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STEPS TO EFFECTIVE EQUIPMENT MAINTENANCE

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UNCTAD Monographs on Port Management

A series of monographs prepared for UNCTAD in collaboration with the International Association of Ports and Harbors (IAPH)

Monograph No. 3

STEPS TO EFFECTIVE EQUIPMENT MAINTENANCE

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Other monographs in this series:

No. 1 Changing from daywork plus overtime to two-shift working

No. 2 Planning land use in port areas: getting the most out of port infrastructure

The views expressed in this monograph are those of the author and not necessarily those of the UNCTAD secretariat.

INTRODUCTION TO THE SERIES

In the ports of industrialized countries, operating systems and personnel development are based on skills acquired through experience, on emulation of other industries and on the innovation which is easily undertaken in advanced industrial environments. These means are generally lacking in developing countries and port improvements occur only after much deliberation and often through a process of trial and error. Some means is required by which ports in developing countries can acquire skills that are taken for granted in countries with a long industrial history, or can learn from the experience of others of new developments and how to meet them.

Formal training is one aspect of this, and UNCTAD has devoted considerable effort to developing and conducting port training courses and seminars for senior management and to preparing training materials to enable middle-management courses to be conducted by local instructors. It was felt that an additional contribution would be the availability of clearly written technical papers devoted to common problems in the management and operation of ports. The sort of text that will capture an audience in the ports of developing countries has to be directed at that very audience, and very few such texts exist today.

Following the endorsement of this proposal by the UNCTAD Committee on Shipping in its resolution 35(IX), the UNCTAD secretariat decided to seek the collaboration of the International Association of Ports and Harbors, a non-governmental organization having consultative status with UNCTAD, with a view to producing such technical papers. This series of UNCTAD Monographs on Port Management represents the results of this collaboration. It is hoped that the dissemination of the materials contained in these monographs will contribute to the development of the management skills on which the efficiency of ports in developing countries largely depends.

Adib AL-JADIR
Director
SHIPPING DIVISION
UNCTAD

FOREWORD

When UNCTAD first decided to seek the co-operation of the International Association of Ports and Harbors in producing monographs on port management, the idea was enthusiastically welcomed as a further step forward in the provision of information to managements of ports in developing countries. The preparation of monographs through the IAPH Committee on International Port Development has drawn on the resources of IAPH member ports of industrialized countries and on the willingness of ports in developed countries to record for the benefit of others the experience and lessons learnt in reaching current levels of port technology and management. In addition, valuable assistance has been given by senior management in ports of developing countries in assessing the value of the monographs at the drafting stage.

I am confident that the UNCTAD monograph series will be of value to managements of ports in developing countries in providing indicators towards decision-making for improvements, technological advance and optimum use of existing resources.

The International Association of Ports and Harbors looks forward to continued co-operation with UNCTAD in the preparation of many more papers in the monograph series and expresses the hope that the series will fill a gap in the information currently available to port managements.

J.K. Stuart
Chairman
Committee on International
Port Development
IAPH

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STEPS TO EFFECTIVE EQUIPMENT MAINTENANCE

I. BACKGROUND INFORMATION

A brief history of maintenance

1. Maintenance probably started out as a need to fix a machine when it broke down. The repairs were probably performed by the operator of the machine. Operator-performed repairs made sense in a way because the operator was the first to know of the failure, he was probably aware of changes which might lead to failure (such as different engine noises, exhaust changes, etc.), and he was the most familiar with how the equipment operated and should operate. As times progressed, however, equipment has become much more complex, and downtime has become more critical.

2. In the present days, it takes many special skills, tools, equipment, and material to repair equipment. The typical operator does not have these skills, and it is not cost effective to pay a skilled mechanic to operate one piece of equipment. This modern complexity has brought about the need for the trained operation, maintenance, and repair craftsman. Along with this craftsman, the support tools, facilities, equipment, parts, and supervision are needed to enable him to make good use of his time. Therefore, the first step in performing effective equipment maintenance is establishing an effective maintenance operating plan.

II. PLANNING FOR THE EQUIPMENT MAINTENANCE FUNCTION

A. Maintenance organization

3. The maintenance organization can be very complex or very simple depending on the amount and type of equipment to be maintained. Facility maintenance should be performed by the same organization as equipment maintenance so that common skills may be shared. Union agreements (if any), precedents, and jurisdictions are a consideration also.

1. Management

4. There should be one person in charge of the maintenance operation, both equipment and facilities. This person should report to the head of the operating department so that conflicts of interest do not occur within the organization. Reporting directly to the maintenance manager (the person in charge of maintenance) should be an equipment manager and a facilities manager. Under the equipment and facilities manager, the supervision could be handled in many ways.

5. One method would be to have individual supervisors responsible for specific skills (i.e., one supervisor for equipment electrical, one for equipment mechanical, one for facilities mechanical, etc.). The advantage of this method is that the supervisors can then be skilled in a specific type of work and the craftsmen can more easily be promoted into the supervisory positions.

6. Another method would be to have individual supervisors responsible for specific areas or types (i.e., one supervisor for lift trucks, one for cranes, one for Terminals 8, 10, 15, one for the main office, etc.). The advantage of this system is that the responsibility for specific areas can be held by one person. The biggest disadvantage of these two methods is that, if operations are performed on

multi-shifts or seven days per week, the responsibility is diluted and actual control during periods when a particular supervisor is off is poor. Also, co-ordination of work tends to be poor between crafts and areas of responsibility.

7. A third method would be to have each supervisor responsible for all skills and areas during the time period that that supervisor is working. (1) */ The biggest advantage of this method is that during the supervisor's work shift there are no conflicts within the operations as far as priorities or responsibilities. There are two drawbacks with this method. They are: the supervisor has to be a "jack of all trades" - he has to know a little about every craft - and he loses control of any carryover work from one shift to another. If there are any failures or other problems on his shift, it can always be blamed on "the other shift(s)".

8. The particular maintenance management method used will be determined largely by the size of the maintenance operation. For very small operations, the equipment and facilities management might be eliminated and the supervisors might report directly to the maintenance manager. On very large operations, there might be two, or even all three, methods of supervision used - the first two for maintenance and the third for operational/emergency repairs. (2)

2. Labour

9. The first level of the maintenance operation consists of the craftsmen themselves. These craftsmen must be provided with the proper tools, equipment, parts, and direction. No matter what size the operation, there should be specialists available, either on site or on call, in several areas. These specialists are electric (equipment and facilities), mechanical (diesel and gasoline), machinist, welder, plumber and painter. Some of these skills can be combined, but the skills must be available in at least one person to advise and direct repairs. The more people available with the various skills, the smoother the operation will run and the less critical each individual will become.

10. In addition to the required minimum amount of specialists, a number of craftsmen are needed for routine-type work. The number and skills of these craftsmen vary greatly depending on the size, type, and shift coverage of the operation. For safety and efficiency considerations, there should always be consideration given to providing at least two individuals available on each work site. There are many maintenance functions which are only possible, or are much easier, with two people. There is also the problem of accidents, which with only one person on site could cause disastrous consequences. The requirement of two people is especially important when considering coverage on various shifts.

3. Shift coverage

11. Shift coverage requirements vary depending on the utilization of the Port's facilities and the amount of control which the Port has when its facilities are used. If utilization is high, then multiple shift, split work week scheduling will probably have to be used in order to maintain equipment during non-cargo-handling shifts. In some instances where there are no non-cargo-handling shifts, the maintenance forces must be ready for any possible available time. Judicial use of overtime is also a consideration. During actual cargo operation, the maintenance organization should always have at least one person at work (only one is required because safety factors can be covered by the equipment operator).

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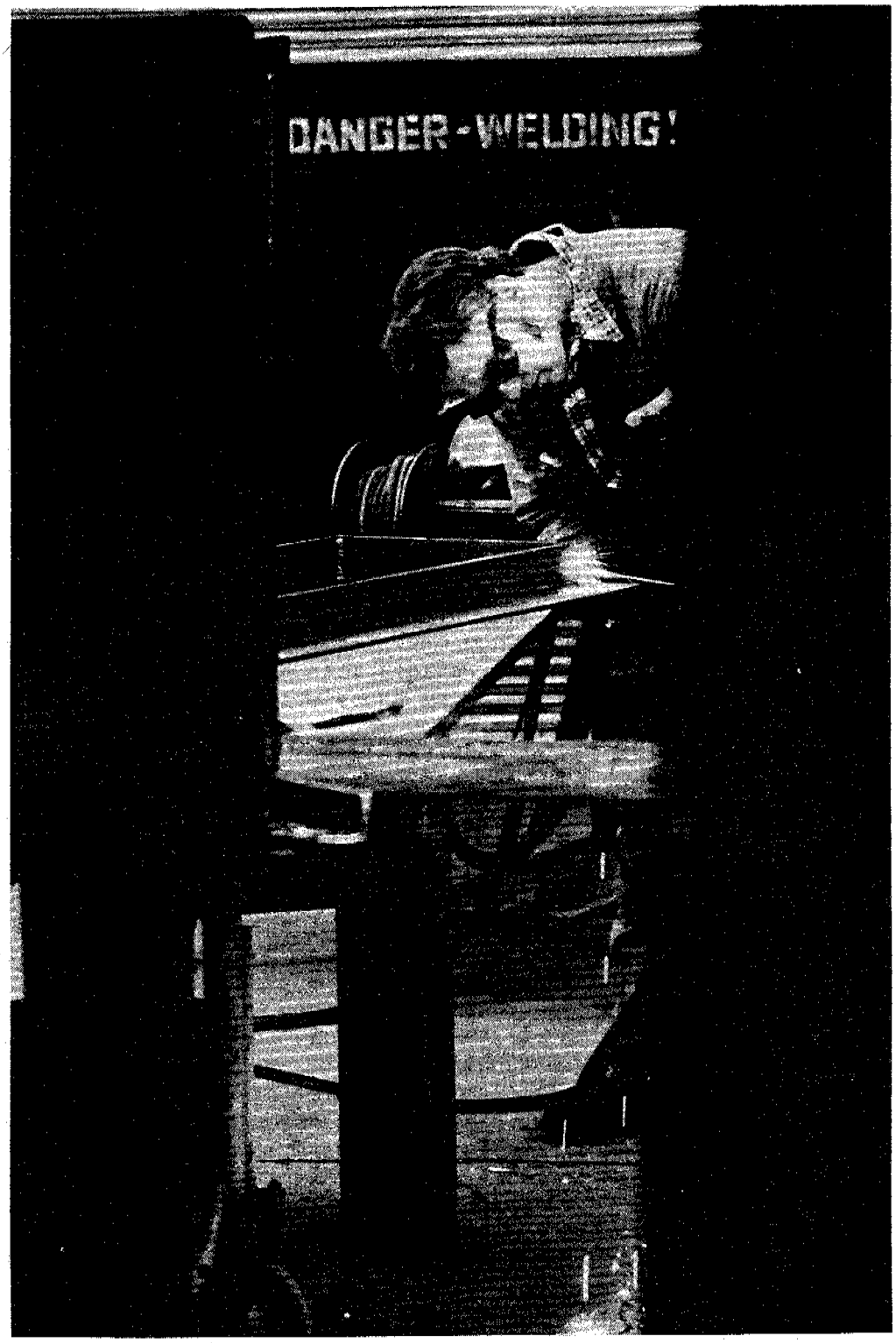
*/ Numbers in brackets refer to exhibits in the appendix.



Repairs/fabrication at maintenance facility

Depending on the amount of equipment in use, adequate manpower should be available, or on call, to handle multiple failures. The specialists do not necessarily have to be on site, but they should be on call for serious failures. There should be at least one member of maintenance management on call at all times for emergency decisions.

12. Administration of maintenance functions and records can be accomplished on a normal five-day, eight-hour shift. There should be at least one person responsible for maintaining records. These records include maintenance histories, failure histories, operating histories, labour statistics, and day-to-day messages. There is also a requirement for someone to handle parts and small tool supply. This person must be responsible for ordering, dispensing, and controlling these items. Most modern equipment repairs need an extensive supply of spares, so this job can be very demanding and can involve a lot of financial responsibility. These record-keeping and stores functions vary widely in the number of personnel required, depending on the size of operations and the number and locations of maintenance facilities.

