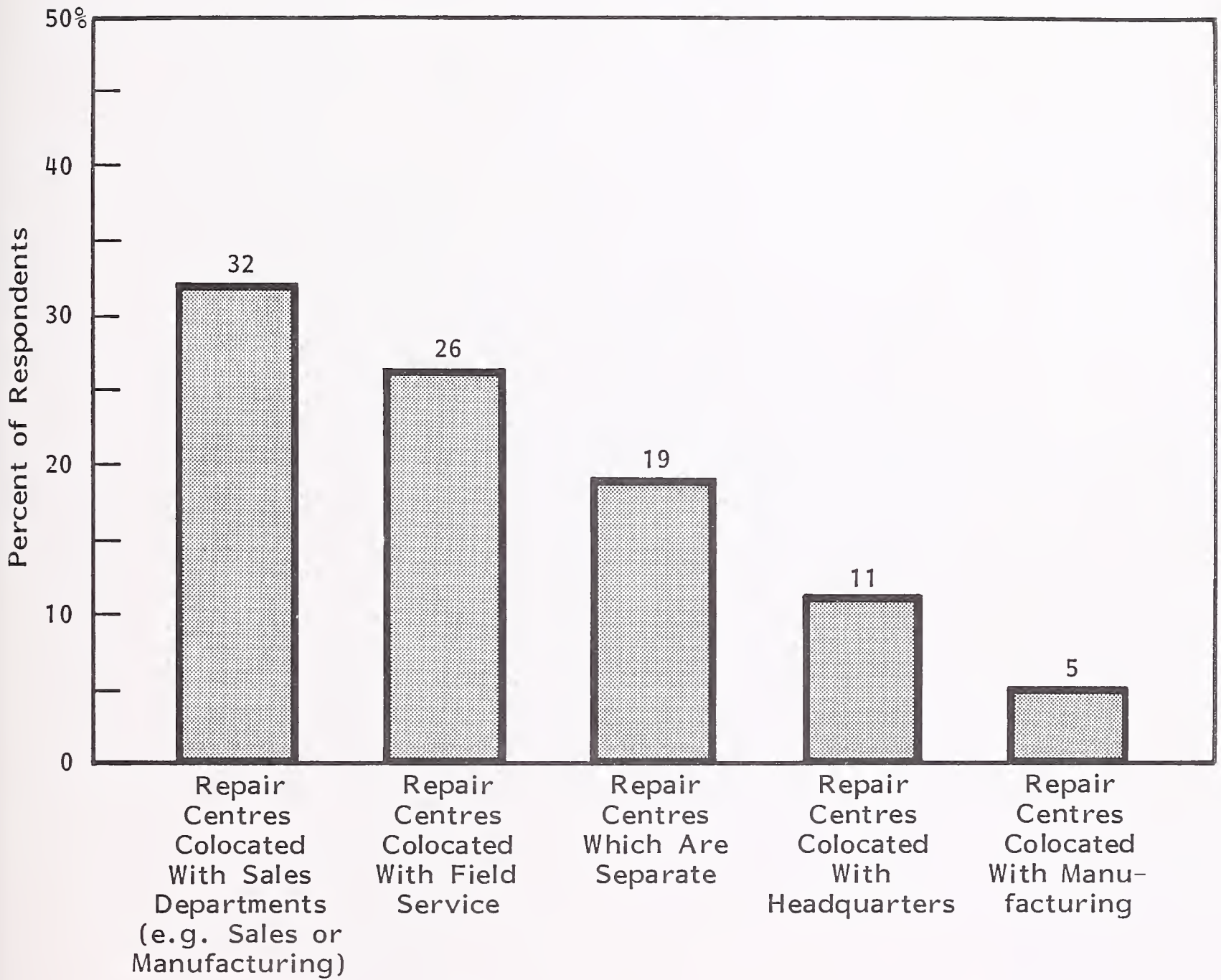
Range: 250 Square Feet to 6,000 Square Feet

Mean: 2,500 Square Feet

Median: 2,200 Square Feet

EXHIBIT IV-5

COLOCATED REPAIR CENTRES



V REPAIR CENTRE FUNCTIONS

V REPAIR CENTRE FUNCTIONS

A. RANGE OF REPAIR WORK

I. LEVELS OF EQUIPMENT REPAIRS

- Repairs are accomplished at two levels.
 - Major assembly work is performed more often at the central repair depots with access to a wider range of spare parts and specialised technical talent.
 - Board level repairs are done in remote repair centres.
 - The remote repair centres usually repair boards by diagnosing a bad chip or PROM on the card and replacing it without soldering or further testing.
 - Board level repairs that require more sophisticated diagnosis, hard wiring, or special testing are usually sent from the field to the regional or central repair facilities.
- All repair centres indicate a general capability for repairs at the major assembly and board levels.

- Some equipment cannot be repaired in the normal field and central repair depot facilities, but most companies have a comprehensive "fix" capability, as summarised in Exhibit V-1.
 - The most common items that are not repaired at the repair centre were sealed disk assemblies, which require a clean room and sophisticated testing devices. These repairs are frequently subcontracted to the original equipment manufacturer.
 - Another common category of equipment not handled by repair centres is low-volume equipment, where activity levels do not warrant developing the necessary repair skills at the repair centre. Engineering and/or manufacturing functions normally handle this type of repair.
 - Several vendors indicated that they could not take on "sophisticated" repairs but declined to define what sophisticated repairs meant.
 - A small amount of repair work is subcontracted to other resources when in-house resources are strained by a large repair backlog.
 - Most repairs of equipment installed with, but not sold by, the vendor are subcontracted to specialists. This means that a vendor who may resell another vendor's peripheral, for example, in his product line, will frequently subcontract the service of that device to the original manufacturer.
 - Most firms send the repair work back to the source of the product, either by:
 - Subcontract, through internally arranged procedures
 - Shipping the bad unit or component back to the manufacturer, as a user would do.

EXHIBIT V-1

EQUIPMENT WHICH REPAIR CENTRES
DO NOT HANDLE

EQUIPMENT TYPES	REASONS FOR NOT REPAIRING	DISPOSITION
Sealed Disks	Lack of Clean Room Facility and ATE	OEM Subcontract
Other Vendors' Devices	No Technical Skills	OEM Subcontract
Low-Volume Items	No Technical Skills	Factory Repair
Items Previously Repaired (2-3 Times)	Cost Effectiveness	Scrap
Obsolete Equipment	No Technical Skills	New Product Alternatives

- Twenty percent of the respondents indicated that their company's policy regarding irreparable items is to scrap them. (This obviously depends on the value of the item.)
 - Usually, the criterion for scrapping an item is two or three previously logged repairs on the unit or piece in question, but for high value items (or scarce items) repairs can continue far beyond that point.
 - One firm indicated that irreparable parts are scrapped to keep used or "junk" parts out of a rather active secondhand market.
 - Another company uses the irreparability of products as a source of new product alternatives; i.e., a genuine sales opportunity for new hardware systems.

2. INTERNAL AND EXTERNAL OPERATIONS

- Internal operations refer to repair activity which is confined to transactions within the company manufacturing and servicing the product. Repair work is done in-house for field service organisations who, in turn, relate directly to customers.
- External operations include repair activities directly related to customers, without involving an internal field service operation. An example of an external operation is a customer who, having an inoperative unit, contacts the repair centre directly without reference to the manufacturer's field service organisation, and deals with the repair resource directly.
- The majority of respondents indicated that repair activities included both internal and external activities.

- Less than one half of the respondents indicated that their repair operations were limited to internal or in-house functions only.
- Perceptions of external, or direct customer-to-repair centre business are reflected in the following responses:
 - "We do third-party work."
 - "Our firm provides walk-in and mail-in services."
 - "We accept repairs at fixed prices."
 - "Our activity includes selling spares, exchanging parts, or repairing equipment."
 - "We provide backup support for field engineers as well as some acceptance testing and modification work."
 - "A repair hotline is provided and a range of remedial services through and including major refurbishment."
- Overall, it appears that firms intend their repair centre activity to be internal. Generally, opening up a direct relationship between a local repair centre and a customer, while almost a necessity in personal computers, seems to be a difficult step for many medium and large system respondents.
 - Only one of eight companies currently offers walk-in repair service, where customers may bring inoperative units or components to a repair centre for diagnosis and remedy.
 - One firm provides a general third-party repair operation at its repair centre: Maintenance service is provided for equipment not in the company's product line, but for which a repairman or group of repairmen are trained.

- Another company has a repair centre "hotline" for customers to receive estimates of cost and availability (lead time) of particular repair work.
- One repair centre application noted is to generate modifications to existing products, as well as to function as a local acceptance test bed.
- External repair work can be related to product and population density and geography. That is, while repair centres in denser areas were used conservatively as internal resources, repair resources in more remote areas are used as a combination of internal and external functions.

3. WARRANTY WORK

- Two-thirds of the respondents indicated that they include warranty work in normal repair operations.
- Several firms qualified the type of warranty effort made at the repair centre level:
 - One firm indicated that its repair centres handled only "dead on arrival" machines or parts.
 - Another firm restricted its warranty repair to micro-based computers.
 - Another respondent said that its repair centres in Europe handled warranty repair while its repair centre in the U.K. did not. The main factory for this firm, in the U.K., handles the warranty requirement.
- One company excludes warranty work. It relies on the originating manufacturing facility (in the U.S.) to perform warranty work.

- This strategy is questionable because it strains both the customer and the local field service function.
 - The customer is stretched because he may have to wait unreasonably long to get his system in operation.
 - The field service organisation is taxed because a high level of spare parts is required to service warranty claims.
- INPUT detected, in this question, a somewhat casual attitude concerning warranty repair.
 - Basically, a repair centre will attempt to maximise its resource without differentiating between a nonwarranty and a warranty repair.
 - These repair centres generally adopt the attitude of "fix the problem" first and "worry about the contract" later. This is not a good business attitude.
 - Their business is service, and when there is any doubt whether the product is in warranty, it usually will be assumed that the warranty is in effect, often without reference to contracts.

4. MODIFICATIONS

- Modifications performed at repair centres include field change orders (FCOs) and engineering change orders (ECOs).
 - An ECO represents a range of changes to a product.
 - Changing a supplier of a specified part will result in an ECO.

- Remedial engineering, to correct a product deficiency, will require an ECO.
 - A product enhancement will often be initiated by an ECO.
- An FCO usually follows an ECO.
 - FCOs are usually considered only when the change is a functional one or when safety or non-performance are involved.
 - Not all FCOs reflect concomitant ECOs.
- Ninety-three percent of respondents to INPUT's questionnaire install modifications, FCOs, to units and assemblies received for repair.
- Unless safety or major product enhancements are involved, it has always been difficult for the field engineering function to properly address the problem of changes.
 - One obvious force is the "let sleeping dogs lie" philosophy which poses the question of disrupting a smoothly running system at the risk of installing an ECO.
 - Even if the manufacturer's engineering or field engineering experts ordered the ECO, it may cause hiccoughs in operations.
 - This dilemma is often avoided on-site in the field, where reluctance to install changes is common.
 - Repair centres are burdened (often extremely) with updating components or assemblies.

- A part requiring numerous modifications may have a simple problem creating more to implement the modifications than to fix the functional error.
- Field service organisations are always at the mercy of engineering departments who can usually prove, on paper, that all revisions are downward compatible.
- Repair centres, recognising that modifications are essential, make a concerted effort to use the repair cycle as a time to update the system.

5. EXCHANGE PROGRAMMES

- An exchange programme, as used in this survey, is the exchange of a bad unit or board for a good one. The bad unit or card is repaired in a repair centre.
- One hundred percent of the respondents indicated that various exchange programmes are in effect at their repair centres.
- Board swapping, a common contemporary field service strategy, is essential for both the customer and the service provider.
 - Board swapping minimises the down time for customers. Bad boards, once they are diagnosed as such, are replaced immediately.
 - The process of exchanging boards also helps the maintenance vendor.
 - It removes real time pressures of repair from the site to the appropriate repair centre.
 - It allows for technical specialisation. Whereas field technicians may not be able to repair all units, the repair centres usually have the required expertise.

- This allows for more efficient scheduling of field technicians.
- There are various constraints or qualifications to exchange programmes.
 - One respondent, bucking the trend towards board swapping, only allows an exchange if the unit or system at the site is unsuccessfully diagnosed and repaired in eight hours. This conservative approach must keep the firm's field technicians on their toes as customers today do not tolerate eight hour down time.
 - Others incorporate exchanges only when quick response times are required.
 - These ranged from two hours, with one firm, to four hours with another.
 - A "loaner" policy may be included in exchange programmes. A good unit is used in place of the defective unit only while the defective unit is being fixed. Once the defective unit is repaired, it returns to the site and system it originally belonged to, and the loaner is returned to repair centre stock.

6. SHIPPING, RECEIVING, AND TESTING

- Incoming receiving, diagnosis, final test following repair, and shipping are important functional areas for repair centres.
 - Any one or all of these functions can have a dramatic impact on the repair pipeline.
 - If not managed properly, or, if one or all of these functions are outside the direct control of field service; e.g., manufacturing or engineering, precious time may be lost in keeping the parts pipeline pumping.

- Repair centres surveyed in this study all indicated that they controlled and performed the receiving (including incoming inspection) function as well as the various test requirements and shipping.
- This is significant in that even central repair facilities have these responsibilities independent of nearby manufacturing and factory facilities. The rationale for duplicate shipping and receiving functions for both factory and service centre must be increased efficiency and, ultimately, better customer satisfaction through improved parts availability.

B. REPAIR CENTRE CONTROLS

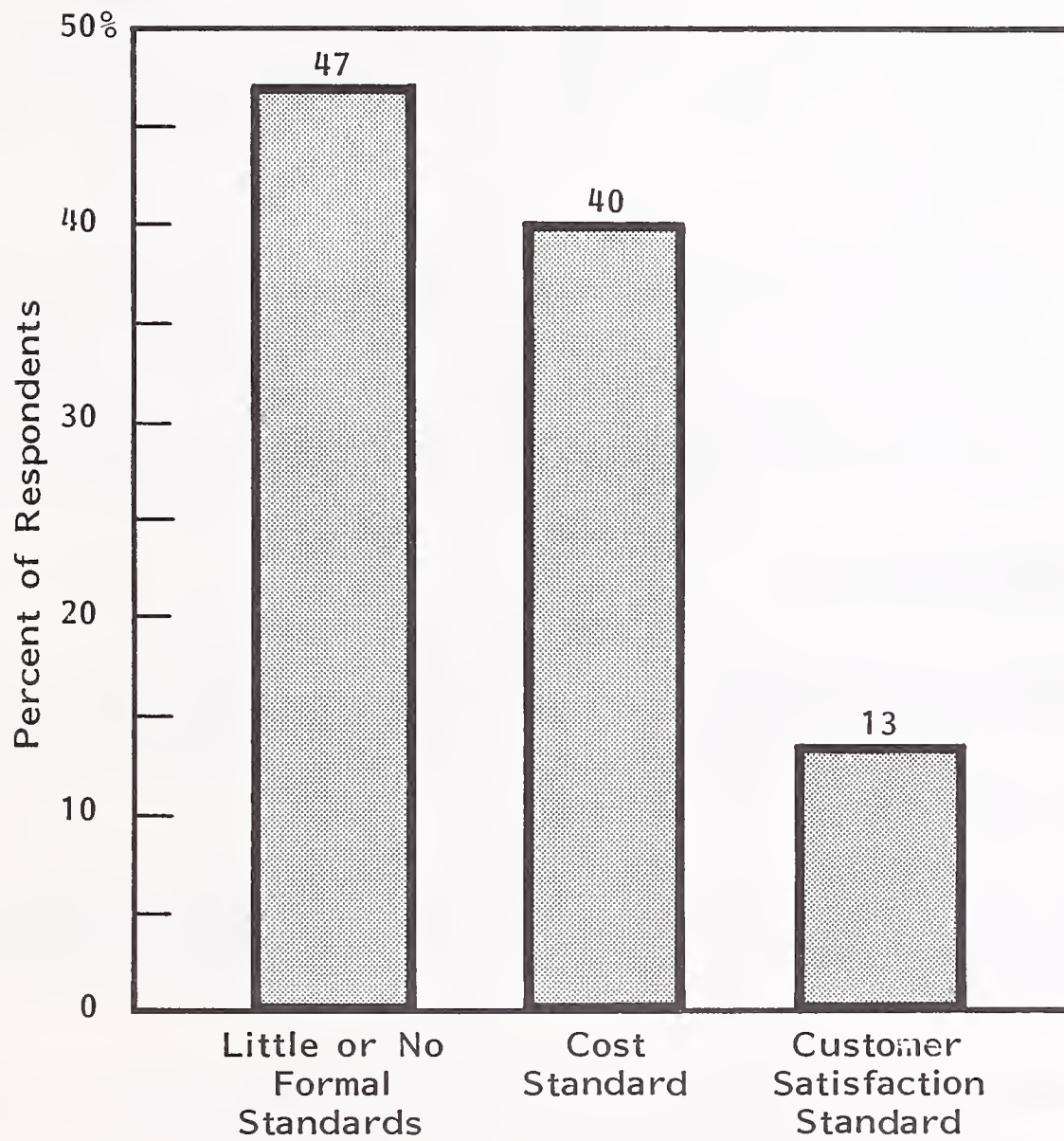
I. PRODUCTIVITY STANDARDS

- Repair centre activities combine technical and business skills within, at a minimum, two organisational jurisdictions.
 - Repair work, especially at central repair depots, is processed similarly to production line processes used by manufacturing.
 - Field service and on-site maintenance work are increasingly becoming repair centre functions.
 - Both of these functional areas incorporate fairly well-known objectives and measures for gauging and planning workloads.
 - Piece work production standards, based on time/motion studies, are common in manufacturing facilities.

- Mean-time-to-repair (MTTR) measures are familiar to every field service operation.
- It is therefore surprising that nearly half of the repair centres operate with few or no standards. Exhibit V-2 graphically demonstrates this apparent anomaly.
 - One explanation for the absence of formalised and established production controls is that many repair centres included in the survey have only been operating for short periods of time. Respondents recognise this and intend to incorporate standards after they acquire some actual operating experience.
 - Over one-third of repair centre managers said that they did not yet use productivity measures.
 - Those that do use different methods for different reasons.
 - One company measures its repair productivity by customer satisfaction, mean time between failure (MTBF), and repeat calls.
 - Another firm stated that its repair centre production goal is simply to match the manpower to the workload.
 - Others indicated that the general repair centre goal is strictly a financial one where costs are aimed at equalling revenue and credits.
 - Neither of these goals is a valid business goal: a repair centre, like any other part of the field service organisation, must make a profit.

EXHIBIT V-2

PRODUCTIVITY STANDARDS
USED BY REPAIR CENTRES



- Productivity standards in repair operations incorporate measures and controls from information received through manual and automated tracking systems.
 - These tracking systems measure labour output, costs, repair incidents, manpower utilisation and reliability of units and assemblies.
 - One major vendor sets a standard for his repair centre personnel at 80 units per month per individual. Modifications, updates, and enhancements are excluded from this target. They do not lend themselves to standards or measures because of the diverse range of modification possible.
 - Another service vendor measures repair productivity in terms of the value of repairs if subcontracted outside the company. This firm seeks to equal or better a repair goal of £20,000 per month, where the £20,000 represents the aggregate cost to subcontract the repairs.

2. TURNAROUND TIME

- Perhaps the most critical aspect of providing customer service is response time; i.e., the time it takes for a service action to be taken after a customer calls for help.
- A closely related and equally important criterion for providing service is parts turnaround time.
 - For a customer whose service contract includes spare parts and labour, parts turnaround is usually an invisible phenomenon.
 - The field engineer, on the other hand, is crucially concerned with turnaround time for repairing spare parts. He must make certain that required spare parts are reasonably available, on short notice, to fix any conceivable problem.

- The concept of initial spares provisioning and the ongoing pipeline of parts is shown graphically in Exhibits III-1 and III-2. The repair element in this is critical.
- For users who rely on spare parts from the vendor, repair turnaround times are extremely important.
 - These users typically perform all or some of their own maintenance needs.
 - The labour talent is on-site and available to diagnose and fix defects. Problems result when spare parts are not readily available.
- Spare parts turnaround time then becomes critical. This is part of the gamble a self-maintainer undertakes.
- Repair turnaround time is that period from the time the repair centre receives an inoperative unit or assembly, until the repaired or replaced unit or assembly is sent back to the originator.
- Most vendor repair centre respondents indicated that their repair relationship is predominantly an internal one, that is where their "customers" are in fact their own field service technicians.
 - Despite this, repair turnaround times ranged widely, as can be seen in Exhibit V-3.
- Respondents indicated that turnaround time for repairs is influenced by a variety of factors:
 - The type and age of the equipment.

EXHIBIT V-3

REPAIR CENTRE TURNAROUND TIMES

Range: 1 Day to 30 Days

Mean: 12 Days

Median: 7 Days

- The type of contract or emergency.
- Several firms have an internal priority system dictating the various turnaround times by system, location, and type of problem.
- Exchange policies affect turnaround time.
- This means that, notwithstanding the absolute length of the repair cycle, a new or like new part is substituted or exchanged for an inoperative one, and the bad part is returned to its appropriate repair depot for disposition.

VI ORGANISATIONAL AND ADMINISTRATIVE
CHARACTERISTICS

VI ORGANISATIONAL AND ADMINISTRATIVE CHARACTERISTICS

A. ORGANISATIONAL STRUCTURES

- Repair centre functions normally are part of the field service operation.
 - In most cases field repair depots are part of the field operations organisation.
 - Occasionally repair facilities are part of other organisations.
 - Central repair depots sometimes report into the field service organisation.
 - Less frequently, the manufacturing organisation controls a separate repair centre.
- Repair centres' organisational structures are shown in Exhibits VI-1 through VI-15.
- A standard organisational structure for repair centres is unnecessary for successful operations. Organisational structures, including repair operations, are a unique and sometimes proprietary element of a firm, reflecting its objectives, strategies, character, style, and type of business. They may also vary according to the maturity of the business.