B. Maintenance facilities and equipment

1. Facilities

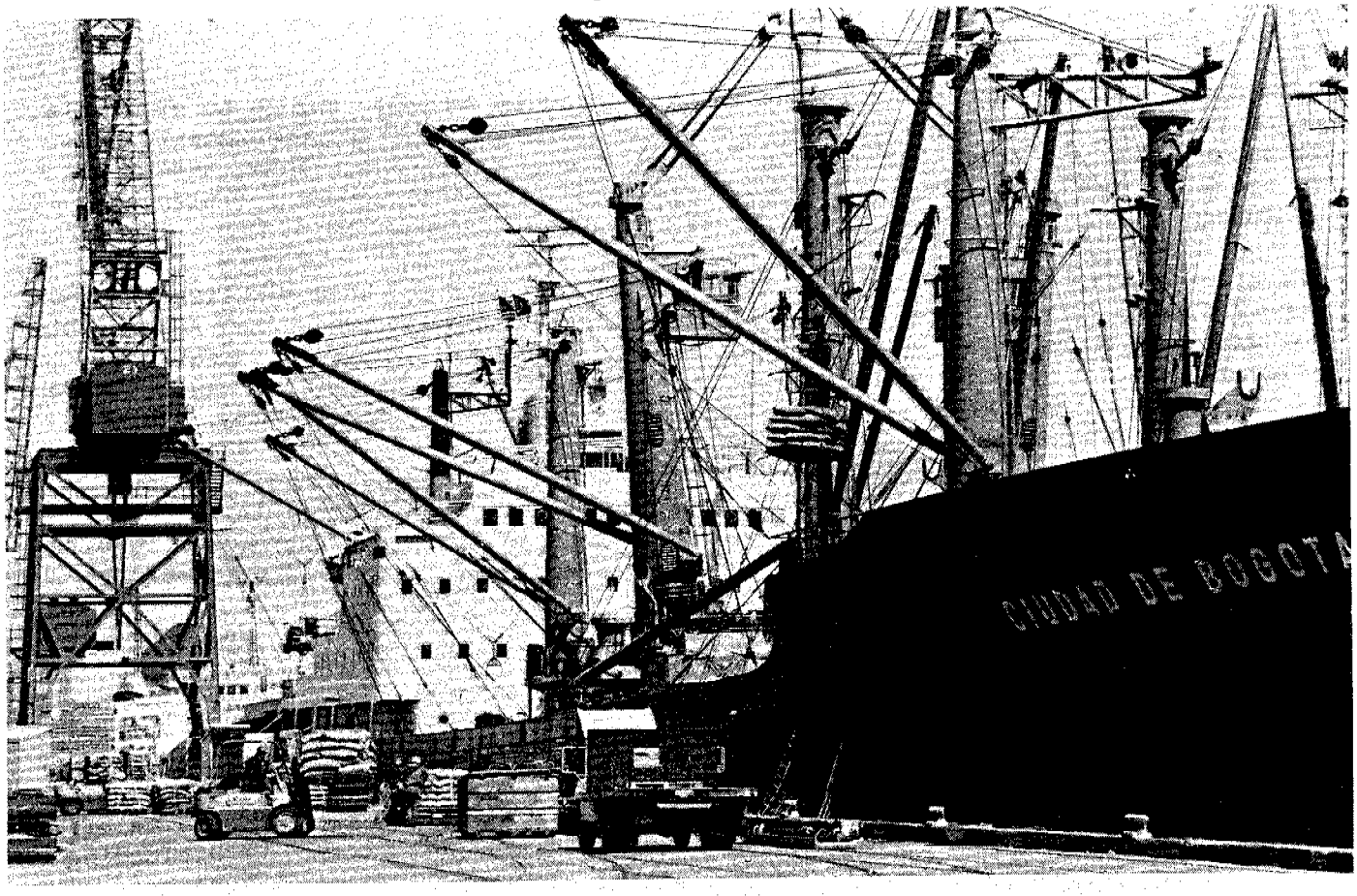
13. There should be one central location for the major maintenance facility. This location should be off the terminal, but nearby. The reason why it should be off the terminal is that most terminal space is much too valuable for non-shiploading uses. This main facility should have a central stores area, fixed maintenance equipment, office areas, and a parking area for maintenance vehicles. Whenever possible, all major repairs and preventive maintenance services should be performed at this facility. This does not exclude the establishment of minor field facilities however.

14. At each terminal (or contingent group of terminals) consideration should be given to having a small field facility. This facility should have a few spare parts and necessary pieces of maintenance equipment, such as a spare container beam, a forklift (to move beam), a drum of oil, etc. This facility could be a lockable 20-foot container, a small fenced yard or, if inclement weather is common, possibly a covered area. The type of repairs made in or around this facility are mainly minor repairs or minor preventive maintenance services.

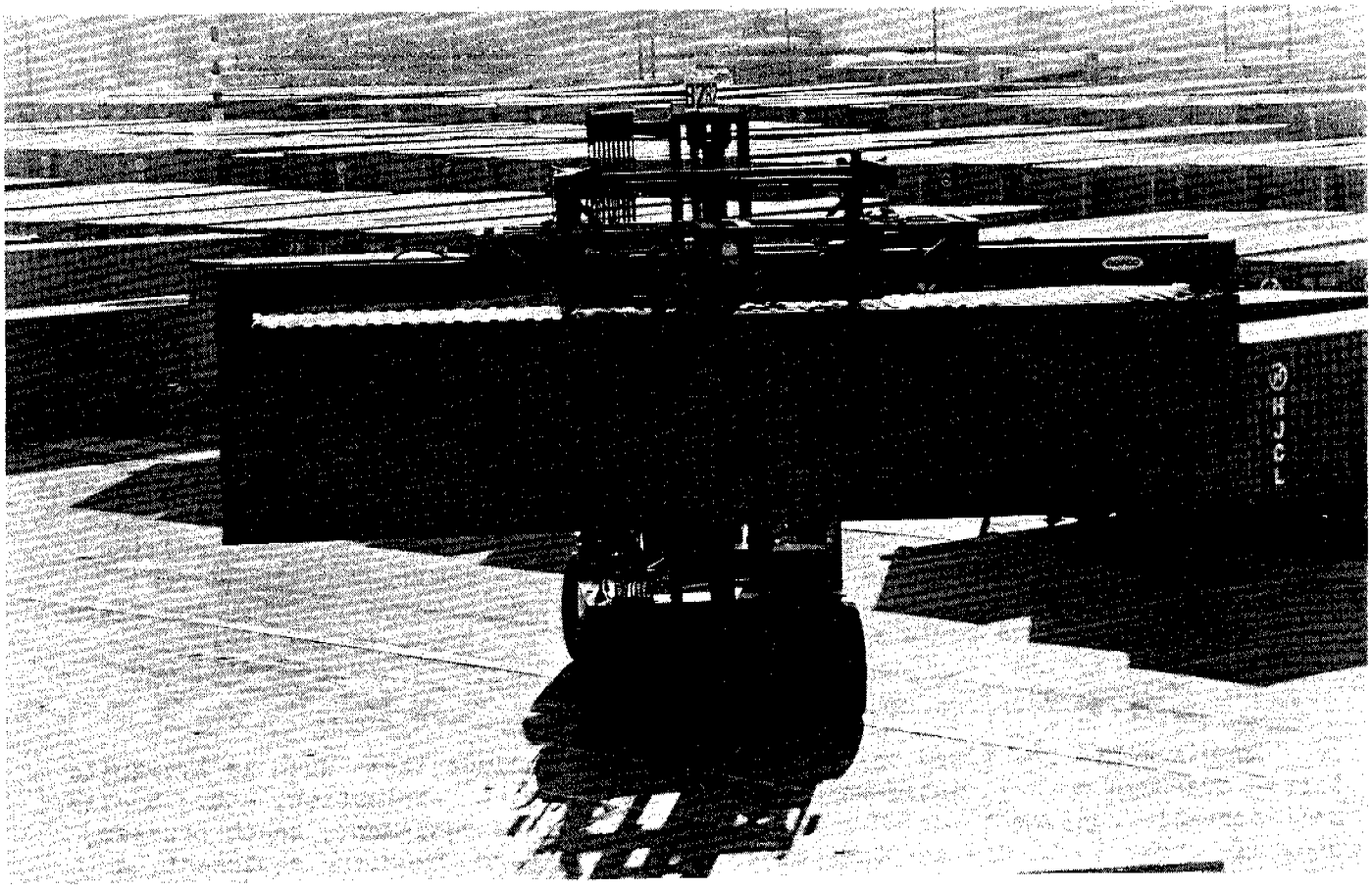
15. Failure repair and servicing for rail-mounted equipment, such as dock cranes, require mobile facilities. Good vehicles for this are service body-equipped trucks or vans containing a workbench, a few spare parts, a ladder, small power tools, a welding outfit, and any necessary blueprints or manuals. These mobile facilities can go to the scene of the failure and repair it on the spot. A special truck equipped with oil, grease, and pressure equipment to supply the lubricants to the area needed is an excellent vehicle for preventive maintenance servicing. Smaller equipment should be serviced and repaired at a facility designed for efficiency and quality of work, but large equipment must be repaired in the field. Minor repairs/services could also be done on small equipment in the field.

2. Maintenance equipment

16. Requirements for fixed maintenance equipment include items such as hydraulic lifts, overhead hoists, metal-working machines for part fabrication, etc. Smaller, semi-portable equipment includes air compressors, lube equipment, bench presses, etc. In order to handle the technology of today's cargo handling equipment, a further need exists for a hydraulics "clean room" and an electronics test room.



Breakbulk ship at work with 50 ton level luffing crane at standby



Toppick lift truck at work

17. Some mobile specialty equipment is also required. Possible choices are a high lift boom truck (light changes, painting); a mobile platform; diesel-powered mobile generator (for power failures); air compressor (for painting and driving air-powered tools); etc. This type of equipment, if readily available, could even be rented from nearby communities.

C. Equipment selection

1. Prearrange facilities

18. The last, but by no means least, area of support required for maintenance planning is the selection of cargo handling equipment. Most ports will already have equipment on hand, but they must eventually replace that equipment, and if they are changing modes (say breakbulk to containers), they will be purchasing additional or new types of equipment. However, before the equipment is actually ordered, some thought must be given to the maintenance of that particular piece/type of equipment.

19. Some type of facility or area must be prepared for this new or additional maintenance. New maintenance tools, equipment, shop layout, or training might be required. These items must be identified prior to the equipment being ordered, and they must be scheduled to be available, on site, prior to the equipment being delivered. The salespeople for the new equipment will be able to supply you with the needs of the equipment and should be able to assist you in planning your facilities and staff to meet those needs.

2. Technical skill availability training

20. The staffing needs for the new equipment include not only the manpower needed but also the particular skills required of that manpower. The manufacturer of the equipment will probably have training capabilities for maintenance of their particular type of equipment. If your prospective purchase is small, then your people would probably have to attend the training at their location, however, if you are making a major purchase, then you could require the manufacturer or sales agency to train your people at your facility.

3. Specifying maintainability and accessibility

21. When the specifications are written or the purchase decisions are made, a major criteria should be the maintainability of that equipment. Maintainability not only includes the capability of being maintained, but also the willingness of the supplier to furnish necessary operation and maintenance manuals. Other factors relating to maintainability are whether other units of equipment are on hand of similar design, whether parts are interchangeable with existing equipment, whether parts are readily available in the area, and whether the required skills are available to properly maintain the equipment.

4. Standardization

22. For those ports which have the option of doing so, it would be advantageous to specify particular makes and models of equipment so that many parts will be interchangeable and the craftsmen will be thoroughly familiar with the equipment. The problem with this type of purchase policy is that the port may become locked into a particular manufacturer of equipment. The dealer/manufacturer may begin

giving poor service at high prices. If the port deals with the lowest bidder (keeping in mind life cycle costs), the costs will be kept down, but the varieties of equipment will proliferate. One way to get the best of both policies is to order a large quantity of the required equipment so that additional purchases will not have to be made in the near future. Another way to reduce the one-manufacturer problem and still keep proliferation within bounds is to specify particular components within the equipment, such as a particular brand and size of diesel engine, or a particular make of control system. The desirability of standardizing wherever possible cannot be stressed enough due to cost (spare parts) and operational (maintenance and repair) savings to be realized by having minimal variety.

5. Parts availability

23. It is usually a good idea to require parts availability either locally or deliverable within a specified time (such as 48 hours). A list of recommended spare parts and special tools should be required from the vendor as part of the equipment sale offer. The price of these items should also be included. (3) The required/desired spares should then be purchased with the equipment so that they will be available as soon as the equipment is placed into service. Also, the provision of manuals must be mandatory. Sometimes equipment can be purchased with the first year's maintenance or repair included. If this occurs, your craftsmen can receive on-the-job training by working with the seller's craftsmen.

III. MAINTENANCE CONTROLS

24. It is necessary to create order out of chaos, to have control over the maintenance actions. These controls, of necessity, take the form of paperwork systems and scheduled follow-up. The first of these control systems is the work order system.

A. Work order system

25. The work order system consists of logging and assigning all jobs with a specific number. (4, 5) These numbers are then used to initiate work assignment follow-up and status reporting and for history reference. (6) The follow-up will include a determination of the work actually completed, and at a later date, the effect the completed work had on operations. The logged history can also be used to determine past over-all performance and the performance of specific groups or individuals. It is also important to know how long it takes to perform various services, what materials or parts work best for servicing, and the time between issuance of the work order and the actual start of the work. Jobs which are written but never completed should also be noted. This logging is also essential for legal reasons, such as recourse to injury lawsuits or claims of negligence. The logged work orders are also the basis of future planning and allow customer information and job status.

B. Work control

26. Prior to the beginning of each year, an annual work plan should be made for the coming year. This plan should include budgeted dollars, (7) manhours, and parts' costs by location for predicted work. A physical inspection of all equipment should be performed prior to developing this plan to determine what major projects need to be done (such as painting, tyre replacement, rail or paving replacement, etc.). When the annual work plan is complete, it should identify

costs for each type of equipment for each location. Then, throughout the year, the actual costs can be compared to those budgeted costs (8) to judge performance and the adaptations needed for the year-after budget.

C. Maintenance stores

27. A great deal of money is usually invested in parts and supplies and therefore a good record system is needed. This involves inventory control with maximums and minimums (reorder time and quantity), sources and methods of procurement, and usages of parts. (9) It is also necessary to have a method for initiating/controlling withdrawals from stores and recording where that withdrawal went. (10) The stock should be identified by type of equipment to which it applies, by date of purchase, length of time on the shelf and turnover rate, and by the cost of the stock. Specialized tools and portable repair equipment should also be stocked and controlled by stores personnel. There should be an established plan for procuring parts on an emergency basis. This plan would include a source of supply and a line of credit (or readily available cash). Sometimes parts must be manufactured due to suppliers going out of business or repair parts being non-existent, sometimes without even drawings existing.

28. Fuel disbursement/ordering should also be controlled by stores personnel. Forms must be devised to control the fuel going into the individual vehicles, (11) as well as fuel going into and out of the central tank. (12) It is best if all small vehicles fuel from a central tank (near your main stores area). However, larger equipment must be fuelled on site. For this on-site fuelling, a tank truck or trailer is essential. Sometimes it might be more cost effective to have a fuel sales agency deliver the fuel directly to the equipment tanks. The main areas of concern here are that you get all the fuel you pay for and the agency insures the availability of delivery whenever you need it - even if required at odd hours, on short notice, or on weekends.

D. Maintenance engineering

29. An essential part of the maintenance control function is technical evaluation of the equipment. For this function, the services of at least one (and possibly several specialized) maintenance engineer(s) is required. This person would conduct failure analysis based on work order logs, failure reports, (13) and special testing. He would audit or specify all major purchases for maintainability, interchangeability of parts, and performance characteristics. This engineer would also develop training programmes for the maintenance personnel and would develop the preventive maintenance instructions and schedules.