EXHIBIT VI-1

REPAIR CENTRE ORGANISATIONAL STRUCTURE -
COMPANY A

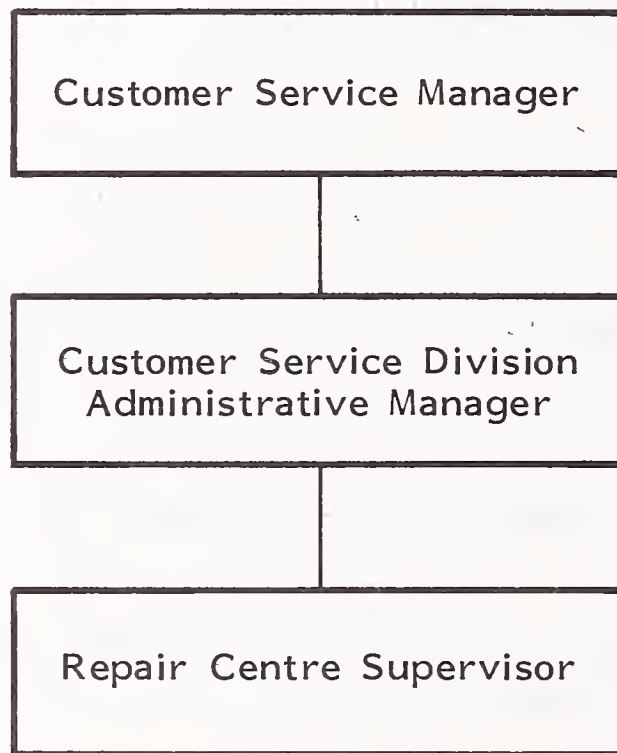


EXHIBIT VI-2

REPAIR CENTRE ORGANISATIONAL STRUCTURE -
COMPANY B

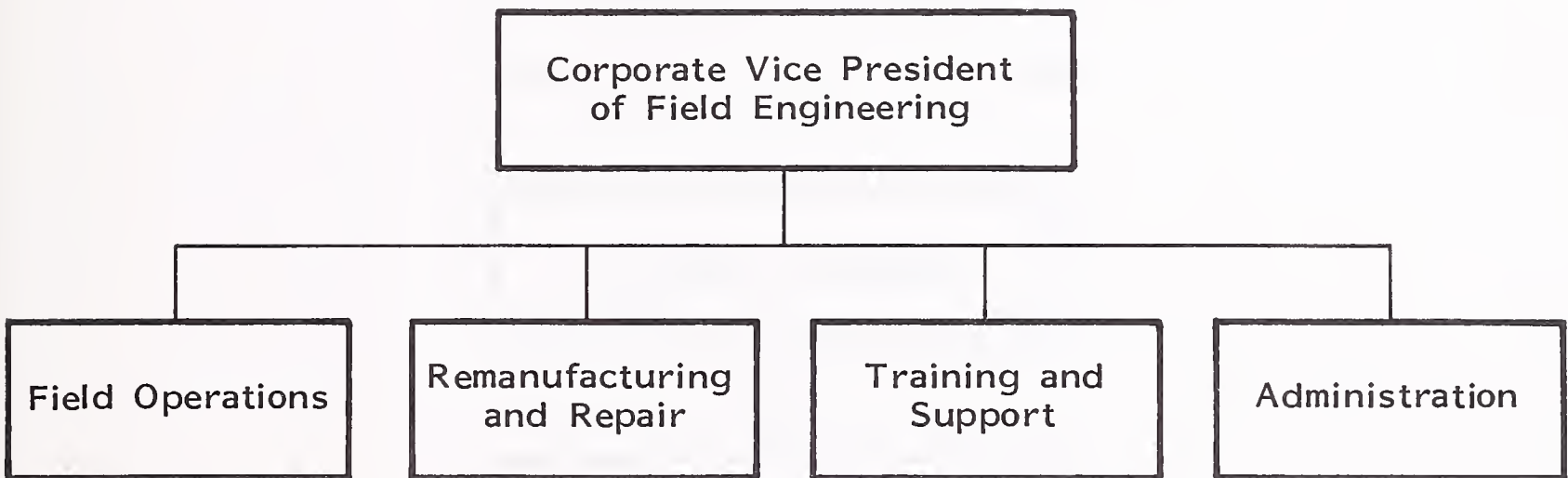


EXHIBIT VI-3

REPAIR CENTRE ORGANISATIONAL STRUCTURE -
COMPANY C



EXHIBIT VI-4

REPAIR CENTRE ORGANISATIONAL STRUCTURE -
COMPANY D

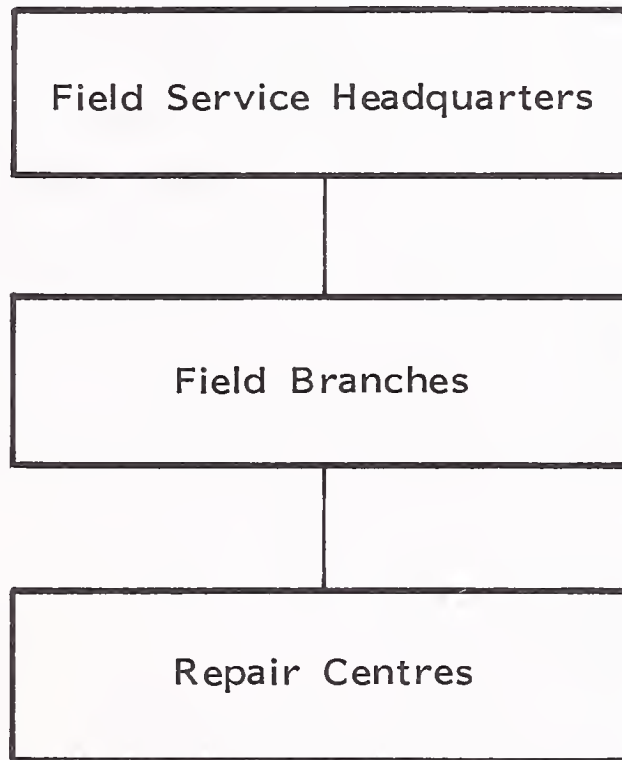


EXHIBIT VI-5

REPAIR CENTRE ORGANISATIONAL STRUCTURE -
COMPANY E

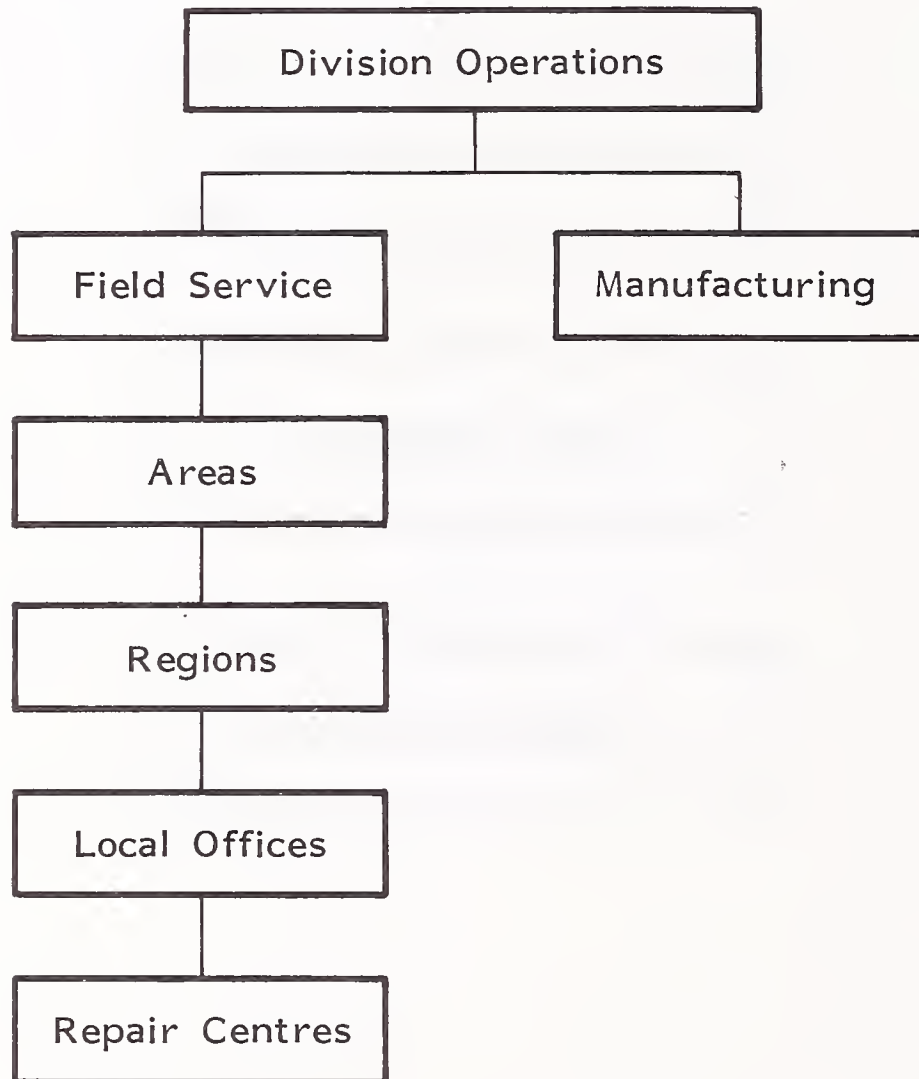


EXHIBIT VI-6

REPAIR CENTRE ORGANISATIONAL STRUCTURE -
COMPANY F

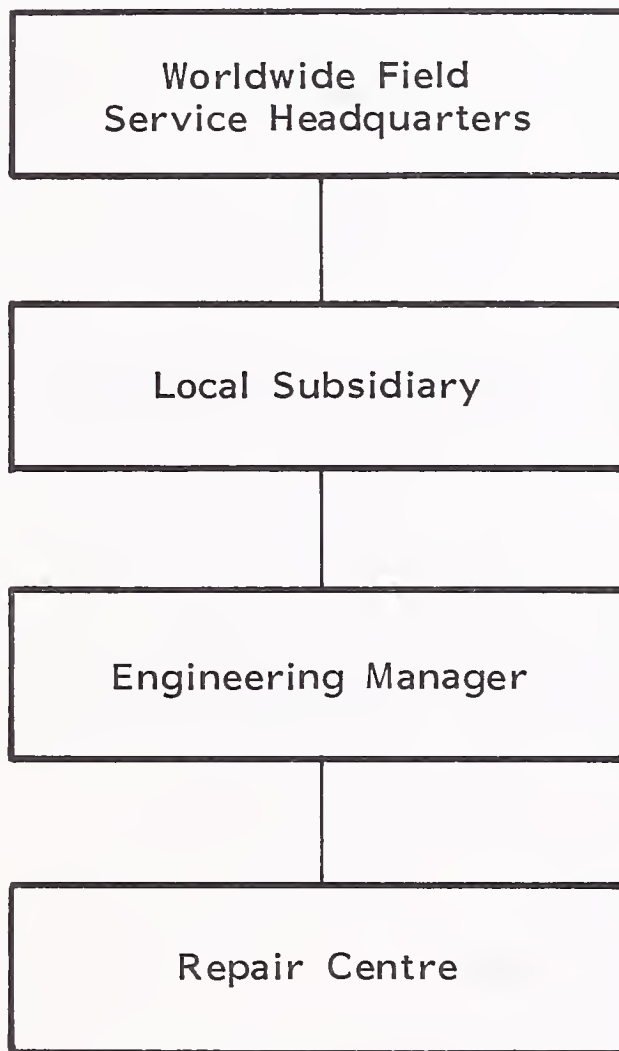


EXHIBIT VI-7

REPAIR CENTRE ORGANISATIONAL STRUCTURE -
COMPANY G

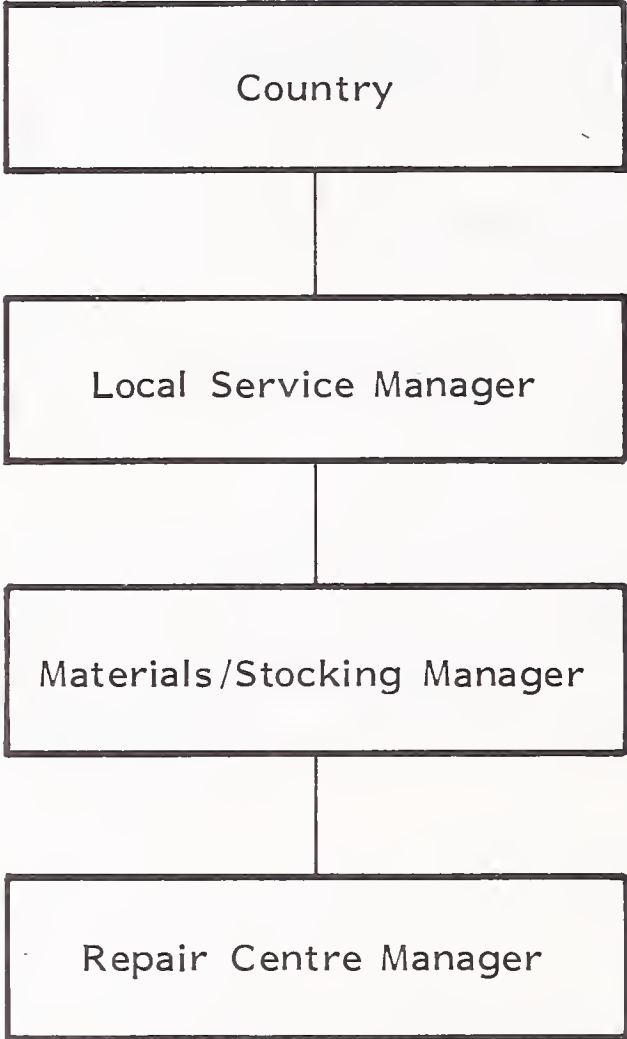


EXHIBIT VI-8

REPAIR CENTRE ORGANISATIONAL STRUCTURE -
COMPANY H

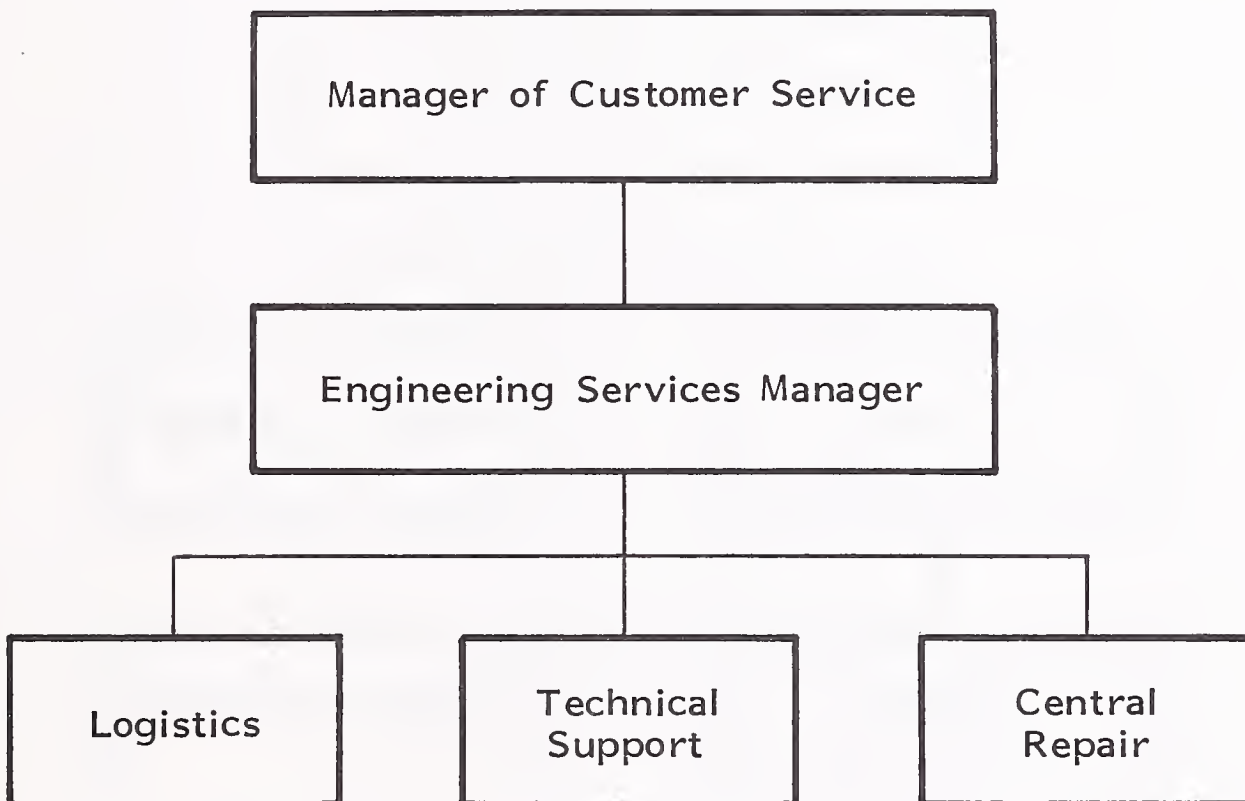


EXHIBIT VI-9

REPAIR CENTRE ORGANISATIONAL STRUCTURE -
COMPANY I

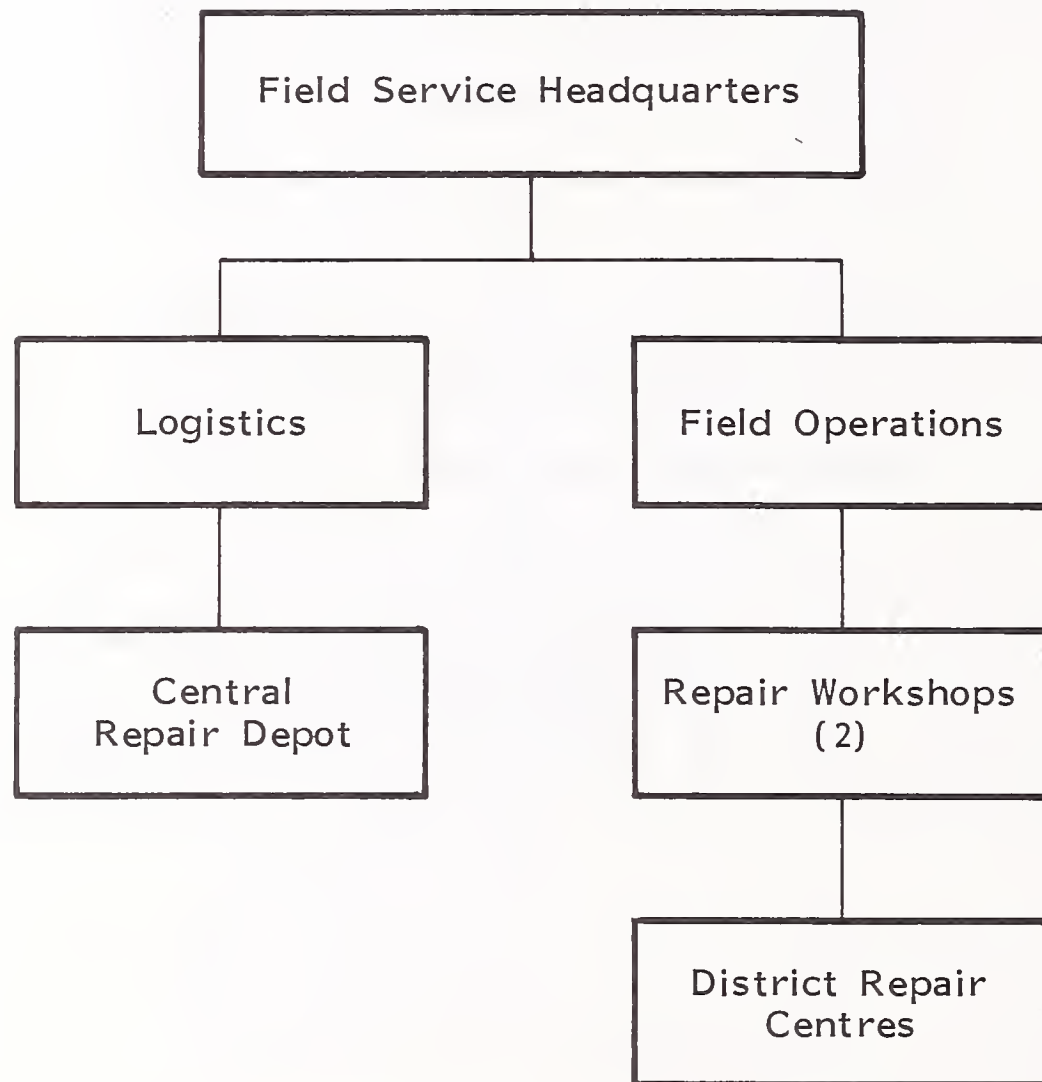


EXHIBIT VI-10

REPAIR CENTRE ORGANISATIONAL STRUCTURE -
COMPANY J

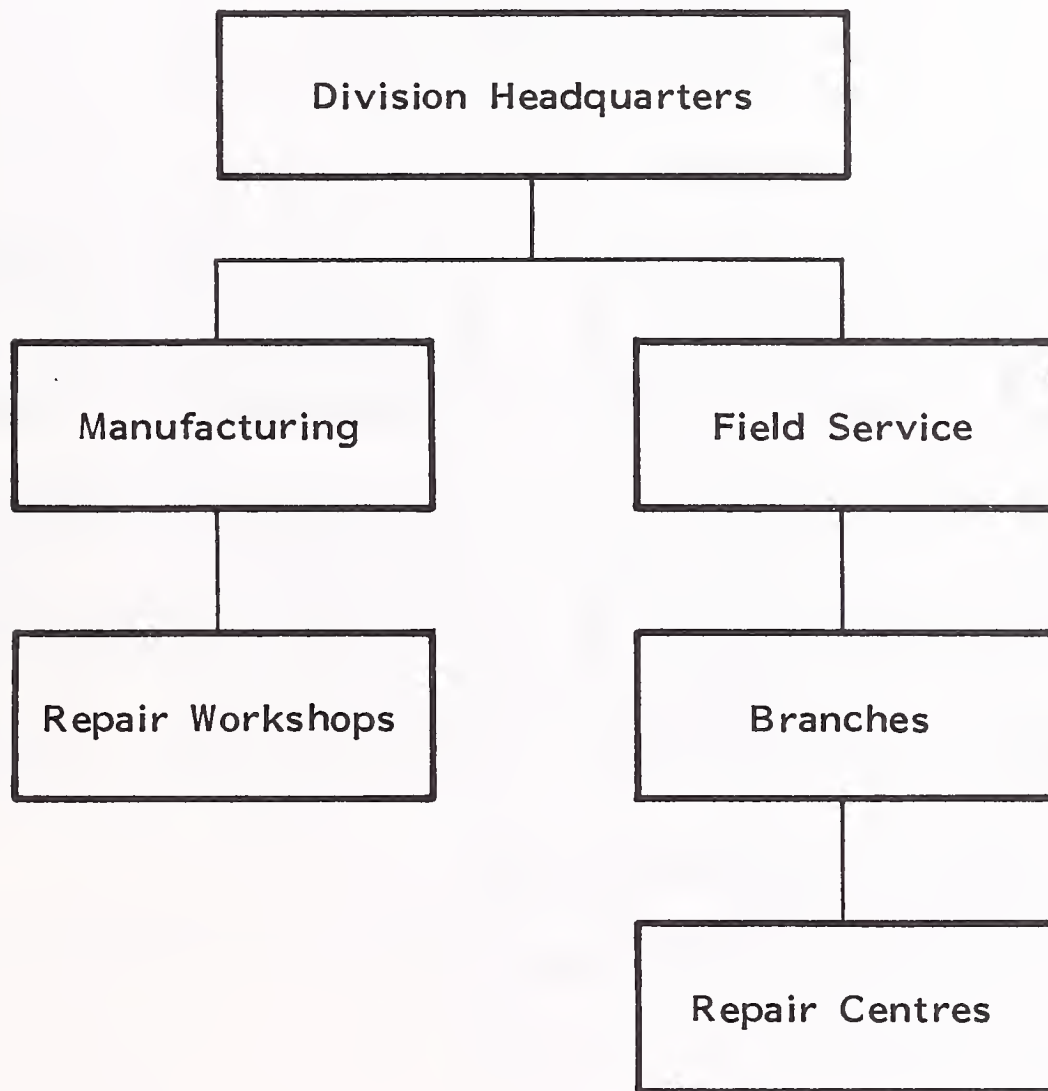


EXHIBIT VI-11

REPAIR CENTRES ORGANISATIONAL STRUCTURE -
COMPANY K

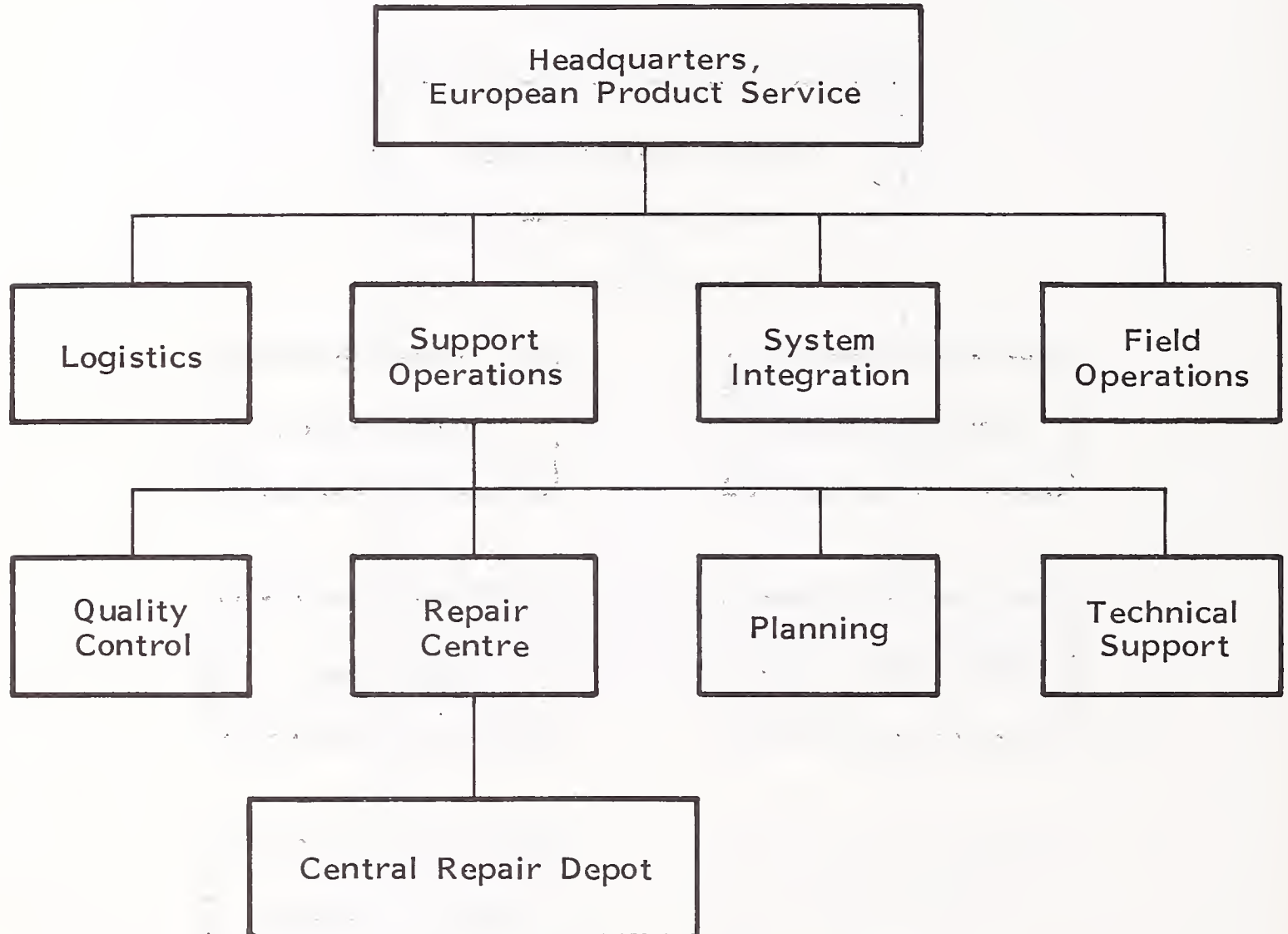


EXHIBIT VI-12

REPAIR CENTRE ORGANISATIONAL STRUCTURE -
COMPANY L

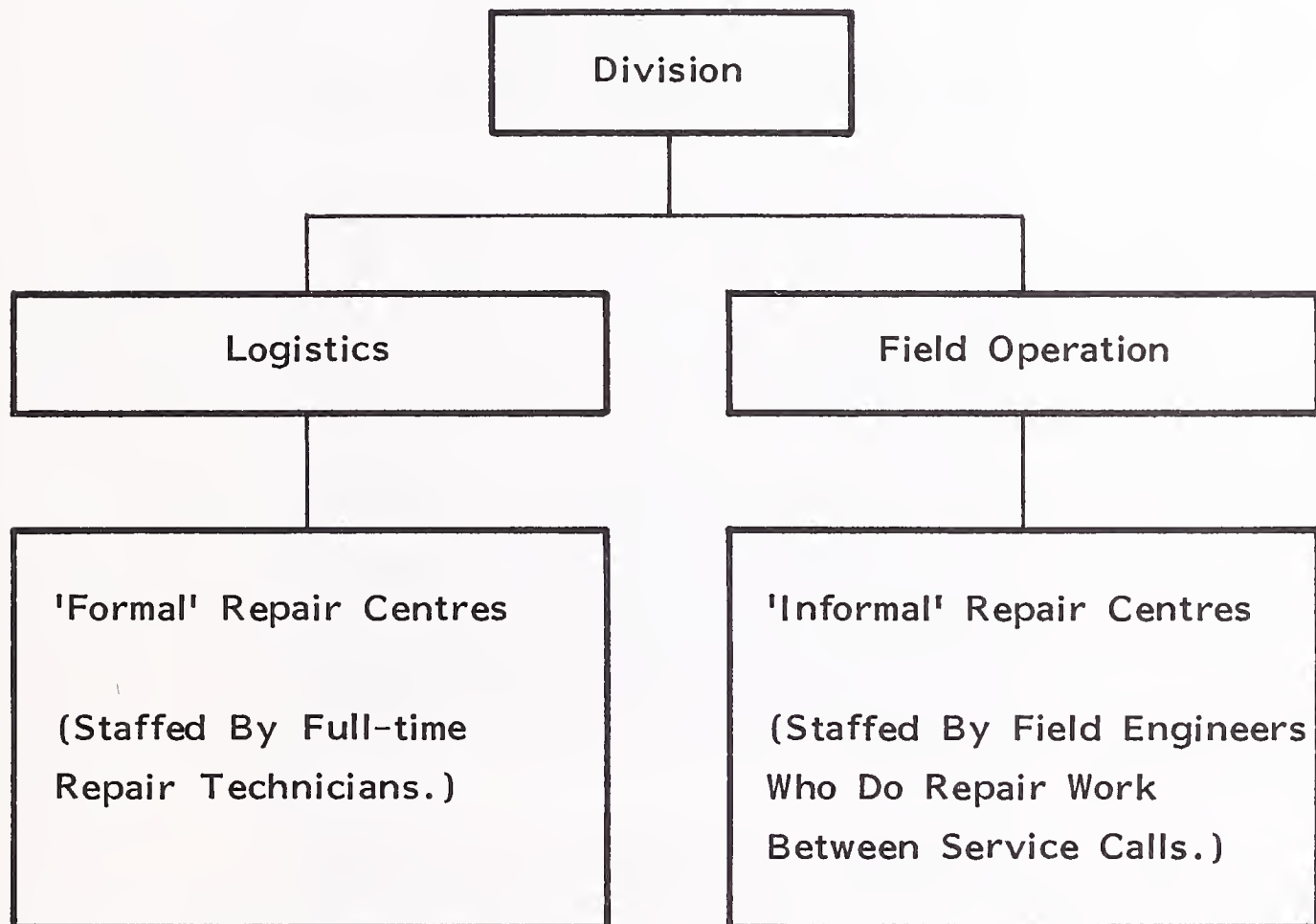


EXHIBIT VI-13

REPAIR CENTRE ORGANISATIONAL STRUCTURE
COMPANY M

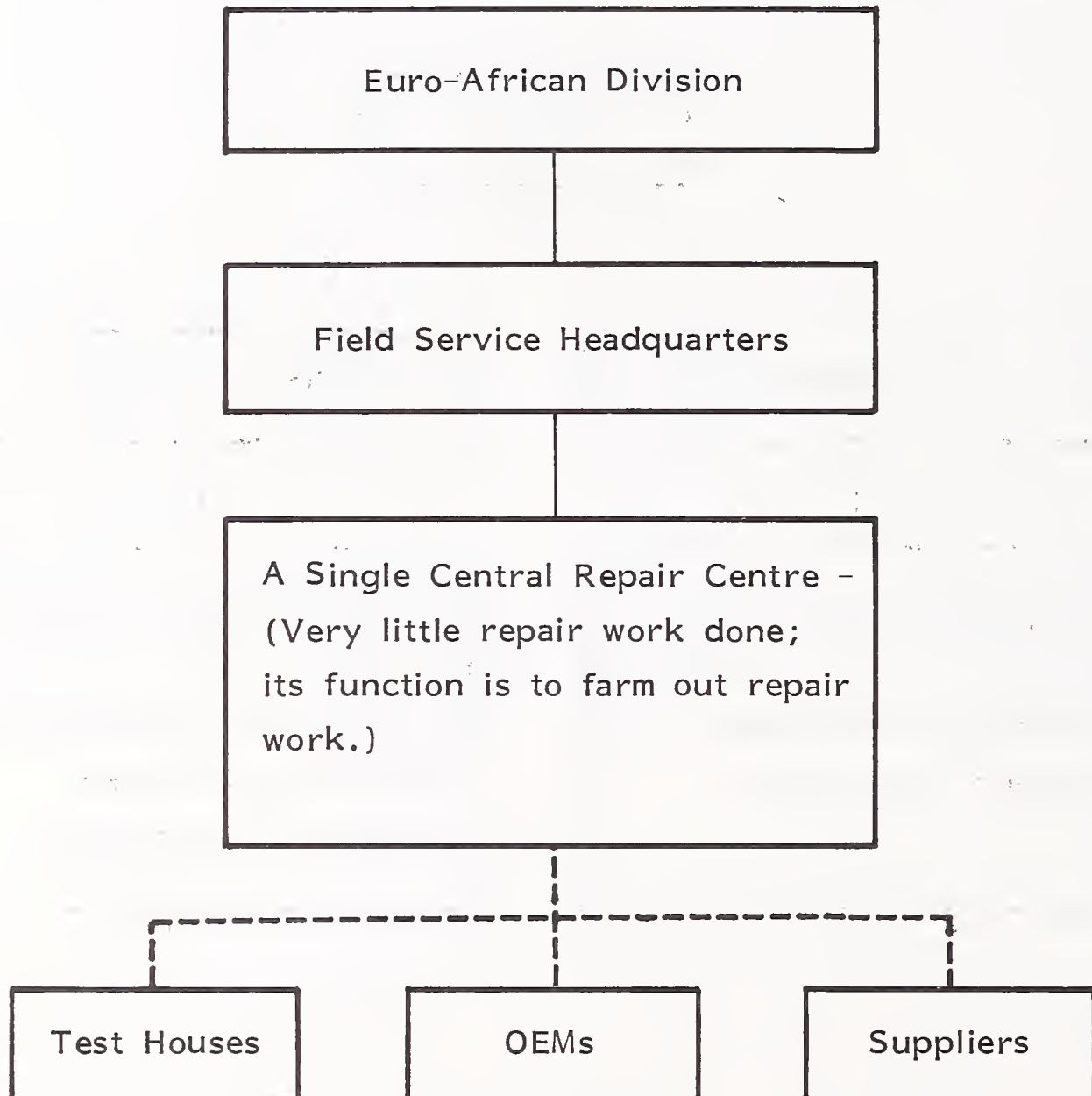


EXHIBIT VI-14

REPAIR CENTRE ORGANISATIONAL STRUCTURE -
COMPANY N

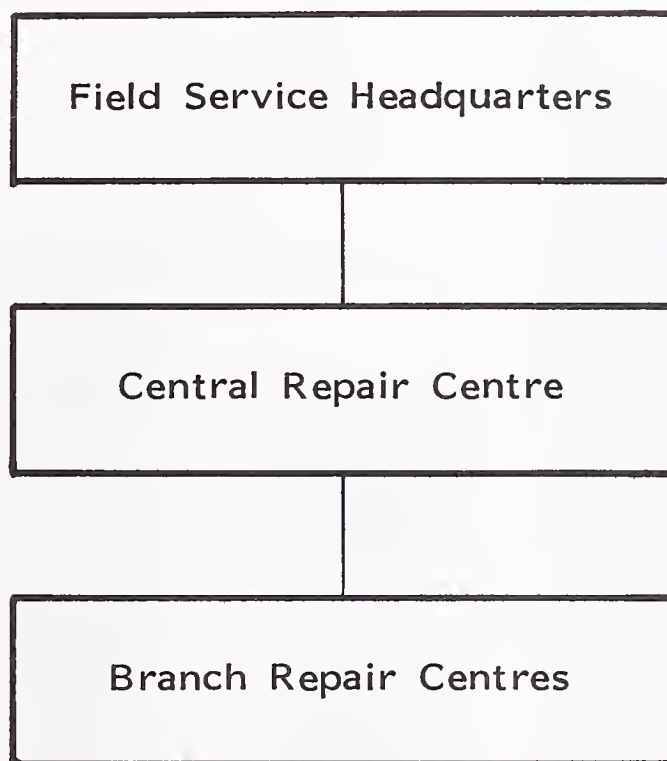
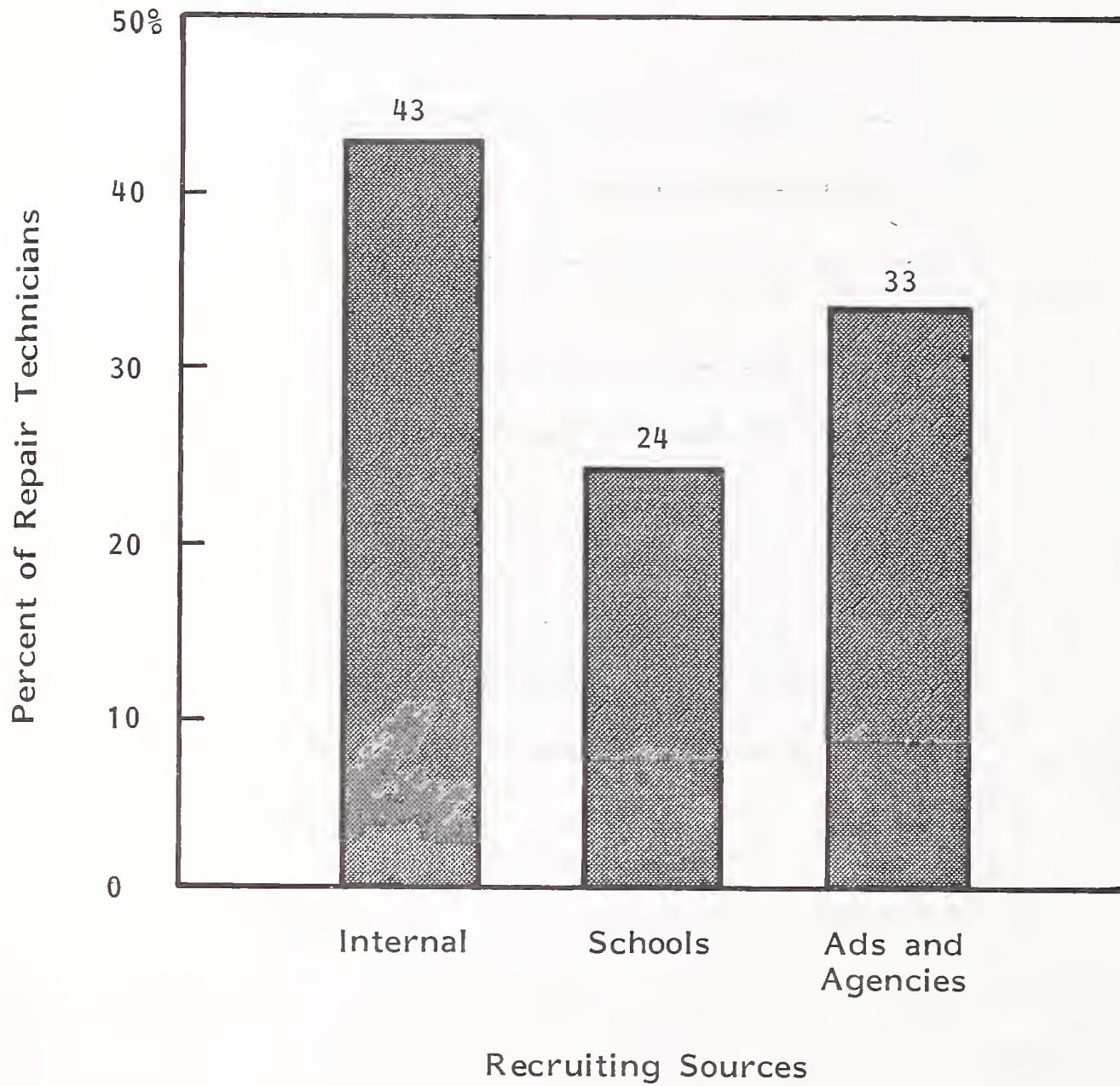


EXHIBIT VI-15

SOURCES FOR RECRUITING REPAIR TECHNICIANS



B. PERSONNEL

I. SOURCES OF REPAIR TECHNICIANS

- Sources for recruiting repair technicians are divided equally between external and internal pools, as shown in Exhibit VI-15.
 - Internally, potential bench repair technicians are developed from field service and factory functions.
 - A dual definition of "repair technician" exists.
 - A bench repair technician is generally a more inexperienced skilled labourer who performs repairs within a prescribed and repeatable set of conditions. His training may include a technical school or military electronics background. This technician fixes faults which are already diagnosed or isolated.
 - Another more skilled repair technician is better educated, sometimes including an engineering education and degree. This employee is usually sought, not so much for actual repair work, but to analyse and diagnose malfunctions.
 - Sources of recruiting for both types of technicians include academic and training environments.
 - Commercial technical schools such as the Control Data Institute provide a resource for bench type technicians.

- The more sophisticated technician often originates from university "sandwich" courses. A "sandwich" course is a cooperative program whereby a university student intersperses his formal education with employment.
- Where redundancy or layoffs affect a significant number of personnel, local laws restrict hiring of any new personnel.
 - One vendor in this situation has used, as a source of repair technicians, his senior field engineer labour force.
 - "Senior" specifically means beyond 50 years of age.
 - This program has been aimed at "burnt out" field engineers who are tired of travel, confrontations with the customer, and continuing pressures.
- Other repair centres are virtual spawning areas for training and developing future technical experts.

2. ATTRITION

- Loss of repair centre employees to other firms is very low, from 3% to 6% annually.
- Reasons for the low attrition include:
 - The current hard economy is an environment which inhibits company or career movement. There is a concern by a few that in better times repair people will be looking to switch.
 - One firm attributed a low attrition factor to the positive style of the firm and its working environment.

- Since the repair centre is a basic proving ground for higher calibre technicians the tendency to move from a source of demand for new talent is rare.
- Internal attrition is a problem to repair managers because repair centres produce a desirable talent pool for other company departments. The investment in training by the repair centre pays off for the company, but the repair department suffers.
- A "caste" system involving repair technicians and field engineers is potentially harmful.
 - A good repair technician is, in many respects, as valuable, if not more so, than a field engineer.
 - The field engineer is provided with extra company benefits which are not offered to repair technicians.
 - Company cars are provided to many field engineers but few, if any, repair centre personnel are allowed company vehicles.
 - Overtime arrangements and premiums definitely favour the field engineer.
 - Offsetting incentives should be considered for qualified repair workers.

3. UNIONISATION

- Unionisation with field service groups, whether in Europe or America, concerns field service management, whether a union or the threat of a union exists.

- Over 75% of the respondents indicated that labour guilds or unions were nonexistent in repair centres.

C. QUALITY OF SUPPORT

- Fourteen of 15 respondents indicated that their repair centres are properly supported by the rest of the company.
 - Repair centres' relationships with sales are generally good.
 - Repair operations appear to be well integrated with the rest of the company.
- Companies should provide more test equipment to do the job.
- Support from the United States, once a major problem, is getting better.
 - Field engineers need to describe faults and diagnosis from the field better, and transmit them to the repair centres with the parts in question.
 - One firm indicated that when it requires repair work to be done through the manufacturing organisation, a legal contract is drawn between the field service group and the manufacturing group (within the same company).
 - Another interesting response was: "There are no major hassles but it's never a perfect world. We have to act autonomously. There is a strong tendency for repair centres in different countries to be rivals."

- Overall, repair centres are adequately supported by other departments within the company. Other departments realize the important influence that repair centres have in the company's economic status as well as customer satisfaction.

D. FINANCIAL ASPECTS

I. BUDGETS

- Separate budgets exist for most repair centres.