E. Other needs

30. Other methods of control are desirable, but are not necessarily required. One is a radio contact system so that the people can be contacted in the field. A radio contact system can be essential in a widespread operation. Portable radios are somewhat better than vehicle-mounted radios because of the greater flexibility of the portable device. Computer control for the various record-keeping functions is desirable also. A modern mini-computer is relatively inexpensive and does not require a great deal of expertise to operate. It can be used to collect the data and then retrieve it at will in any sort of pattern required. (14, 15) Real time computer systems are still in their infancy, but they show great potential for control and analysis of equipment.

IV. EQUIPMENT MAINTENANCE

A. Preventive maintenance (PM)

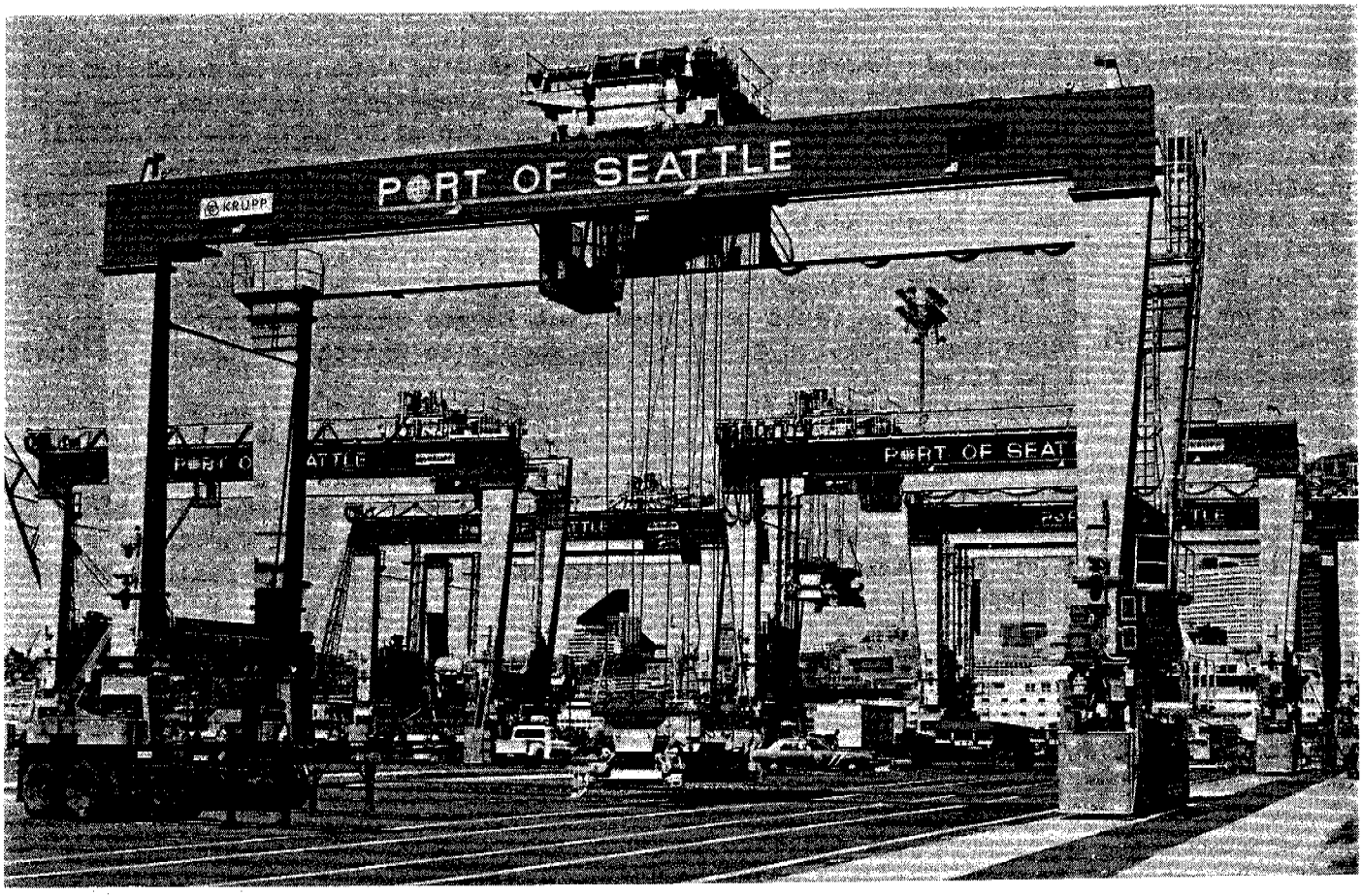
31. At one time, people used to repair equipment only when it broke down. The problem with this philosophy was that the equipment could not be depended upon, and in the modern day, when lost time has a large financial impact, dependability is becoming more and more important. Most organizations currently believe in preventive maintenance.

32. There are some drawbacks to preventive maintenance however. Much time is spent on this maintenance and sometimes the results of this time spent are not very obvious. Extra hours of run time are put on equipment just testing and servicing it. Sometimes parts can be overserviced - such as overlubricating bearings or tightening and loosening fittings excessively - causing premature failure or other related failure. If the equipment is not used often, keeping it in a state of constant readiness may cause costs to exceed revenues.

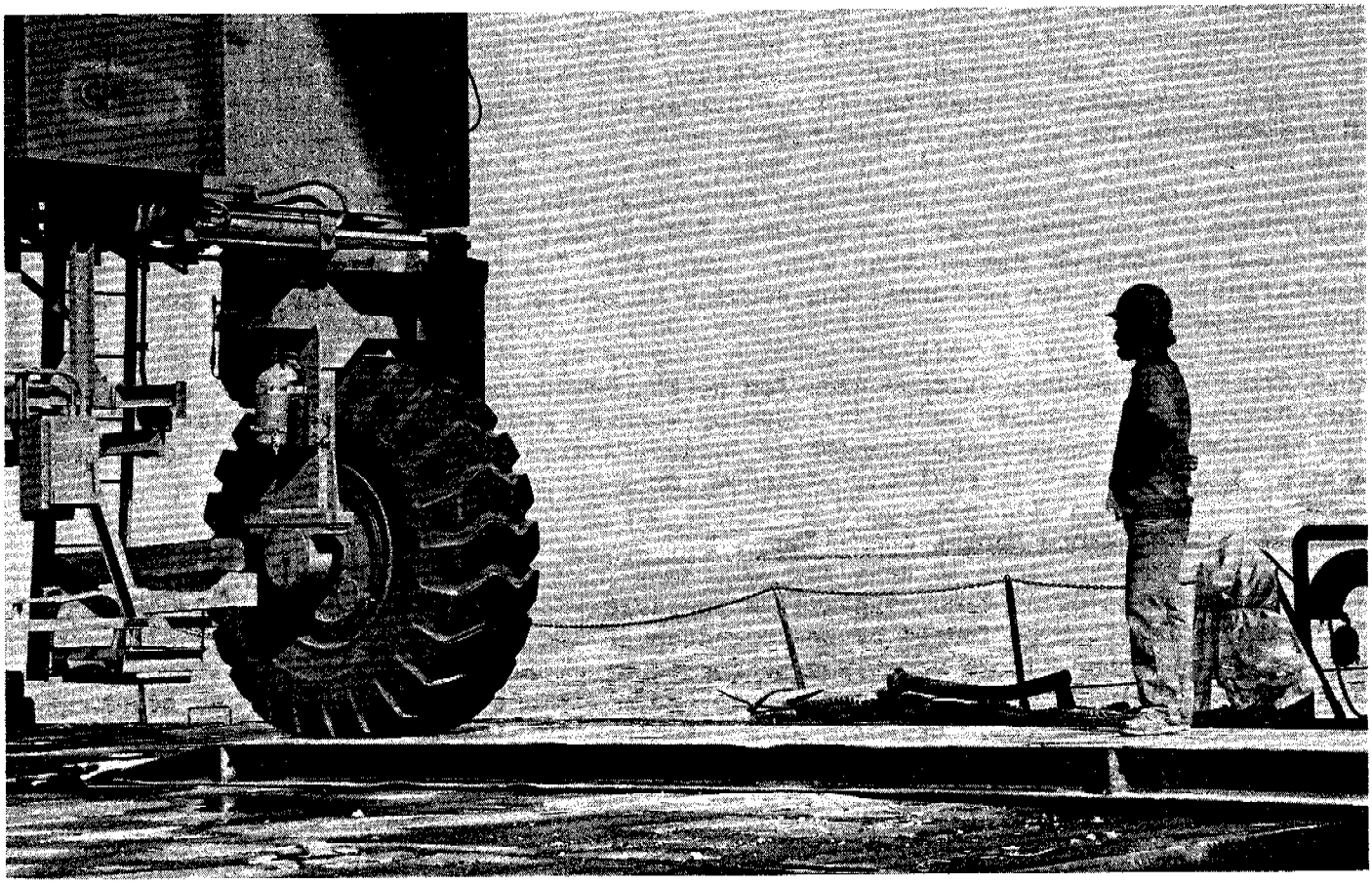
33. However, the advantages of a preventive maintenance system far outweigh the disadvantages for most situations. Knowledge that a piece of equipment has been recently serviced and therefore will probably not fail is of great benefit. Establishment of customer goodwill by having dependable equipment is also important. In some instances, where the port is directly liable for lost time penalties, a cost avoidance can actually be realized. Regular preventive maintenance can also safeguard equipment users from negligence claims in case of injury caused by failure. The amount of emphasis to be put on preventive maintenance depends greatly on the operating philosophy and image desired by the particular port authority. A typical scenario plans for 70 per cent of labour to be expended on preventive maintenance.

34. The manufacturer's recommendations are a good starting point to prepare a preventive maintenance procedure. It must be kept in mind that the manufacturer does not have to pay for the preventive maintenance (PM), so it is in his best interest to recommend excessive PMs. This causes the equipment to last longer and enhances the reputation of the manufacturer. Failure to follow the PM recommendations also supplies the manufacturer with an excuse if the equipment fails. In many instances, the manufacturer also specifies PMs to cover worst-case conditions, while your actual operating conditions may be much less severe. There are some of the reasons why the recommendations must be just a starting point. With this starting point as a base, specific PMs can be prescribed for your particular usage, for the skill level of your maintenance people, for the required reliability, for the extent of your maintenance tooling, and for the desired cost vs. revenue factor.

35. The PM will be initially set up and later revised on the basis of common sense and experience. For high usage equipment, the PM should be triggered by an hour meter, such as every 50 hours, 200 hours, 600 hours, etc. For low usage equipment, the PM should be triggered by the calendar, i.e. monthly, quarterly, yearly, etc. All metered jobs should also have at least one calendar PM so that if usage suddenly drops off on a particular piece of equipment, periodic checks will still occur. The equipment operating hours will have to be collected periodically, of course, to trigger the issuance of the scheduled PM. (16)



Rubber tire yard cranes being assembled



Rubber tire yard crane being moved

36. The low order PM (weekly, monthly, 50-hour, 200-hour, etc.) should be mainly a simple check. (17) It is designed to determine whether everything works well and to see whether there are any obvious faults at hand or developing. These low order PMs should only take two men about 1-2 hours each. If any major faults are found, they should not be corrected in the PM, but a separate work order should be written so that the time spent on the PM is not distorted. Minor repair/adjustments and other services should be accomplished within the PM; If the fault repair is not critical, it can be scheduled by the supervisor for a future time. If it is critical, the PM should be completed and then the fault corrected (but logged on the separate work order). Comments regarding condition of equipment should be written on the PM so that those comments will be filed.

37. Higher order PMs can include some routine items such as changing oils, lubrication, tune-ups, etc. (18) Still, any "unusual" faults noticed should be repaired on a separate work order. The purpose of the separate work order is to isolate unusual times so that a standard performance can be determined for the regularly scheduled PM, and also to separate routine service costs from failure repair costs for budgeting purposes.

38. Once it is decided what the PM is to encompass, then a decision must be made as to its presentation. There are two theories in this connection. One is that the PM should be very detailed. This theory is often practised by the military and aircraft industries where reliability is essential to the saving of lives. The other theory is to make the PM fairly non-specific and rely on the skills and technical knowledge of the craftsmen to determine the specifics. The drawback to the first theory is that the craftsmen can abrogate responsibility by only doing what is specifically called for. The drawback to the second theory is that the less skilled craftsmen will not know what to do and different craftsmen will do the same PM differently. The best method for port operations is probably somewhere in between these two theories, leaning more toward the detailed procedure for high production and/or low skill levels and leaning toward less specificity for highly skilled people or low-productivity type of operations. Whatever type of presentation is decided upon the actual wording should be easily changeable so that the PM service does not become obsolete and so that misinformation can be easily corrected.

39. A compromise type of system might be a very detailed checklist to make sure everything is inspected, but very general instructions to allow the craftsmen to check the items in whatever manner they wish. (18, 19) The PM should be readily identifiable as to who performed the service to assign accountability for good and bad results.

40. The PM follow-up should provide for noting any comments, writing work orders to correct any deficiencies, and spot-checking work at random to ensure completeness. (20) The maintenance engineer should also do failure analysis related to the PM to determine whether the PM should be revised, expanded, or contracted.

B. Maintenance during operations

41. Another type of routine maintenance is called operational maintenance. This maintenance is often performed by the operator of the equipment; however, on larger pieces of equipment, it is sometimes performed by skilled craftsmen. This operational maintenance includes checking fluid levels and equipment condition prior to start-up and after shut-down. (20) Operational maintenance is also listening for unusual

noises, looking for signs of excessive smoke or oil leaks, judging actual performance, and making minor adjustments during operation. If the operator is an experienced, skilled, or well-trained person, he can do most of this type maintenance, but he must be given some sort of form to allow feedback to the regular maintenance craftsmen. If the operators change frequently, are unskilled, or are unreliable, then these checks should be performed by the craftsmen themselves. Often it is worthwhile to have a craftsman stand and watch a piece of equipment in action for a few hours. The craftsman can then sometimes spot potential problems developing.