- Field repair centre budget activity is not separately discernible from the overall field operations budgets, in field locations.
- Very few repair centres are accountable as separate cost or budget centres.
- A few vendors budget specifically for central and major repair facilities, while operations in remote repair depots are budgeted collaterally with the field office operation.
- Total repair centre network budgets are quite similar among responding companies.
 - Four out of five firms gave estimates within 33% of the others. They stated that their repair operations budgets were:
 - . £ 300,000.
 - . £ 250,000.
 - . £ 240,000.

- . £200,000.
- The fifth respondent to this question who provided a definite answer estimated his repair centre budget to be in the neighborhood of £400,000.
- One major repair centre operation revealed that current costs are \$488,000 while revenues are \$459,000.

2. COST BENEFITS

- The answers to the question of how much cost savings to overall operations are attributable to repair centres varied.
 - One firm said "none . . . at the moment."
 - Another confessed the savings were "minimal, only \$2,000 per year."
 - An office equipment maintenance vendor calculated that repair centres contribute a 3% annual saving to their firm in costs of secondary site visits to acquire the right part.
 - A British firm replied that repair centres are not viewed as a cost saver per se, but as a new sales generator.
 - Another firm said that direct cost savings were hard to identify but that indirect corporate savings from a better quality control programme (precipitated by the repair centre) were important.
 - A firm from The Netherlands estimated that a 10% to 20% cost savings may be realized in its organisation - all directly attributable to repair centres. An interesting digression was noted from this firm: "Our

motive is to decentralise repair operations and confront people with their own errors." (This comment inaccurately assumes the field engineer made the mistake in the first place (this is not always the case).

- However, through repair centres, manufacturing and engineering deficiencies are more clearly recognised and made known.
- Still another company declared that it saved approximately £20,000 per year in unused and unnecessary dealer support. Also fewer spares holdings and less training provide this firm with a conservative 1% savings in annual budgeted pounds.

- Additional responses included:

- "We cannot assess direct dollar savings; however, we know that if repair centres did not exist inventory would go through the roof; the customer would be negatively impacted, and freight charges would be unusually high."
- "Without repair centres, our field service expense would be double."
- "\$500,000 per year."
- "£20,000 per month."

VII VENDOR PROFILES

VII VENDOR PROFILES

A. GENERAL

- A selection of vendor profiles or case studies shows, in further detail, how some firms handle repair centres. These vendors represent large and small companies with views and strategies supporting both centralised and decentralised repair operations.

B. COMPANY A

- Company A is a large European division of a major U.S. mainframe manufacturer.
 - Its European headquarters are near London and field services are aggressively marketed, including:
 - Field installation and maintenance.
 - Software support.
 - Parts distribution.

- Supplies and accessories (\$40 million in annual revenue).
 - Facilities planning (\$500,000 in revenue).
- The facilities planning business, now in its first year, was initiated for three reasons.
 - Company A found itself giving facilities planning information away free of charge.
 - If facilities planning was insufficient, Company A suffered because of problems in installation and service. Company A therefore thought providing facilities planning would minimise subsequent problems.
 - Finally, facilities planning represents a good revenue opportunity for Company A.
- Company A's repair philosophy has changed significantly in recent years.
 - Until 1979, corporate policy dictated that there be no repair centres.
 - This was because field engineers were equipped and trained to handle repairs on-site.
 - With the strategy to repair to the lowest level, "we kept the logistics problem simple," according to the field service manager, "but our customers began to suffer."
 - Pressures to establish repair centres in the field were then absorbed by the 14 subsidiaries representing Company A throughout Europe. This procedure of locally repairing parts proved inefficient, lengthy, and lacking in quality.

- Company A then decided to centralise all European repairs at a major facility in Belgium, about equally distant from each of its distributors.
- It also discovered untapped resources for repairs in numerous "test houses" which already had much of the test equipment and software to provide economic diagnostics and fixes.
- The central repair depot was set up as a clearing house for repairs.
 - Eighty percent of the repairs are farmed out to test houses, OEMs, and in some cases to the various factories of Company A.
 - The staffing required is minimal.
 - One manager.
 - Two repair technicians.
 - One traffic controller/expeditor.
- Procedures for operating the central facility include the following:
 - Before any unit is considered for repair, the initiator, either distributor or field serviceman, must telex the repair facility in Belgium with details of the part, diagnosis, serial number, and other pertinent information.
 - A goal of four weeks for repair turnaround time is established.
 - A part is scrapped if:
 - It has previously been repaired three times.

• Its value is less than \$100.

- The overall goal for the repair centre is to break even, where revenue and credit equal costs.
 - All repairs are expected to cost 25% or less of the cost of a new part.
 - Exhibit VII-1 shows cost and pricing relationships in terms of cost transfer prices.
- Following approximately one year's experience in using the centralised repair clearing house, Company A is satisfied with the results.
 - Despite the success there still is a tinge of suspicion from subsidiaries who now have to deal directly with Company A and pay 33% of list price of a new part, for repairs.
 - Company A figures it saves about \$500,000 annually using this repair strategy.