C. Maintenance response to equipment failures

42. The most critical type of maintenance is breakdown maintenance. For high-speed equipment (such as container cranes) this downtime can be very critical. In a breakbulk operation where a ship is in port for several weeks, the loss of a few hours is incidental, but in a container operation where ships are only in port for a day or two, a few hours' loss can be a significant percentage of operation time and can also ruin schedules at other ports if the ship sailing is delayed.

43. Response time therefore becomes very critical. Fast response entails a direct cost, however, so a trade-off must be considered. The fastest response is provided if the skilled craftsmen are available during all operating times at the location of the operating equipment. This would involve additional craftsmen for each piece of equipment to cover multiple breakdowns. Slow response time would be provided by having the craftsmen at home on call as needed. A compromise would be to have a craftsman at each location with additional craftsmen on call for multiple breakdowns, or else skilled craftsmen at a central location to be dispatched as needed at the job sites. The biggest problem with the latter method is that it often requires a skilled person on the job site to determine which particular craft needs to be dispatched to repair a failure.

44. There is often a need for temporary equipment repairs. This type of repair might include such things as bypassing a safety switch, temporarily welding a connector, wiring a broken part together, etc. When repairs of this nature are planned, the aspect of employee safety must be given prime consideration. Also, any temporary repairs should be recorded into a paperwork system which will ensure follow-up and an eventual permanent repair. (5) If these temporary repairs are not followed up, they can lead to unsafe equipment, additional lost time, and a reputation for sloppy workmanship.

45. A mobile vehicle (as mentioned earlier) will usually be needed for temporary repairs. Also needed are ladders for access, welding outfits, a vise, miscellaneous nuts, bolts, fuses, etc., and any common failure items, such as light bulbs, certain switches, etc. A skilled craftsman with a thorough knowledge of the equipment can save valuable time and will know what can and what cannot be temporarily repaired.

D. Equipment modifications

46. The final category of maintenance falls into the area of modifications. Modifications include design improvements, safety improvements, and occasionally miscellaneous changes requested by users.

47. Before making any modifications, all of the implications should be studied. Many times an item will be modified in one area which will cause a failure in another area, or the modification might compromise the safety of another area. When the modifications are completed, all drawings relating to the area modified should be updated and any preventive maintenance instructions should be updated.

48. The recommendations for design and/or safety improvements can come from many sources, such as operators, craftsmen, supervisors, manufacturers, and other ports. The cost implications should always be considered first, however, so that funds are not spent without adequate return.

V. RECORDKEEPING

49. Recordkeeping is an important part of equipment maintenance. Records can show trends and progress, the time to repair/replace equipment, and reasons for failure. Recordkeeping is also essential in order to prepare valid budgets.

A. Budgets

50. A maintenance budget should be established in order to provide a yardstick against which to measure the results of subsequent actions. The budget should be based on past performance modified for future expected usage, inflation, major expenditures, and goals. The budget may have to be revised from time to time during the year as situations change. The budget should be broken into categories by equipment types, locations and, where possible, by type of work performed, i.e., modifications, failure repair, etc. (7; 8)

B. Standardized coding for all equipment

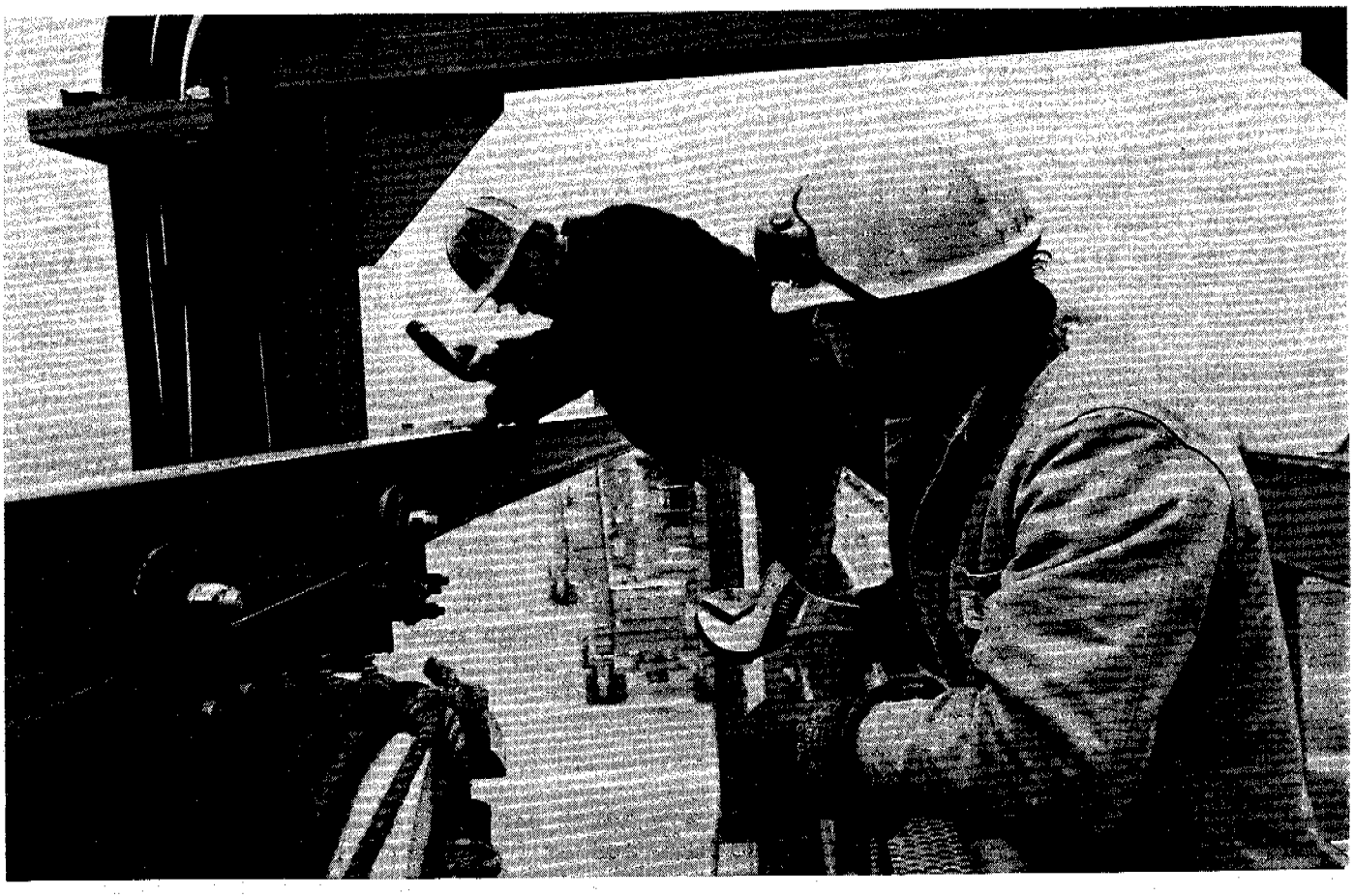
51. In order to keep systematic track of the various pieces of equipment, a standardized coding system should be established. This coding should include such differentiation as type of equipment (crane, lift, truck, hustler, etc.), location of equipment (for relatively immobile items), and individual equipment number. In addition, other items might be included, such as model number, manufacturer, or whatever other categories might assist you in identifying or sorting similar pieces of equipment. The coding should also be fairly simple so that people in the field will not make errors when filling out failure repair paperwork.

C. Equipment file

52. Each item of equipment should also have a file. Upon purchase, all information pertaining to that equipment piece should be filed. This would include manufacturing data and part numbers, maintenance manuals, instruction manuals, etc. (3, 21, 22, 23) Also, any servicing done during the life of the equipment should be recorded and/or filed. (24, 25, 4, 5, 10, 16-20) This file should be reviewed periodically to see if the piece of equipment is having excessive failures, is receiving adequate service, etc.

D. Applications of equipment history

53. Once the actual maintenance of the equipment is begun, it is very important to keep detailed history records. With the records, trends can be determined, preventive maintenance instructions can be modified, decisions on replacing equipment can be made, and past responsibility can be established.



Repairs on the work site

54. The history should be reviewed periodically by the maintenance engineer to determine what, if any, changes should be made. If a computer is available, it can be used to sort the failure history on the basis of equipment types, failure types, cost amounts, etc. This will help highlight the important data. The computer can also be set up to generate exception reports whereby repeated failures will be highlighted.

55. The history is invaluable in forecasting manpower and money needs. The best predictor of future needs is usually history (with some modifications for expected changes). The need to forecast manpower needs is essential to ensure that adequate craftsmen are trained and available. Financial forecasting is necessary to determine whether repair or replacement is more cost effective. A predictor often used is expected tonnage/TEUs/hours of usage for the equipment.

VI. MISCELLANEOUS

A. Safety

56. Safety is a most important issue which addresses safeguards on the equipment and safe practices by the craftsmen. Hard hats should be worn in many situations, people should stay clear when hoisting objects, tools should not be left lying around, lockouts should be provided on machinery, etc. Much time and money is lost due to carelessness which could be avoided. Periodic meetings must be held to emphasize safety and to obtain feedback from employees regarding unsafe practices and safety-related improvements. Many safety items are required by local or national laws.

B. Spare parts/storekeeping

57. Also important because of the costs are spare parts inventory and general storekeeping. It would be desirable to have spares for everything, but the purchase and carrying costs of the spares would be excessive. The opposite extreme would be to stock no spares and to purchase items as needed from vendors or manufacturers. This procedure causes excessive downtime while waiting for parts. An appropriate middle ground must be determined. This determination will be influenced by many intangibles, such as port reputation, reliability of vendors, local availability of supplies, etc. Another important factor will be the degree of standardization of equipment. Manufacturers will often provide a list of recommended spares. In order to ensure that this list is not inflated with unnecessary parts, it is important to specify that recommended spares be supplied as part of the initial purchase price.

58. Lead time should play a part in the spares selection also. If a critical part must be shipped from another area with a lead time of several days to several weeks, that part should be stocked. If a vendor down the street has a particular part in stock, the need for you to stock that part is low. If the cost to the Port for downtime due to waiting for parts can be quantified, that would help greatly in making spare parts inventory decisions. Many times the only short-term cost to the Port is lost goodwill, however.

C. Contracting maintenance work

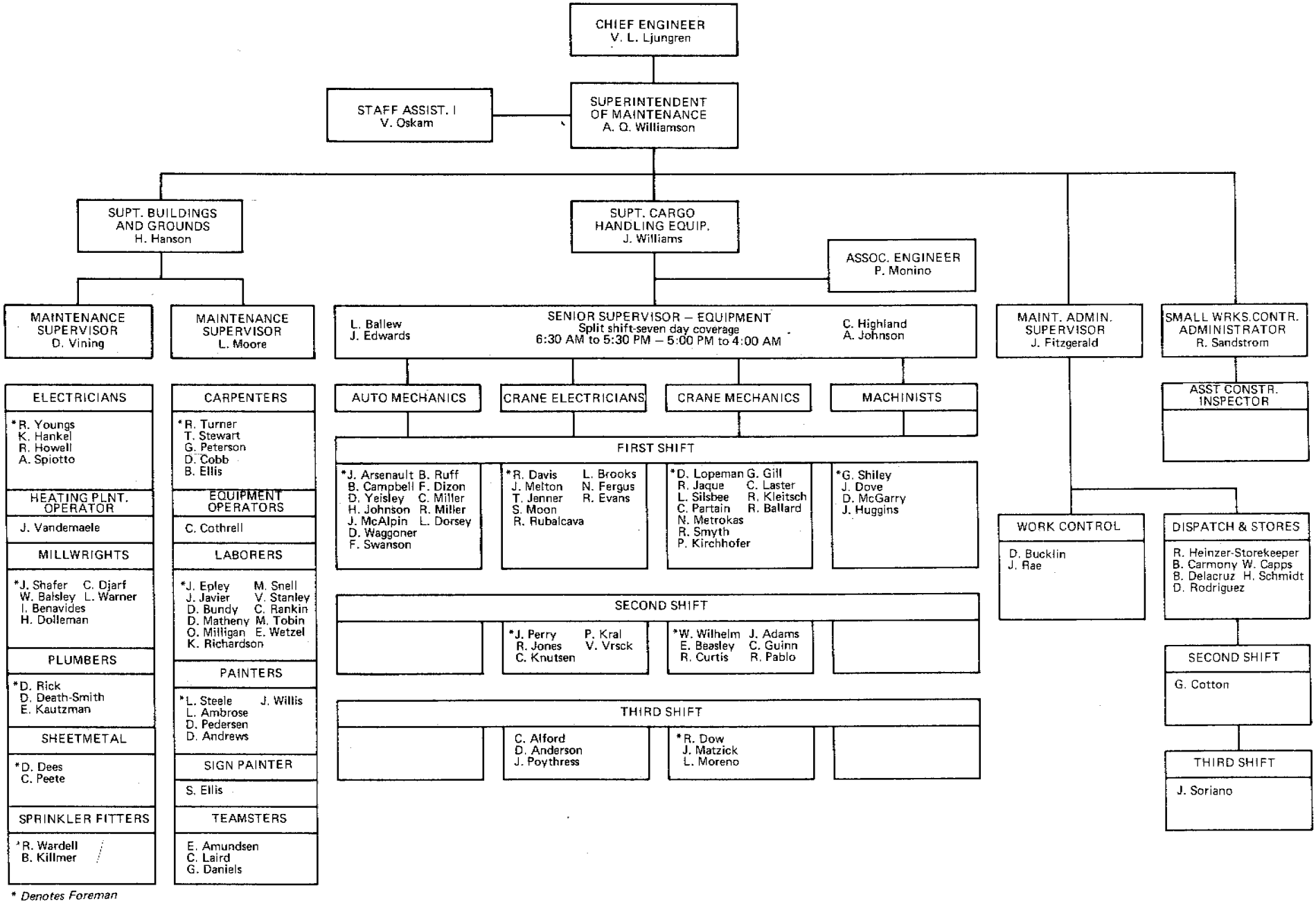
59. All ports contract some maintenance work. Total contracting is often a viable consideration for the smaller port if local firms are available who do heavy equipment maintenance. Care must be taken to ensure that the contractor is experienced in the type of maintenance planned and that he has adequate forces, supplies, and equipment available locally to give good performance. A method of analysing contractor performance should be established in order to determine whether to continue the contract, and possibly as a means of assessing damages.

60. The major drawbacks of contracting maintenance are cost and a loss of control over the quality of work and the emergency response time. Contracting maintenance also involves a third party in any problems regarding number of failures or poor service. If maintenance is contracted, an administration system must be set up to co-ordinate the maintenance. Contract administration requires high skill by experienced personnel. This entails not only paperwork control, but also field inspections and problem resolutions. A contractual maintenance plan requires exacting specifications and control.

APPENDIX

Exhibit 1

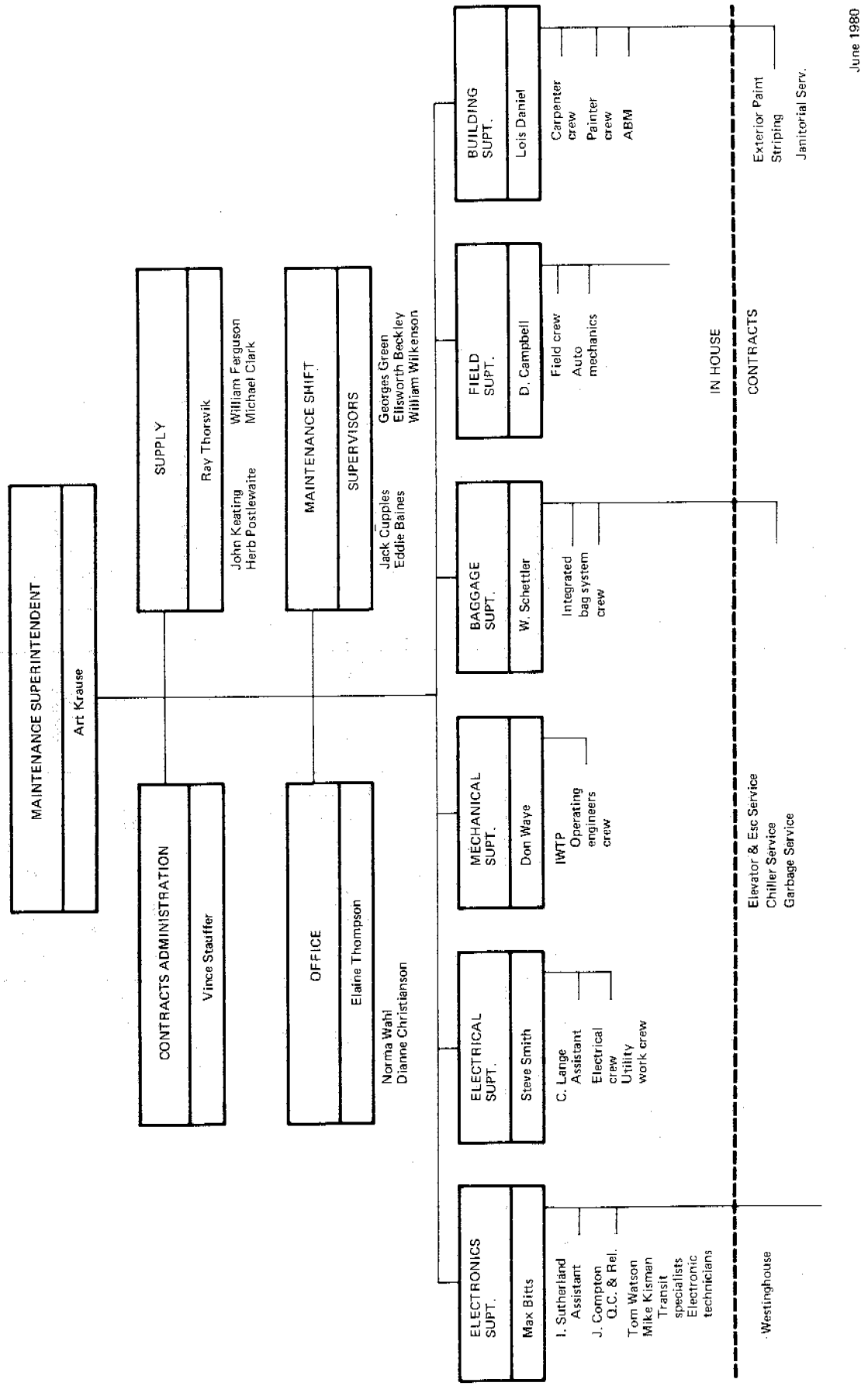
MAINTENANCE DEPT. ORGANIZATION CHART



* *Denotes Foreman*

Exhibit 2

Port of Seattle
AIRPORT MAINTENANCE



June 1980

Exhibit 3

FORMAT FOR SPARE PARTS LIST

CRANE SERIAL NO. REFERENCE DATE: RECOMMENDED SPARES LIST Page 1 of

SEQUENCE NUMBER	CONTRACTOR'S PART NO.	PIECE* MARK	DESCRIPTION	LOCATION/ FUNCTION	VENDOR NAME PART NO.	RECOMMENDED QUANTITY	UNIT PRICE	EXTENDED PRICE
1			Wiper Blade	Windshield Wiper				
2			Arm	Windshield Wiper				
3		02A	Saddle Assy, Int., Fixed & move	Festoon System				
4		02D	Wheel (Durethane), Saddle Type	Festoon System				
5		02C	Bumper, Saddle	Festoon System				
6		001	Flipper	Telescopic Spreader				
7		023	Bearing, Flange Cartridge	Telescopic Spreader				

* Manufacturer's identification shown on the drawing and marked on a unit of fabrication.

TYPE OR PRINT LEGIBLY

POS A-37

Exhibit 4

FUND

ORIGINAL-ENGINEERING

6402-82 WORK REQUEST-WORK ORDER NOTICE

WORK REQUEST NO. HRC 6/25/82

WORK ORDER NO. AMEND. NO.

CHIEF ENGINEER PLEASE PERFORM THE FOLLOWING WORK AT LOCATION Human Resources - Pier 66

Please move the door closer from the file room door to the back door in the Human Resources Department. (For further instructions, contact Renate Higgerson (3302) or Cheryl DeLosSantos (3286)

163-7740

RECEIVED
JUN 24 1982
SHOP

Charles R Blood

DATE REQUIRED ▶ 6/28/82 REQUESTED BY ▶ Charles Blood DATE ▶ 6/23/82 DEPT. HEAD ▶ Charles Blood

TO MAINTENANCE SUPT. ADMIN. ENGINEER PROPERTY MGR.

S/O 43328

EST. AMOUNT _____ COMM. AUTH. DATE _____

ABOVE WORK AUTHORIZED BY ▶ _____ DATE ▶ 6/29/2 CHIEF ENGR. ▶ EXEC. ▶

TO CHIEF ENGINEER THE ABOVE WORK HAS BEEN COMPLETED – NOTE EXCEPTIONS

BY ▶ DATE ▶

ORIGINAL-ENGINEERING
COPY2-ENGINEERING FILE
COPY3-CONTROLLER/ACCOUNTING
COPY4- AIRPORT/WATERFRONT MANAGERS
COPY5-PROJECT ENGINEER
COPY6-REQUESTOR

PORT OF SEATTLE

Exhibit 5

57552

MAINTENANCE SERVICE ORDER

TERMNL.	EQ./BLD. NO.	ITEM TYPE	WORK ORDER/ACCOUNT NO.
37	36	CRANE	157-7815

SERVICE REQUESTED/PROBLEM REPORTED: No Hoist.

DATE REQUIRED BY	TIME REQUIRED BY	DATE NOTIFIED	TIME NOTIFIED	P.M.	G.M.	OTHER	WORK REQUEST NUMBER
1/29/83	ASAP	1/29/83			✓		✓

REQUESTED BY	TELEPHONE NUMBER	WRITTEN BY	TELEPHONE NUMBER
ILWU		Moon	

SPECIAL INSTRUCTIONS (BILLING DATA, CONTACTS ETC.)

QUANTITY AND UNITS	MATERIALS	STOCK/REQN. #	DESCRIPTION OF WORK DONE AND NAME OF CRAFTSMAN	HOURS	DATE
			Replaced HMT contacts with spare from BJT.		
			Brooks & Moon	2	

TOTAL PARTS	EQUIPMENT METER READING BEFORE	EQUIPMENT METER READING AFTER	TOTAL LABOR

ACCEPTED BY	FOREMAN SIGNATURE	SUPERVISOR SIGNATURE	WORK ORDER COMPLETE ☐
		1-30-83	WORK ORDER INCOMPLETE ☐

180-19 Rev. 12/80

WHITE - MAINTENANCE/ACCOUNTING YELLOW - TERMINAL FILE PINK - INITIAL CRT INPUT GREEN - FOREMAN FILE

Exhibit 5 (continued)

MAINTENANCE SERVICE ORDER INSTRUCTIONS

INFORMATION REQUIRED FROM REQUESTOR/WRITER

A TERMINAL – LOCATION OF EQUIPMENT.

B E.Q./BLD. NUMBER – EQUIPMENT NUMBER OR BUILDING LOCATION OF ITEM.

C ITEM TYPE – CRANE, BOILER, WATERLINE, ROOF, FORKLIFT, ETC.

D WORK ORDER/ACCOUNT NO. – WORK ORDER NUMBER OR COST CENTER-ACCOUNT (EQUIPMENT) NUMBER.

E SERVICE REQUESTED/PROBLEM REPORTED – A SHORT DESCRIPTION OF WHAT NEEDS TO BE DONE OR WHAT HAS HAPPENED.

F DATE REQUIRED BY – IF UNKNOWN, INDICATE BY DASH.

G TIME REQUIRED BY – IF UNKNOWN, INDICATE BY DASH.

H DATE NOTIFIED – DATE WHEN SERVICE/PROBLEM REPORTED TO THE SHOP

I TIME NOTIFIED – TIME WHEN SERVICE/PROBLEM REPORTED TO THE SHOP.

J P.M., G.M., OTHER – CHECK PREVENTIVE MAINTENANCE, GENERAL MAINTENANCE, OR OTHER (DAMAGE REPAIR, WORK REQUEST, ETC.)

K WORK REQ. NO. – WORK REQUEST NUMBER (IF APPLICABLE).

L REQUESTED BY – NAME OF REQUESTOR OR "BEEPER".

M TELEPHONE NUMBER – WHERE REQUESTOR CAN BE REACHED (DASH FOR BEEPER).

N WRITTEN BY – THE PERSON WHO FILLS OUT THE TOP PART OF THE MSO.

O TELEPHONE NUMBER – THE NUMBER FOR THE PERSON IN "G" ABOVE, MAKE DASH IF SAME AS REQUESTOR.

P SPECIAL INSTRUCTIONS – INVOICE TO, CUSTOMER ORDER NUMBERS, RELATED PAPERWORK NUMBERS, CONTACT FOR INFORMATION, ETC.

INFORMATION REQUIRED FROM THE CRAFTSMAN DOING THE WORK

A QUANTITY AND UNITS – QUANTITY OF MATERIALS USED AND UNITS RELATED TO THAT QUANTITY.

B MATERIALS – DESCRIPTION, VENDOR, PART NUMBER ETC.

C STOCK/REQN. # – STOCK OR REQUISITION NUMBER.

D DESCRIPTION OF WORK DONE – COMPLETE DESCRIPTION AND NAME OF CRAFTSMAN.

E HOURS – HOURS SPENT PERFORMING WORK. (IN HOURS AND TENTHS OF AN HOUR)

F DATE – DATE OF HOURS SPENT.

G EQUIPMENT METER READING – (IF APPLICABLE) HOUR METER READING OR ODOMETER READING WHEN EQUIPMENT SERVICED REQUIRED FOR ALL PM WORK, OPTIONAL ON OTHERS.

H ACCEPTED BY – SIGNATURE OF TENANT PERSONNEL ACKNOWLEDGING NOTIFICATION. WRITE NOT AVAILABLE WHERE TENANT PERSONNEL CANNOT BE FOUND. MADE DASH IF NOT APPLICABLE.

I COMPLETE – MAKE CHECK MARK IF WORK ORDER COMPLETE.

J INCOMPLETE – MAKE CHECK MARK IF WORK ORDER INCOMPLETE.

INFORMATION REQUIRED FROM OTHER PERSONNEL

- STOCK/REQN. # – MATERIAL COST FROM WORK ORDER ADMINISTRATOR.
- TOTAL PARTS – TOTAL MATERIAL COST FROM WORK ORDER ADMINISTRATOR.
- TOTAL LABOR – FROM FOREMAN.
- FOREMAN SIGNATURE – SIGNATURE SIGNIFYING COMPLETE MSO FORM.
- SUPERVISOR SIGNATURE – SIGNATURE SIGNIFYING COMPLETE MSO FORM.
- WORK ORDER COMPLETE – SUPERVISOR CHECK IF WORK ORDER IS COMPLETE.
- WORK ORDER INCOMPLETE – SUPERVISOR CHECK IF WORK ORDER IS INCOMPLETE.

Exhibit 6

Job assignment form

Job No.	Due Date	Date Issued to Craftsmen	Date Completed	No. of Hours	Misc.
Crane #				Unit P.M.	