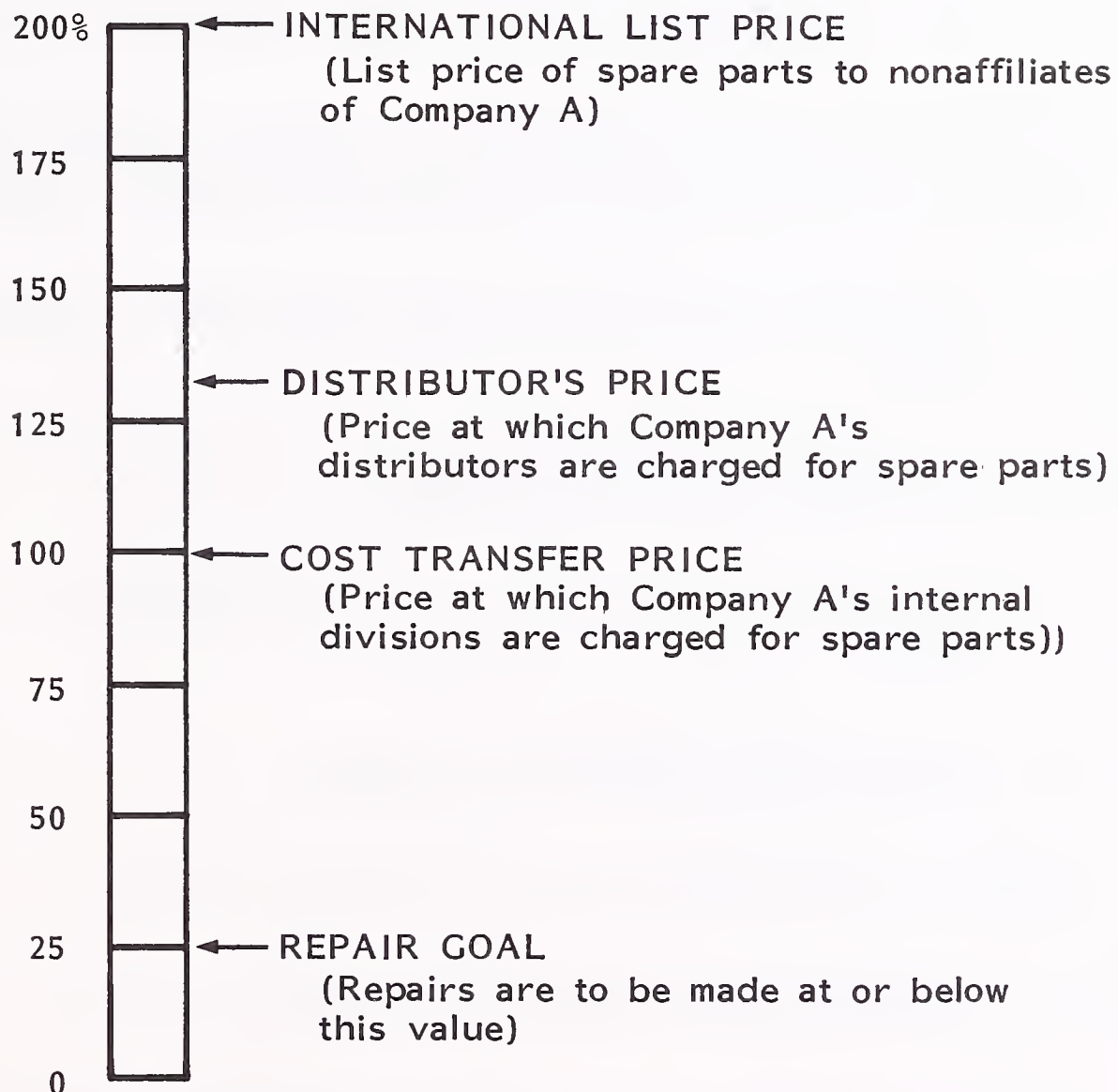
C. COMPANY B

- Company B is a British, London-based firm whose major business is leasing and selling small computers and terminals, as a dealer. In recent years the field service operation has become a profit contributor on revenue volume of £500,000.
- There are seven decentralised field repair centres in each marketing and service region of the U.K.

EXHIBIT VII-1

COMPANY A'S REPAIR AND SPARE PARTS SCHEME

Percent of Cost
Transfer Price



- Each local repair centre operates independently and:
 - . Utilises about 4,000 square feet of space.
 - . Has approximately £20,000 worth of test equipment at each location.
- The local, or branch repair centres handle most of the board level repairs.
 - . Turnaround time is one to two days.
 - . Emergency service is available with 24-hour turnaround time.
- A central repair facility supports branch facilities, handling component level work as well as that requiring more sophisticated technical capability.
 - Turnaround time from the central repair depot is approximately one week.
 - A refurbishment service is offered.
 - The gauge for productivity is to repair £20,000 worth of repairs per month.
 - Central repair is operated by 12 people.
- Company B is forecasting expansion of its repair activities.
 - About 60% of all repairs are accomplished in-house.
 - The plan is to reduce the dependence from non-Company B sources for the balance of the repair requirement.

- Conservatively, Company B thinks it saves about £240,000 per year as a result of its repair strategy.

D. COMPANY C

- Company C, is another British firm located near London, having a network of repair centres located in the U.K. as products.
 - It also has a network in other major European centres where it markets its computer-based telecommunication systems and terminals.
 - Repair centres in European cities outside the U.K., linked through Company C's logistics organization, are semi-autonomous.
- The U.K. repair network comprises three different levels of repair functions.
 - Local repair sites, within six districts, offer the first line of repair expertise, utilising field engineers who perform repairs in between site service calls.
 - This work is usually at board level.
 - Each local repair site has the ability to test 90% of the problems in the equipment.
 - Two workshops have been implemented within the past 18 months.
 - These are staffed by full-time repair technicians who do nothing but repair work.

- Any unit or item which cannot be repaired locally in less than eight hours is sent on to the workshops.
 - The workshop is a specialised repair facility offering an advanced degree of technical support to the field.
 - The central repair depot then provides diagnostics and fixes for the more unique and perplexing field problems.
 - Intermittent problems with parts are sent to the central repair depot.
 - Major units, CPUs, and disk drives are sent to the central depot.
- Company C's assessment of its repair philosophy is positive.
 - However, it really does not expect to see direct cost benefits for two years.
 - Overall, it can handle 95% of all repairs. It wants to improve this and become more autonomous.
 - Turnaround time has improved to an average of one day, using exchanges.
- Company C has received unexpected benefits from transferring heavy repair workloads from the central depot to the two workshops.
 - The workshops provide a closer tie to the field.
 - A better dialogue between the field technicians and the workshops has resulted.

- This improved communication has rekindled the field engineers' interest and intellectual curiosity.
 - . When workshops did not exist, field repairmen would package up insoluble repairs and ship them to the central repair site.
 - . Now, with repair workshops in place a technical dialogue is established.
 - . Field engineers are more motivated now and the overall requirement for spares has been reduced.

E. COMPANY D

- Company D, headquartered in The Netherlands, has repair centres at each of its distributor locations:

Austria	Ireland	Spain
Belgium	Italy	Sweden
Denmark	Netherlands	Switzerland
Finland	Norway	United Kingdom
France	Portugal	Yugoslavia
Greece		

- Company D's products are similar in each country, allowing for standardisation of repair procedures.
 - Each distributor has to "tool up" independently with its own resources to perform repairs.

- Dependence upon headquarters repair is therefore currently heavy, but it will decline.
- A major breakthrough in Company D's repair strategy is an in-house developed tester which will analyse or diagnose problems in 50% of the printed circuit boards in use.
- Repair turnaround time is about four weeks which Company D thinks is good.
- Repair centre resources compete with other service development which also require resources including a central dispatch programme.
 - Test equipment programs and standards require definition.
 - Workshop administration is insufficient and more people are needed.
- This firm's repair motive is to decentralise repairs "to confront people (field service) with their own errors."

VIII THE OUTLOOK FOR REPAIR CENTRES

VIII THE OUTLOOK FOR REPAIR CENTRES

A. OPERATING GOALS, PLANS, AND MEASURES

- A variety of responses to the survey questions regarding goals, plans, and measures was noted.
 - Most respondents had positive ideas regarding repair centre objectives.
 - Nearly half of the companies included in the survey were implementing new (within the last twelve months) repair centre activities.
 - Many of these respondents reflected a "wait and see" philosophy about repair centre planning.
 - A basic goal by these firms is to establish a viable repair organisation and once stabilised, begin measuring its effectiveness.
 - Two companies with longer established repair operations expressed a desire to have their repair operations become self-sufficient or autonomous.
- A single, common goal or set of measures did not result from the respondents queried.

- The nearest limit of a common purpose for repair centres expressed either implicitly or explicitly was improved customer satisfaction.
- One vendor indicated a multiple goal set for its repair operations:
 - Support the field.
 - Support the direct customer base.
 - Provide repairs and modifications (11,000 repaired units per year).
 - Aim for a productivity factor of 80 units repaired, per person, per month.
 - Optimise the spare parts pipeline through effective use of repair centres.
 - Strive for a 14-day turnaround repair cycle.
- Another firm whose repair centre has been in operation for less than a year cited the major objectives as:
 - Improve turnaround time to 15 days.
 - Implement more detailed plans and measures.
 - Track repairs by type of problem and unit and set up a fixed or standard cost of repair to be able to establish a fixed price for each repair, in the future.
- Another respondent answered succinctly, "To repair all that is received and as little as possible."

- One other firm intends to concentrate on the quality of repairs with the ultimate objective of decreasing the number of repeat calls required by field engineers.
- A small-sized maintenance vendor is investigating a bonus scheme to improve its repair output.

B. FUTURE PLANS

- The question about the future for repair centres was designed to get a general statement by respondents to two important issues.
 - One issue was planning for future expansion or centralisation.
 - The other was establishing any innovative concepts planned for including, for example, ideas for walk-in or mail-in depots.
- Again, responses did not reveal any common set of guidelines.
 - Attitudes toward walk-in/mail-in provisions varied.
 - Three firms indicated that they felt this consumer type of service was unnecessary.
 - Reasons for this opinion include the lack of product adaptation to this type of service and the feeling that the walk-in concept "is not popular." One respondent said "We don't believe the future includes walk-in type of service."
 - An opposing view on walk-in repair depots was expressed by two large vendors, both having micro-based computer products in their product line.

- One of these firms, a major American mainframe manufacturer, is establishing specified areas in newly acquired locations for "clinic" types of repair depots. Every new lease for facilities includes a certain amount of extra room to be used, ultimately, as a repair clinic.
 - The other firm, a European manufacturer, is banking heavily on its newly announced personal computer. Walk-in depots are "of major interest" but plans for these are directly related to sales volumes.
- Two more firms, one large and one small, contemplate walk-in depots.
 - They are awaiting signals from their respective customer bases to establish them.
 - The smaller firm anticipates a definite trend to over-the-counter repair depots and is thinking about opening this type of facility in shopping centres, for convenience.
- Further replies to questions about future repair centre plans included the following:
 - A large firm, based in the U.S., looks forward to obtaining more sophisticated test equipment to enhance its repair operation.
 - This firm also has a goal of performing 80% of its own repairs locally in European repair depots.
- Another respondent is concentrating its repair efforts into one huge central European repair facility.

- A smaller maintenance vendor is setting a goal for its repair activity to fix 60% of all items received for repair.
- One other company does not plan to open more field repair centres until 1984. They figure that two recently established workshops can absorb the repair requirements until then. They are "still on the learning curve."

C. OPPORTUNITIES

- Specific opportunities for repair centres were not readily identified by repair centre managers.
 - Repair centre operations are too new to identify much opportunity.
 - Efforts by repair centres are focused toward today's problem, reaction, rather than the future, proaction.
 - Candid responses are included in Exhibit VIII-1.
- Third-party maintenance is an interesting potential opportunity for repair centres but not that attractive at present.
 - Exhibit VIII-2 shows significant consideration has been given to third-party maintenance by repair managers.
 - The struggle to implement new repair strategies, within a reactive mode, seems to defer repair managers from aggressively pursuing a natural opportunity.
 - With trained technicians and adequate test equipment, it is not difficult to transfer these resources and skills to similar products and devices manufactured by other firms.