Exhibit 7

REPORT NUMBER GLR512 (FCR512) PORT OF SEATTLE PAGE 349
DATE-TIME RUN 01/19/82 BUDGET SPREAD SHEET SEQUENCE: HIERARCHY POINT, ACCOUNT

WORKING BUDGET NO 02 WHOLE DOLLARS
1130110... TERMINAL 37 FACILITY

DESCRIPTION / ACCT NO.	JAN / FEB	MAR / APR	MAY / JUNE	JULY / AUG	SEPT / OCT	NOV / DEC	TOTAL
77310000	600	600	600	600	600	600	
SERVICE SYS-OTHER							
77330000							
SERVICE SYS-FIRE CONTROL	300	400	400	400	400	400	4,600
77350000	400	400	400	400	400	300	
ELEVATOR & ESCALATORS				400			400
77400000							
PARKING LOTS			300	400	300		2,200
77500000		300	300	300	300		
FENCES	300	300	300	300	300	300	3,700
77550000	300	300	300	300	300	400	
REMODEL AND ALTERATIONS		100	100	100	100	100	1,000
77600000		100	100	100	100	100	
COMMUNICATION SYSTEMS	650	650	650	650	650	650	8,000
77700000	650	750	650	650	750	650	
CRANES CONTAINER	17,500	17,500	17,500	17,500	17,500	17,500	210,000
78150000	17,500	17,500	17,500	17,500	17,500	17,500	
YARD CRANE MAINTENANCE	5,350	5,350	5,350	5,350	5,350	5,350	64,200
78280000	5,350	5,350	5,350	5,350	5,350	5,350	
FDA SANITATION			250				500
78500000				250			
OTHER EQUIPMENT		250			250		1,000
78810000			250			250	
CUSTOMER REIMBURSABLE							
78900000							
CUSTOMER REIMBURSEMENT							
78910000							
MAINTENANCE EXPENSE	27,850*	29,550*	29,850*	43,600*	29,700*	29,000*	368,000*
76500000	28,900*	30,100*	30,250*	30,250*	29,850*	29,100*	
OPERATING & MAINT EXPENSE	32,130*	33,780*	34,080*	47,830*	33,930*	33,230*	419,000*
70000000	33,130*	34,380*	34,480*	34,530*	34,080*	33,420*	

Port of Seattle

Exhibit 8

REPORT NUMBER GLR311 (FCR312)
DATE-TIME RUN 102182

PORT OF SEATTLE RESPONSIBILITY HIERARCHY
RESPONSIBILITY STATEMENT
SEPTEMBER1982

SEQUENCE: ACCOUNT

1130110157 TERMINAL 37 R.E. MAINTENANCE

MONTH-TO-DATE ACTUAL THIS MO	MONTH-TO-DATE BUDGET THIS MO	MONTH-TO-DATE VARIANCE DOLLAR	MONTH-TO-DATE VARIANCE %	ACCT NUMBER	DESCRIPTION	YEAR-TO-DATE ACTUAL THIS YTD	YEAR-TO-DATE BUDGET THIS YTD	YEAR-TO-DATE VARIANCE DOLLAR	YEAR-TO-DATE VARIANCE %	PURCHASE COMMITMENTS
					OPERATING & MAINT EXPENSE					
					OPERATING EXPENSE					
			.0	74110000	SIGN MODIFICATIONS	634	150	484	322.8	
9,216	3,330	5,886	176.8	74220000	CRANE OPERATING EXPENSE	64,646	29,970	34,676	115.7	
5,219	1,605	3,614	225.2	74280000	YARD CRANE OPERATING EXPENSE	45,462	10,215	35,247	345.1	
4		4	.0	76200000	TAXES	235		235	.0	
14,440	4,935	9,505	192.6	70500000	TOTAL OPERATING EXPENSE	110,977	40,335	70,642	175.1	
					MAINTENANCE EXPENSE					
374	800	426-	53.2	76510000	WHARVES & PIERS	5,182	7,400	2,218-	30.0	
1,190	750	440	58.7	76600000	BUILDINGS	12,882	6,750	6,132	90.9	
2,759	600	2,159	359.8	77000000	TRUCK SCALES	4,586	5,050	464-	9.2	
347	700	353-	50.5	77100000	YARD AREAS	7,408	19,600	12,192-	62.2	
457	400	57	14.2	77150000	LANDSCAPING	12,959	7,139	5,820	81.5	
			.0	77200000	DRIVES & ROADS	3,502	1,200	2,302	191.8	
605	1,000	395-	39.5	77300000	SERVICE SYS-MECHANICAL	10,118	8,600	1,518	17.6	
479	600	121-	20.1	77310000	SERVICE SYS-ELECTRICAL	12,519	5,200	7,319	140.8	
465	400	65	16.2	77350000	SERVICE SYS-FIRE CONTROL	5,164	3,500	1,664	47.5	
113		113	.0	77400000	ELEVATORS & ESCALATORS	209	400	191-	47.9	
	300	300-	100.0	77500000	PARKING LOTS	39	1,900	1,861-	98.0	
	300	300-	100.0	77550000	FENCES	144	2,700	2,556-	94.7	
1,765	100	1,665	664.9	77600000	REMODEL & ALTERATIONS	4,885	700	4,185	597.9	
81-	650	731-	112.5	77700000	COMMUNICATION SYSTEMS	2,385	5,950	3,565-	59.9	540
38,692	20,210	18,482	91.4	78150000	CRANES, CONTAINER	222,016	191,050	30,966	16.2	2,774
19,211	10,140	9,071	89.5	78280000	YARD CRANE MAINTENANCE	99,277	62,520	36,757	58.8	3,409
			.0	78500000	FDA SANITATION	36	500	464-	92.8	
	250	250-	100.0	78810000	OTHER EQUIPMENT	185	750	565-	75.3	
3,802		3,802	.0	78900000	CUSTOMER REIMBURSABLE	21,235		21,235	.0	
1,121-		1,121-	.0	78910000	CUSTOMER REIMBURSEMENT	38,049-		38,049-	.0	
69,057	37,200	31,857	85.6	76500000	TOTAL MAINTENANCE EXPENSE	386,682	330,909	55,773	16.9	6,723
83,497	42,135	41,362	98.2	70000000	TOTAL OPERATING & MAINT EXPE	497,658	371,244	126,414	34.1	6,723
83,497-	42,135-	41,362-	98.2	00000000	NET AFTER OPERATING & MAINT	497,658-	371,244-	126,414-	34.1	6,723-
					INDIRECT EXPENSE					
					ALLOCATED COSTS					
74		74	.0	86110000	ALLOC INSURANCE FROM ADM/OH	209		209	.0	
57,799		57,799	.0	86170000	MARINE MAINTENANCE OVERHEAD	160,355		160,355	.0	
11,405		11,405	.0	86220000	ALLOCATED MARINE MAINTENANCE	39,478		39,478	.0	
5,548		5,548	.0	87000000	ALLOCATE ADMINISTRATIVE OVER	15,585		15,585	.0	

Exhibit 9

Stores record card

DATE MO. DAY YR.	DOCUMENT OR DEPT. NO.	QTY.	BAL.	DATE MO. DAY YR.	DOCUMENT OR DEPT. NO.	QTY.	BAL.	DATE MO. DAY YR.	P.O. OR REQ'N NO.	QTY.

SOURCE (1)		(2)					
UNIT OF ISSUE		UNIT COST		LEAD TIME DAYS		ORDER POINT	
STOCK NO.		DESC.		LOCATION			

Exhibit 10

1) TODAY'S DATE

2) DATE REQUIRED

PORT OF SEATTLE
STORES TRANSFER/REQUISITION

Nº 42740

3) MARK FOR	
A) PERSON	
B) DEPARTMENT	
C) LOCATION	BUILDING

4) CHARGE TO	
A) ACCT. NO.	
B) W/O NO.	

5) PARTS ARE FOR (Name plate data if applicable)	MSO NUMBER
6) SUGGESTED SOURCE OF SUPPLY (If known)	

7) ITEM NO.	8) STOCK NO.	9) DESCRIPTION	10) QTY REQ	11) UNIT	12) SP	13) STOCK LOCATION	4) CHARGE TO	14) QTY REC.	15) UNIT PRICE	16) TOTAL	17) *

18) MAT. REQ. NO.	20) ORDERED BY		* FOR CREDIT	24) SUBTOTAL	
	21) APPROVED BY			25) SALESTAX	
19) PUR. ORD. NO.	22) FILLED BY	DATE		26) GRAND TOTAL	
	23) RECEIVED BY	DATE			

DPIC1.00
180-8

Exhibit 10 (continued)

1. TODAY'S DATE - self-explanatory. Enter the numeric day, month and year.
2. DATE REQUIRED - this is the date the material is needed to begin the work. Enter the numeric day, month, and year.
3. MARK FOR - this section will contain information on who and what department is to receive the material.
   a. Person - the name of the person who is to receive the items
   b. Department - the name and the classification of accounts department number.
   c. Location - the specific area, including a building name or number if appropriate, where the items are to be delivered.
4. CHARGE TO - this section will contain information on which account is to be charged for the material ordered. Caution : MSO numbers will not be recorded as "Charge To" accounts.
   a. Account Number - the classification of account number as assigned by the Accounting Department.
   b. Work Order Number - the number assigned to each work order by the Engineering Department.
   c. MSO NUMBER - the number assigned to the Maintenance Service Order by the Waterfront Maintenance Shop.
5. PARTS ARE FOR - a brief description of what the material will be used on or for.
6. SUGGESTED SOURCE OF SUPPLY - where the items can be purchased, if known.
7. ITEM NUMBER - as each stock number or description is entered, the next consecutive number will be recorded.
8. STOCK NUMBER - part number, manufacturer's number, or vendor's number associated with the item.
9. DESCRIPTION - a brief explanation of what the part is.
10. QUANTITY REQUIRED - the number of units needed.
11. UNIT - the unit of measure associated with the item.
12. S/P - "S" for each item issued out of stock. "P" for items purchased.
13. LOCATION - designated area assigned to each stock item.
14. QUANTITY RECEIVED - number of units issued.
15. UNIT PRICE - price per unit of measure.
16. TOTAL - total price per item number (block 14 times block 15).
17. * - check when items are returned for credit.
18. MATERIAL REQUISITION NUMBER - printed number in the upper righthand corner of the Material Requisition.
19. PURCHASE ORDER NUMBER - printed number in the upper righthand corner of the Purchase Order.
20. ORDERED BY - name of the person placing the order.
21. APPROVED BY - signature of the person authorized to purchase the material.
22. FILLED BY - name of the person retrieving the items from the storeroom.
23. RECEIVED BY - name of the person receiving the items.
24. SUB-TOTAL - total of column 16.
25. SALES TAX - sales tax involved for items consumed by the Port.
26. TOTAL - combined total from block 24 and 25.

Exhibit 11

MONTHLY VEHICLE GAS REPORT	MONTH/YEAR	LOCATION	VEHICLE NUMBER

INSTRUCTIONS: At the end of each month, please return this form to Charles Huey, General Services, Pier 66. Odometer reading must be indicated at end of each month.

DATE	GAL. of GASOLINE	PUMP NUMBER	QUARTS of OIL	ODOMETER READING	COMMENTS
TOTALS					

160-44

Exhibit 12

PORT
OF
SEATTLE

GAS DISBURSEMENT No. 40111

Date _____ 19___

Mileage _____

Vehicle No. _____

Issued by _____

ACCOUNTING
CODE

Remarks _____

YOUR SALE NO	GALLON READING - FINISH	10THS
PREVIOUS SALE NO.	GALLON READING - START	10THS

Gallons Delivered ➔

MOTOR OIL ADD _____

OK _____

Rec'd By _____

FORM 180-32

Exhibit 13

Copies To:
SYSTEM ENGR.
REAL ESTATE
TERMINAL 18
SS 4-12-82

EQUIPMENT FAILURE TIME REPORT

NAME OF SHIP	WORKING
PANCALDO	☑ YES ☐ NO

DATE: 4-9-82
TERMINAL: 18
LOCATION: SAME

REPORTED BY
☐ SUPV. ☑ PAGE BOY ☐ TOWER PERS. ☐ DOCK PERS. ☐ FOREMAN ☐ DISPATCHER ☐ OTHER _____

LAST NAME OF REQUESTOR OF SERVICES	LOCATION WHEN CONTACTED	TIME-TRAVEL TO RESPOND	ON TERMINAL?	SHOP?	OTHER
UNKNOWN	T-37	—	☐ YES ☑ NO	☐ YES ☑ NO	

TYPES EQUIPMENT REQUIRING REPAIRS OR SERVICE

CRANE #	RTG #	OTHER #
36		

CAUSES OF MALFUNCTIONS:

AREA	ELECTRICAL	MECHANICAL	OTHER, INDICATE BELOW
☐ BRAKES	☐	☐	☐
☐ MAIN HOIST	☐	☐	☐
☐ BOOM	☐	☐	☐
☑ TROLLEY	☐	☑	☐
☐ ENGINE	☐	☐	☐
☐ GEN. ENGINE HOUSE	☐	☐	☐
☐ GANTRY	☐	☐	☐
☐ OTHER	☐	☐	☐

SUSPECTED DEFECTIVE COMPONENTS: / REMARKS:

SEAT NEED AJUSTMENT ON SEAT WAS OK - OPERATOR TROLLY WIRE - TROLLY WIRE ONE MORE NOTCH - ALSO SLIDING WINDOWS CLOSED - MADE TEMPORARY REPAIR

COFFEE BREAK (2000HRS) COMPLAINED ABOUT LOOSE WAS TIGHT BUT TIGHTEN DIDN'T STAY

BEAM No	☐ ELECTRICAL	☐ MECHANICAL	☐ HYDRAULIC	☐ TWIST LKS
CAUSE				
USER DAMAGE	☐ ELECTRICAL	☐ MECHANICAL	☐ HYDRAULIC	☐ OTHER
CAUSE				

OPERATOR ABUSE	OPERATOR ERROR	OTHER, INDICATE
☐ YES ☑ NO	☐ YES ☑ NO	

MISC. EMER. CALLS:

WORK ACCOMPLISHED DURING COFFEE BREAK NO DOWNTIME CKN

MACHINE DOWN AT	MACHINE BACK ON-LINE	TOTAL DOWNTIME	NAME
2000	2010	NO DOWNTIME	

Exhibit 14

REPORT DATE 02/06/84 MSDUNDY MSD'S FOR TERMINAL 18 PAGE 9

JANUARY 1983

LOCATION	SYSTEM NUMBER	ITEM TYPE	DESCRIPTION	DATE COMPLETED		MSD HOURS	CRAFT
18	000	01	MOVE 36 SOUTH, MOVE 28 TO 1950	1/27/	83	04.00	CRNO
18	000	01	MONITOR 36 & 37	1/ 2/	83	07.50	CRNO
18	000	01	RELOCATE ALPHA TERM. UNITS	1/ 3/	83	75.50	CREL
18	000	01	CK & MAINTAIN 28 & 32	1/ 7/	83	02.00	CREL
18	000	01	BEAM CHANGE, 32 & 28	1/ 7/	83	03.00	CREL
18	000	01	START & CHECK 36 & 37	1/ 7/	83	04.00	CREL
18	000	01	START & CHECK 32, 28, 29	1/ 7/	83	06.00	CREL
18	000	01	NO WORK LIGHTS ON 28/29	1/ 7/	83	02.00	CREL
18	000	01	CK CONDITIONS & UPS 32/29/28	1/ 7/	83	02.00	CREL
18	000	01	CK OUT 36/37 FOR OPERATORS	1/ 7/	83	03.00	CREL
18	000	01	CK OUT 36/37 FOR OPERATORS	1/ 8/	83	02.00	CREL
18	000	01	CK OUT 28/32/29 FOR OPERATIONS	1/ 8/	83	03.00	CREL
18	000	01	CK C/O OF ELECT SYS 32/28	1/ 8/	83	02.00	CREL
18	000	01	CK C/O OF ELECT SYS 36/37	1/ 8/	83	02.00	CREL
18	000	01	CHECK BEARS ON 29/32	1/ 8/	83	02.00	CREL
18	000	01	CHECK BEARS ON 36/28	1/ 8/	83	02.00	CREL
18	000	01	REMOVE ANEMOMETER GEN 36/37	1/11/	83	02.00	CREL
18	000	01	START UP 28/29/32 & CHECK OUT	1/ 8/	83	04.50	CRNO
18	000	01	START UP & CHECK 36 & 37	1/ 2/	83	04.00	CRNO
18	000	01	START UP & CHECK 28 & 32	1/ 2/	83	03.50	CRNO
18	000	01	CK CONDITION & OPER. 28, 32	1/ 2/	83	03.00	CREL
18	000	01	CHECK OUT 36 & 37	1/ 3/	83	02.00	CREL
18	000	01	CK ELEC CONTRL WORKS, 36 & 37	1/ 3/	83	02.00	CREL
18	000	01	LOST POWER ON 28/32	1/ 7/	83	03.00	CREL
18	000	01	CK FLCV SYSTEM ON B-106	1/ 6/	83	03.00	CREL
18	000	01	CK CONDITION & OPERATION 36/37	1/14/	83	04.00	CREL
18	000	01	CK CONDITION OF BEAMS 32/36/37	1/14/	83	02.00	CREL
18	000	01	CK OUT 36/36/37 & SHUT DOWN	1/15/	83	03.00	CREL
18	000	01	CHECK BEARING ON 36/32/28	1/15/	83	04.00	CREL
18	000	01	SHUT DOWN 36/37 & CK SPREADERS	1/16/	83	02.00	CREL
18	000	01	START UP 36 & 37	1/ 2/	83	02.00	CREL
18	000	01	START UP 28 & 32	1/ 2/	83	02.00	CREL
18	000	01	MAKE MOUNT BOLTS, 36, 37	1/ 5/	83	02.00	FILM
18	000	01	GANTRY FRAME COVER BOLTS, 36,37	1/ 5/	83	06.00	CREL
18	000	01	SHUT DOWN 28 & 32	1/ 2/	83	02.00	CRNO
18	000	01	MONITOR 28, 32, 36 & 37	1/ 2/	83	05.50	CRNO
18	000	01	MONITOR 28/29/32/36	1/ 8/	83	04.50	CRNO
18	000	01	START UP 36/37 & CHECK OUT	1/ 7/	83	04.00	CRNO
18	000	01	START UP 28/32/29 & MONITOR	1/ 7/	83	04.50	CRNO
18	000	01	START UP 28/32 & CHECK OUT	1/ 2/	83	02.00	CRNO
18	000	01	MONITOR 36 & 37	1/ 3/	83	05.50	CRNO
18	000	01	SHUT DOWN 27/32	1/ 8/	83	04.00	CRNO
18	000	01	WORK ON HEAD BLOCK ON 28/29	1/12/	83	02.50	CRNO
18	000	01	BEAM CHANGE, 28 & 32	1/ 6/	83	03.00	CRNO
18	000	01	SHUT DOWN 28 & 32	1/ 6/	83	03.00	CRNO
18	000	01	MONITOR 36/37 WORKING SHIP	1/ 7/	83	01.00	CRNO
18	000	01	MONITOR 28/29/32 WORKING SHIP	1/ 7/	83	01.50	CRNO
18	000	01	START UP 36/37 & MONITOR	1/ 8/	83	05.00	CRNO
18	000	01	START UP 28/32 & MONITOR	1/ 8/	83	05.00	CRNO

Exhibit 15

REPORT DATE 02/07/83 MSOMUNDY MSO'S FOR CRANES #8 & #7 PAGE 2
JANUARY 1983

ITEM NUMBER	CR/FT	DESCRIPTION	DATE COMPLETED	MSO HOURS
036	CRNO	START & CHECK	1/19/ 83	02.00
036	CRNO	SHUT DOWN & CK OIL & WATER	1/19/ 83	02.00
036	CRNO	MONITOR	1/19/ 83	01.50
036	CRNO	MONITOR	1/25/ 83	02.00
036	CRNO	START AND CHECK	1/20/ 83	02.00
036	CRNO	MONITOR	1/26/ 83	01.50
036	CRNO	MOVE TO 1950' MARK	1/17/ 83	02.00
036	CRNO	CK BEAM, ENG.OIL & WATER	1/18/ 83	02.00
036	CRNO	MONITOR	1/17/ 83	02.50
036	CRNO	START UP & CHECK	1/18/ 83	02.00
036	CRNO	MONITOR	1/18/ 83	03.00
036	CREL	INSTL 100 FT SHOREPOWER CORD	1/31/ 83	04.50
036	CREL	NO CONTROL PWR LIGHT/BACKREACH	1/17/ 83	01.00
036	CREL	BYPASS THE UP-STOP LIMIT	1/25/ 83	04.00
036	CREL	BEAM NOT WORKING	1/29/ 83	02.00
036	CREL	INSTL SHORTPOWER EXT CORD	1/16/ 83	02.00
036	CRE2	CHECK OUT & SHUT DOWN	1/18/ 83	02.00
036	CREL	REPL BURNED OUT LIGHTS	1/30/ 83	02.00
036	CRNO	MONITOR	1/19/ 83	03.50
036	CRNO	CK OUT BEAM & BOOM SLACK LIMIT	1/20/ 83	02.00
036	CRNO	MONITOR WORKING SHIP	1/21/ 83	02.00
036	CRNO	REPL ROLLER PIN ON BEAM 120	1/28/ 83	01.00
036	CRNO	MOVE TO 1550' MARK	1/27/ 83	02.00
036	CRNO	MONITOR, CHECK BEAM 120	1/29/ 83	01.50
036	CRNO	START, CHECK & MONITOR	1/29/ 83	02.50
036	CRNO	BEAM & HOUR CHANGES	1/29/ 83	04.00
036	CRNO	MAINTENANCE	1/30/ 83	03.00
037	CRNO	MOVE NORTH TO FIRST PIN HOLES	1/ 6/ 83	02.00
037	CRNO	BOOM UP & MOVE OFF SHIP	1/30/ 83	02.00
037	CREL	INTERMITTENT LOSS CONTROL PWR	1/ 7/ 83	03.00
037	CREL	OPERATE & CK HOIST & TROLLEY	1/ 2/ 83	11.00
037	CREL	MAIN BREAKER NOT WORKING	1/ 9/ 83	01.50
037	CREL	R/R ONE BOOM DOC FLOODLIGHT	1/16/ 83	02.00
037	CREL	BROKEN TWIST LOCK	1/ 3/ 83	03.00
037	CREL	INTERMITTENT CONTROL POWER	1/10/ 83	01.00
037	CRIT	NO HOIST	1/ 2/ 83	02.00
037	CREL	REPL BOOM A/C LIGHTS	1/ 4/ 83	02.00
037	CREL	INTERMITTENT HOIST,NO TROLLEY	1/ 8/ 83	06.00
037	CREL	CK BOOM WARNER & MOVE	1/ 9/ 83	04.00
037	CRNO	MOVE TO SOUTH	1/ 8/ 83	01.00
037	CRNO	REPLACE FLIPPER	1/ 7/ 83	01.00
037	CRNO	START, CHECK BEAM,BOOM,SLACK	1/14/ 83	02.00
037	CRNO	MOVE NO. TO 2850' MARK	1/ 6/ 83	02.00
037	CRNO	REPAIR CORNER ROLLER, B-12A	1/ 3/ 83	02.00
037	ELEC	RELAMP ELEVATOR CARS & PITS	1/17/ 83	02.00
037	PNTR	PAINT WINDOW FRAME	1/14/ 83	02.00
037	CRNO	CK FUEL LEAK & REPAIR	1/23/ 83	02.50
037	CRNO	MONITOR WORKING SHIP	1/ 8/ 83	01.00
037	CRNO	MOVE TO BOW OF THE SHIP	1/ 9/ 83	02.00
037	CREL	INTERMITTENT TROLLEY	1/ 8/ 83	07.00

Exhibit 16

PORT OF SEATTLE

MAINTENANCE DEPARTMENT

Equipment operating hours for week ending _____

Straddle Carrier	
Nº	Hour meter reading
8	
9	
10	
11	
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Exhibit 17

PREVENTIVE MAINTENANCE INSTRUCTIONS

PMI #: 100161 * JOB TITLE: HITACHI DIESEL 50 HOUR SERVICE PAGE 1

	DESCRIPTION	OK	BAD	COMMENTS
1.	RECORD HOUR METER READING. 13153			
2.	CLEAN CRANE - MACHINE HOUSE, CABS, ETC., IF NEEDED. clean			
3.	VISUALLY NOTE SPOOLING OF WIRE ROPE ON DRUMS, REPORT ABNORMAL CONDITION. ok			
4.	CHECK OIL LEVEL IN HYDRAULIC SUMP TANK FOR SPREADER. ok			
5.	CHECK ALL INSTRUMENTS FOR FUNCTIONAL OPERATION. ok			
6.	MAKE OPERATIONAL CHECK OF CRANE. ok			
7.	VISUALLY INSPECT CONDITION OF LADDERS AND SAFETY RAILS, REPORT DISCREPANCIES. ok			
8.	CLEAN ALL DIRTY WINDOWS ON CRANE. clean			
9.	MAIN ENGINE			
	A. CHECK OIL LEVEL. ADD 1 Gal			
	B. CHECK COOLANT LEVEL. OK			
	C. CHECK HYDRAULIC STARTER FLUID LEVEL. ok			
10.	AUXILLARY ENGINE			
	A. CHECK OIL LEVEL. ADD 2 qt.			
	B. CHECK COOLANT LEVEL. ok			
11.	HOIST AND DRIVES Lube Lube			
	A. CHECK LUBRICATION OF OPEN GEARS (BOOM HOIST, MAIN HOIST, TROLLEY, GANTRY). Lube Lube			

Exhibit 18

PREVENTIVE MAINTENANCE INSTRUCTIONS

PMI #: 102185 CHAIN->802185 * JOB TITLE: HITACHI ELECTRIC 2400 HOUR SERVICE PG 1

DESCRIPTION		OK	BAD	COMMENTS
1. HOUR METER	[ ]			
2. LIGHTS				
A.WORK FLOODS	[ ]			
B.WALKWAY	[ ]			
C.MACHINE HOUSE	[ ]			
D.CAB	[ ]			
E.AIRCRAFT	[ ]			
F.BOOM DOG	[ ]			
3. M G SET-3				
A.DIRT	[ ]			
B.OVERHEATING	[ ]			
C.MOUNTING BOLTS	[ ]			
D.GREASE LEAKAGE	[ ]			
E.BRUSHES/HLDRS	[ ]			
F.COUPLINGS	[ ]			
G.MOIST HTR.	[ ]			
H.LUBE BEARING	[ ]			
I.MEGGER	[ ]			
J.WIPE INTER.	[ ]			
K.COMMUTATOR	[ ]			
4. HOIST MOTOR-2				
A.MOIST HEATERS	[ ]			
B.DRUM BRK ADJ	[ ]			
C.DIRT-VENT-AIR	[ ]			
D.COUPLINGS	[ ]			
E.BRUSHES/HLDRS	[ ]			
F.OVERSPD SWITCH	[ ]			
G.GREASE LEAKAGE	[ ]			
H.FANS & MOTOR	[ ]			
I.FAN FILTER	[ ]			
J.LUBE BEARING	[ ]			
K.LINING & DRUMS	[ ]			
L.BOLTS	[ ]			
M.MEGGER	[ ]			
N.WIPE INTER.	[ ]			
15. GANTRY BELLS-2	[ ]			
16. TROLLEY MOTOR				
A.DIRT-VENT-AIR	[ ]			
B.MOIST HEATERS	[ ]			
C.DRUM BRK ADJ	[ ]			
D.BRUSHES/HLDRS	[ ]			
E.COUPLINGS	[ ]			
F.GREASE LEAKAGE	[ ]			
G.FANS & MOTOR	[ ]			
H.FAN FILTER	[ ]			
I.LUBE BEARINGS	[ ]			
J.BOLTS	[ ]			
K.LINING & DRUM	[ ]			
L.MEGGER	[ ]			
M.WIPE INTER.	[ ]			
17. GANTRY MOTORS-8				
A.DIRT	[ ]			
B.OPER PROBLEMS	[ ]			
C.MOIST HEATERS	[ ]			
D.BRUSHES/HLDRS	[ ]			
E.BRAKES ADJUST	[ ]			
F.BRAKE CONTACTS	[ ]			
G.WIRES/CONNECTS	[ ]			
H.INTERNAL J-BXS	[ ]			
I.CONDUITS	[ ]			
J.MEGGER	[ ]			
K.WIPE INTER.	[ ]			
18. BOOM MOTOR				
A.DIRT-VENT-AIR	[ ]			
B.MOIST HEATERS	[ ]			
C.COUPLINGS	[ ]			
D.BRUSHES/HLDRS	[ ]			
E.DRUM BRK ADJMT	[ ]			
F.BAND BRK THRST	[ ]			
G.GREASE LEAKAGE	[ ]			
H.OVERSPD SWITCH	[ ]			
I.LINING & DRUM	[ ]			
J.MEGGER	[ ]			
K.WIPE INTER.	[ ]			
19. L/SINTERNALLY				
A.HOIST OVERHOIST	[ ]			
B.HOIST GEARED-4	[ ]			
C.TRLLY GEARED-6	[ ]			
D.BOOM UPPR STOP	[ ]			
E.BOOM GEARED-4	[ ]			
F.BOOM DOG	[ ]			
G.TRIM-MOTOR-2	[ ]			
H.RAIL PIN-2	[ ]			
I.RAIL CLAMPS-4	[ ]			
J.SHEAVE FRAME-2	[ ]			
10.CONTROL CENTER				
A.DIRT-VENT-AI	[ ]			
B.WIPE & VACUM	[ ]			
B.OVERHEATING	[ ]			
C.MOIST HEATERS	[ ]			
D.LOOSE PARTS	[ ]			
E.LIGHTS	[ ]			
F.TRANSFORMER	[ ]			
G.FANS PANEL	[ ]			
H.FANS REGULATOR	[ ]			
I.CONNECTIONS	[ ]			
J.OPEN CONTACTORS AND RELAYS	[ ]			

Dm. 1/16

NOTE = Need some start up sheets, and some 12X16X1 Hoist Filters on crane.