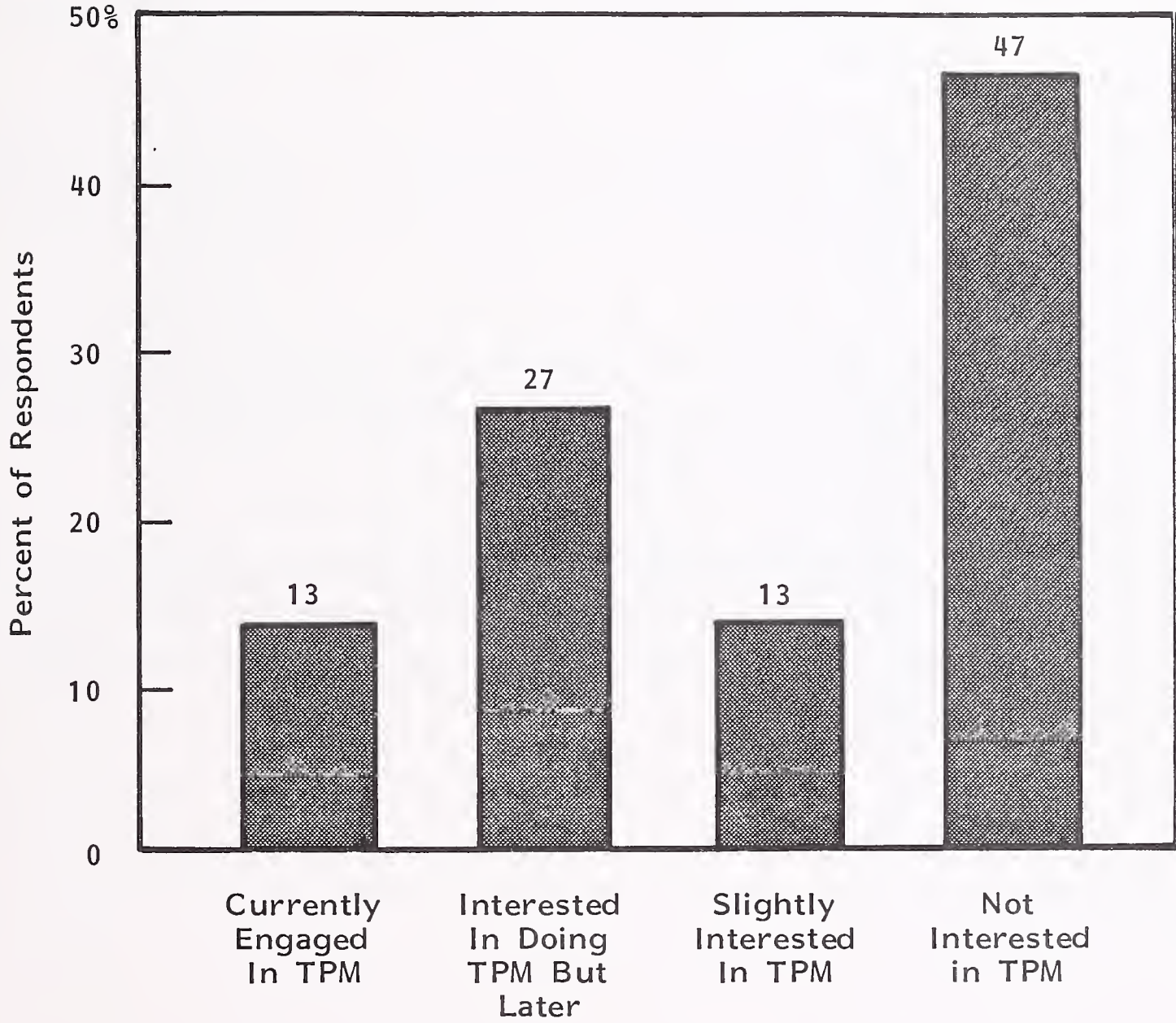
EXHIBIT VIII-1

REPAIR CENTRE OPPORTUNITIES

- 'Continue as part of the Customer Service Division'
- 'Provide faster and better repair when newer and better automatic test equipment is acquired'
- 'Stay competitive with third-party maintenance'
- 'Improve turnaround time and cost effectiveness. But we need better ATE to accomplish this.'
- 'Provide improved throughput for high volume product repairs. This is not an opportunity so much as it is an inevitability.'
- 'Revenue'
- 'Training'

EXHIBIT VIII-2

THIRD-PARTY MAINTENANCE (TPM)
AS A REPAIR CENTRE OPPORTUNITY



- Repair centre managers should reexamine third-party service for potentially new revenue associated with minimum incremental cost.
- Another imaginative opportunity exists in franchising remote repair operations.
 - This will correct a number of problems associated with remote repair centres.
 - Utilisation of manpower in remote areas is usually less than optimum because the product density is not enough to keep a full-time repairman busy.
 - This results in cost overruns for employers of such personnel. Franchising transfers the burden of unproductive time from the third-party firm to the entrepreneur.
 - By providing the remote, independent repair entrepreneur with proper training, parts, and support, the franchisee can then seek further business opportunities on his own, while attending to the firm's direct customers.

APPENDIX: QUESTIONNAIRE

1. How many repair center does your organization have in Europe? _____

2. If there are multiple centers, ask the following questions; if not go to question #3.

a. Are these centers interconnected or spearate entities?

- Interconnected _____
- Separate _____
- Both _____

b. If interconnected, how?

Other Countries _____

Within the same country _____

c. Does each repair center have the same function (i.e. do they repair the same equipment as the others?)

Please briefly describe: _____

3. Where are these repair centers located?

Cities	Countries
_____	_____
_____	_____
_____	_____
_____	_____

4. What is the approximate size or area of a typical repair center?

_____ Square meters, or

_____ Square feet

5. Is your typical repair center in a building shared by:

a. Other functions of your firm _____

If yes, which others _____

b. Other firms _____

6. Please provide an estimate of the type of repair equipment installed at a typical repair and its approximate value:

Equipment

Approximate Value

7. What are your firm's guidelines for establishing repair centers?

FUNCTIONAL DESCRIPTION OF REPAIR CENTERS

8. Does your repair center(s) activity include external as well as internal operations? That is, does the repair center work with customers (external) as well as your firm's employees (internal)?

- Internal only _____
- External only _____
- Both internal and external _____

9. If external functions are performed, what are they? _____

a. Does your repair operation do warranty work? _____

10. What type(s) of repairs are performed at each repair center?

Products	Types of Repair
_____	_____
_____	_____
_____	_____

11. To what level of equipment are repairs performed?

- Major assembly _____
- Board _____

12. What types of equipment are not repaired at:

- a. Field repair centers _____

- b. Main repair depot _____

13. How do you handle an item that cannot be repaired? _____

14. Do your repair centers swap equipment (i.e. ship a repaired part for an inoperative part, thereby eliminating repair and test time):

- Yes
- No

15. Are FCO's and/or ECO's automatically incorporated in repairs?

- Yes
- No

16. Does your repair center perform:

- a. It's own incoming inspection? Yes No
- b. It's own diagnosis? Yes No
- c. It's own final test check out (after repair)? Yes No
- d. It's own shipping? Yes No

17. What is your repair center's turn-around time? (i.e. time received to time shipped)

Actual _____ Planned _____

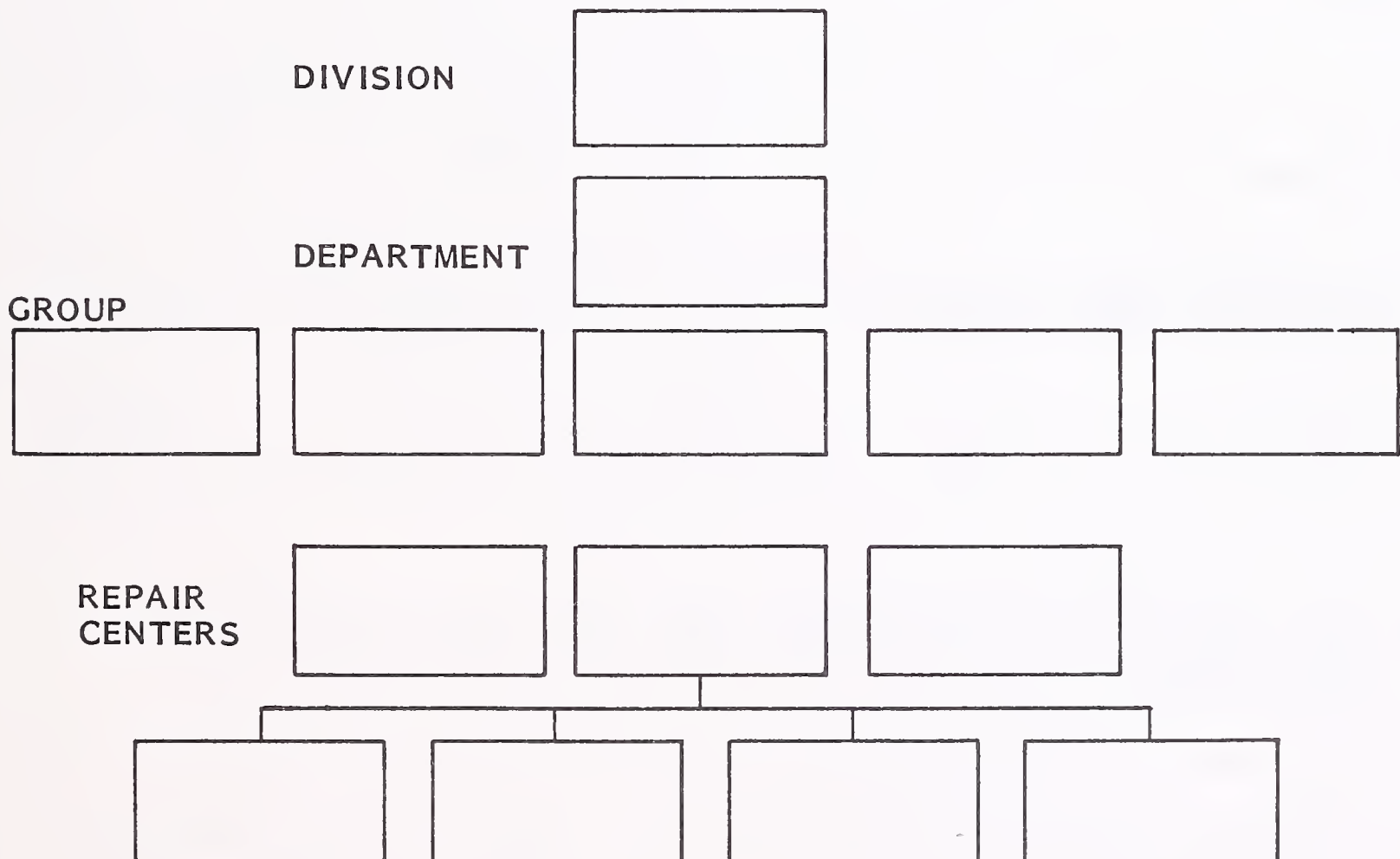
18. What productivity standards are used at your firm's repair center(s)?
(such as pieces repaired per technician per day)

Actual _____ Planned _____

19. How is the flow of repaired equipment controlled? _____

ORGANIZATIONAL AND ADMINISTRATIVE
CHARACTERISTICS OF REPAIR CENTERS

20. Please briefly describe the repair center's organizational structure by title:



21. Is there a separate budget for your firm's repair centers?

a. Yes No

b. If yes, approximately what is the budget for repair centers?

1) Each _____ per repair center

or

2) All _____

22. What sources are used to hire repair technicians? _____

23. What is the approximate attrition factor for repair technicians? _____

 Why? _____

24. Are repair technicians unionized? Yes No

25. Do you feel that your repair centers are properly supported by the rest of your firm? Please discuss:

26. Please briefly discuss the operating goals, plans and measures for your repair centers:

FUTURE PLANS FOR REPAIR CENTERS

27. Briefly discuss future plans for repair centers (e.g., new openings, new services such as walk-in or mail-in, closings, relocations, etc.):

28. In your opinion, what are the greatest opportunities for repair centers?

29. Do you plan to use your repair centers for Third Party Maintenance?

- () Yes
- () No

30. How much of a costs savings have repair centers been to overall operations?

PLANNED

ACTUAL

FUTURE

THANK YOU VERY MUCH. THIS CONCLUDES INPUT'S INTERVIEW.

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