17. C Moist heaters (Replaced) Missing all motor checks except # 5 + 1

Cleaned & checked OK 1/16 D.M.

Part of Seattle

38

PREVENTIVE MAINTENANCE INSTRUCTIONS

PMI #: 102185 CHAIN->802185 CHAIN->802195 * JOB TITLE: HITACHI ELECTRIC 2400 HOUR SERVICE PG 2

DESCRIPTION

- K.OPEN CONTACTRS AND RELAYS [ ]
- L.CLEAN CABINETS IN AND OUT [ ]
- M.RESISTOR BANKS CONNECT,CLEAN [ ]
- N.J-BXS, INTER. [ ]

11. EMERGENCY STOPS [ ]
- A.GRND INTERN.-4 [ ]
- B.BOOM [ ]
- C.CAB [ ]
- D.MACHINE HOUSE [ ]

12. SHEAVE FRAME
- A.OPER PROBLEMS [ ]
- B.LIGHTS-INTR. [ ]
- C.CONDUITS, J-BXS INTERNALLY [ ]
- D.BALONEY CABLE [ ]
- E.PLUGS-INTERN. [ ]

13. BOOM [ ]
- A.CONSOLE-INTER. [ ]
- B.J-BOXS-INTER. [ ]
- C.CONDUIT [ ]

14. CAB
- A.CONSULES-INTR. [ ]
- B.BEAM PANEL-INT [ ]
- C.FACILITIES-INT [ ]
- D.TRANSFORMERS [ ]
- E.FESTOON VISUAL [ ]
- F.DIRT [ ]
- G.BEAM J-BX INT. [ ]

15. INTERCOM
- A.LEG-2 [ ]
- B.CAB [ ]
- C.BOOM [ ]
- D.MACH HOUSE [ ]

16. WIND WARNER [ ]
- A.LIGHTS-2 [ ]
- B.HORN [ ]
- C.RELAYS [ ]
- D.BOLTS TIGHT [ ]
- E.(5 SEC) DELAY [ ]
- F.HAND HLD TEST [ ]
- G.VOLTAGE CALBR [ ]
- H.CLN ANNEM. [ ]

17. MACHINE HOUSE
- A.FAN, CLEAN [ ]
- B.HEATERS, CLEAN [ ]
- C.J-BXS INTERN. [ ]
- D.CONDUITS [ ]

18. SERVICE HOIST [ ]
- A.OPERATION [ ]
- B.LIMIT SWITCHES [ ]
- C.PENDENT CABLE [ ]
- D.PUSH BUTTONS [ ]
- E.LOAD TEST [ ]
- F.CONTROL PANEL INTERNALLY [ ]

19. CRANE OPERATION [ ]

20. SLACK ROPE [ ]
- A.CONDITION [ ]
- B.TIGHTEN LOAD CELLS [ ]
- C.VOLTAGE CALIBR [ ]

21. 5 KV TRANFMER [ ]

22. ANTI-SWAY [ ]
- A.OPERATION [ ]
- B.SOLENOIDS-INT [ ]
- C.CONTROLS-INT. [ ]
- D.J-BOX-INT. [ ]

23. BOOM LATCH
- A.THRUSTOR [ ]
- B.J-BXS/CONDUIT [ ]

24. 4160 SWITCHES IN MACHING HOUSE
- A.REMOVE [ ]
- B.CLEAN [ ]
- C.TIGHTEN CONN. [ ]

25. RAIL CLAMPS-4 [ ]
- A.SOLENOIDS [ ]
- B.J-BXS,INTER. [ ]
- C.CONDUITS [ ]

26. J-BOXES INTER.
- A.TRUCKS [ ]

OK	BAD	COMMENTS
		A.A
		1/16

Exhibit 19

ACCOUNTING OR FILE COPY

REPORT NUMBER: PM0530-01

PORT OF SEATTLE

JOB NUMBER: 102185

DATE-TIME RUN: 01/14/83 - 00:12

PREVENTIVE MAINTENANCE SYSTEM

DIRECT INQUIRIES FOR...
EQUIPMENT------382-3588
BUILDINGS------382-3577
REQUESTED BY:

PREVENTIVE MAINTENANCE SERVICE ORDER

COST CENTER: 0000157
ACCOUNT NO: 000007815

DATE: 01/14/83 DUE DATE: 02/13/83

SERVICE REQUIRED: PERFORM PM JOB 102185

LOCATION	ITEM DESC	ITEM NO	ITEM TYPE	FREQUENCY	CRAFT
370	CRAN	039	01	2400 U	CRANE ELECTRICIANS

HITACHI ELECTRIC CONTAINER CRANE 2400 HOUR SERVICE
METER READING 10345

MATERIALS

QTY	NO.	ARTICLE	REQ	COST
		1/31/83 ALFORD & Anderson	13	
		2/1/83 Anderson ALFORD	8	

LABOR

DESCRIPTION OF WORK ACCOMPLISHED	HOURS
1-16-83 Anderson/Poythress	5 hrs
1/16/83 Pierce/Moon	12.5
1/18/83 ALFORD/Anderson	7
1/19/83 Alford and Boythress/Anderson	17 hrs
1-20/83 Boythress/Alford	3 hrs
1-20-83 melton/EVANS	8 Hrs
1-21-83 Alford/Boythress	10 hrs
1/-2283 Anderson/Poythress	2 Hrs
1/22/83 Knutsen/Jones	6 hrs
1/24/83 Anderson/ALFORD	5 hrs.
1/25/83 ALFORD/Anderson	5 hrs
1-27-83 Alford-Boythress	8 hrs
1-28-83 Alford-Boythress	10 hrs

TOTAL MATERIAL:

TOTAL LABOR:

SERVICE MEN:
FOREMAN: Charles Alford
DATE: 2/1/83
SUPERVISOR: Paul E. Radke 2-1-83

REF. DISCREPANCY MSO:

Exhibit 20

CONTAINER CRANE START-UP AND SHUT-DOWN LOG

LOCATION	JOB TITLE	CRAFT
T-46	Elect.	Elect

VESSEL NAME	VOYAGE NO.	START-UP DATE	CRANE NUMBER
Tres.		1/28/83	#41

STARTING TIME	HOUR METER	WATT METER
0600	6242.8	0623

PROCEDURAL STEP	COMMENTS
1. Start-up motor generator set.	
2. Energize motor controls.	
3. Check electrical system for control power to all crane motions.	
4. Make operational check of crane.	
5. Are crane capacity and speed charts posted and visible to operator.	
6. Are special warnings and operation instructions posted in the cab and machine house.	

SHUT DOWN TIME	DATE	HOUR METER	WATT METER
0800	1/27/83	6269.5	625

1. Are crane ladders and hand safety rails in good repair.
2. Are rail clamps and pin anchors secure and in place.
3. Remove control power from crane and shut-down motor-generator set.
4. Note any repairs needed on crane as result of this inspection.

REMARKS Beam Locer L.te out.

Signature of Craftsman

REPORT ANY INDICATION OF OPERATIONAL ABUSE OF EQUIPMENT TO YOUR SUPERVISOR

Exhibit 21

EQUIPMENT DATA AND PARTS

VEHICLE	MAKE YEAR	PARTS	NUMBER	MISCELLANEOUS
	MODEL	FILTERS		
	SER. NO.	OIL		
ENGINE	MAKE TYPE			
	MODEL	FUEL		
	SER. NO.			
TRANS	MAKE	AIR		
	MODEL			
	SER. NO.	TRANS		
DRIVE AXLE	MAKE	HYDRAULIC		
	MODEL	BEARINGS		
STEER AXLE	MAKE			
	MODEL			
GENERAL INFORMATION	WEIGHT			
	LENGTH			
	HEIGHT			
	WIDTH	INJECTORS		
		SPARK PLUGS		
PARTS	NUMBER	COND.		
V-BELTS		POINTS		
		CAPS		
U-JOINTS				
KING PINS				
U-HOSE				
L-HOSE				

180-27

Exhibit 22

CAPACITIES AND OTHER DATA

ENGINE	MAKE	TIRES	FRONT	SIZE
	MODEL			PRESSURE (LBS.)
	SERIAL NO.		REAR	SIZE
	OIL CAPACITY (QTS.)			PRESSURE (LBS.)
COOLING SYSTEM	CAPACITY (QTS.)	BATTERIES	TYPE	
			CAPACITY (AMP.-HRS.)	
MAIN TRANSMISSION	MAKE	AUXILIARY TRANSMISSION	MAKE	
	MODEL		MODEL	
	CAPACITY (PTS.)		CAPACITY (PTS.)	
DIFFERENTIAL		CARGO BODY OR TANK	MAKE	
			MODEL	
			CAPACITY lbs. or gals.	

MOUNTED EQUIPMENT

	MAKE			MAKE	
	SIZE	MODEL		SIZE	MODEL
	MAKE			MAKE	
	SIZE	MODEL		SIZE	MODEL

Exhibit 23

LUBRICATION RECOMMENDATIONS

PART	LUBRICANT		SERVICE INTERVAL	
	SUMMER	WINTER	MILES OR DAYS	
ENGINE CRANKCASE				
TRANSMISSION				
DIFFERENTIAL				
WHEEL BEARINGS				
CHASSIS FITTINGS				

VEHICLE IDENT. N

Exhibit 24

VEHICLE HISTORY

NOTE REPLACEMENT OR REPAIR OF MAJOR COMPONENTS

ITEM	MILEAGE	DATE	MILEAGE	DATE	MILEAGE	DATE	MILEAGE	DATE
CRANKSHAFT								
MAIN BEARINGS								
CONNECTING ROD BEARINGS								
CAMSHAFT								
CYLINDER LINERS								
PISTONS, PINS, RINGS								
EXHAUST VALVES								
INTAKE VALVES								
SUPERCHARGER								
DIESEL INJECTORS								
DIESEL INJECTION PUMP								
CARBURETOR								
AIR COMPRESSOR								
GENERATOR OR ALTERNATOR								
STARTING MOTOR								
BATTERY								
RADIATOR								
CLUTCH								
TRANSMISSION (MAIN)								
TRANSMISSION (AUX.)								
DIFFERENTIAL								
DRIVE AXLE SHAFTS								
UNIVERSAL JOINTS								
WHEEL BEARINGS (REAR)								
WHEEL BEARINGS (FRONT)								
FRONT AXLE KING PINS, BUSHINGS								
TIE-ROD ENDS								
BRAKE LININGS								

Exhibit 25

PM	JANUARY	FEBRUARY	MARCH	APRIL	MAY	JUNE	JULY	AUGUST	SEPTEMBER	OCTOBER	NOVEMBER	DECEMBER	VEHICLE IDENT. NO
A													
B													
C													

MAINTENANCE MANAGEMENT SYSTEM

08	09	10	11	14	15	16	18	20	21	22	25	26	27	28	29	30	32	33	34	35	36	38	39	40	41	42	43	44	45	46	48	49	50	51	52	53	55	56	60	61	62	63	64	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	DATE	WORK ORDER NUMBER
		FRAME	STEERING	SUSPENSION	WHEEL/RIM/HUB/BEARING	AXLES, DRIVEN	CLUTCH, REPLACE/REBUILD	CLUTCH, REPAIR/ADJ.	DRIVE SHAFTS	POWER TAKE OFF	TRANSMISSION, REPLACE	TRANSMISSION, REPAIR	AIR INTAKE SYSTEM	COOLING SYSTEM	EXHAUST SYSTEM	FUEL SYSTEM	POWER PLANT, REPLACE	POWER PLANT, REPAIR	CHARGING SYSTEM	CRANKING SYSTEM	BATTERY	IGNITION SYSTEM	LIGHTING SYSTEM	CAB/SHEET METAL	INSTR./GAUGES/METERS	HEATING/VENTILATION	AIR CONDITIONING	BODY (TANK) INTERIOR	BODY (TANK) EXTERIOR	DOORS	VEH. COUPLING SYSTEM	ACCESSORIES	LANDING GEAR	POWER TAIL GATE	WINCH	RADIO EQUIPMENT	TOWING	CLEANING/PAINTING	TIRES	LUBE	EMISSION CONTROL DEVICES	HEATING UNIT	MECHANICAL REFRIG.	CONDENSER	EVAPORATOR	PUMP	CYLINDER PISTONS	LINES/HOSES/FITTINGS	CONTROLS	VALVES	FLUID RESERVE TANK	COMPRESSOR	FRAME/SUPPORTS	PIVOTS/PINS	BLADES/BUCKETS	HOISTING DEVICES	CABLES	ROLLER/BOGGIES	TRACKS/CLEATS	BROOMS/BRUSHES	CHAINS/SPROCKETS	SAFETY EQUIP.	OTHER		