

P&PD MAINTENANCE PROGRAM

STUDY

MAY 1982

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## P&PD MAINTENANCE PROGRAM STUDY

### 1.0 INTRODUCTION

#### 1.1 Statement of the Purpose

The purpose of this study is to evaluate the maintenance requirements of all Printing and Photography Division equipment, except copiers and physical plant utilities and systems, in order to establish specific maintenance programs (MP), where feasible; and to develop a system to track and report on Division maintenance costs and requirements, both scheduled and unscheduled, as determined from this study.

#### 1.2 Statement of the Problem

The scope of the P&PD maintenance support or requirements has never been defined. Additionally, P&PD has not had any formal system of tracking and recording maintenance problems and costs. The latter, in particular, has become a more visible concern of P&PD's operating budget and a contributing factor to the purpose of this study.

#### 1.3 Facts Bearing on the Problem

Since the magnitude of this project seemed quite large, there were obviously other concerns besides inventory and dollar value. Some of these are:

1.3.1 Maintenance Definitions - Develop a means of defining the type or level of maintenance/repair service required, and determine who has the primary responsibility for performing the level of service defined.

1.3.2 Category Determinations - Task component management to decide which definition of maintenance best applies to each piece of equipment in each component.

1.3.3 Assess In-House Maintenance Capabilities - Survey the maintenance personnel for education, experience, and training qualifications, and analyze the depth-of-responsibility as it applies to P&PD equipment.

1.3.4 Spare Parts - Inventory P&PD's spare parts and determine a dollar value if possible. Consider the impact of spare parts procurement for selected equipment.

1.3.5 Contractual Maintenance - Gather data on the costs and extent of P&PD contract maintenance, and survey branch manager's assessments in terms of 'Are we getting what we pay for?'

1.3.6 System Determination - Consider what means will be used to provide a system to track and report on Division maintenance requirements and costs.

1.3.7 References - Research existing systems from other government or commercial sources to provide guidance, comparison, or other input in developing an effective system for P&PD.

## 2.0 DISCUSSION

### 2.1 Project Scope

The original concept of this project was to conduct a preventive maintenance study. This intent gradually expanded to developing a total system to encompass all facets of preventive maintenance and cost control through computerized means. More recently, because of the obvious scope of the project and a different managerial perspective, the purpose has been modified to developing background information as a means of providing a senior management tool for decision making in charting the future of a P&PD maintenance program. The ADP considerations, for the preparation of a functional specifications statement of any such program, have been delegated within the Plans, Programs, and Systems Staff, and will be dealt with separately from this report. In addition, for the purpose of semantic simplification, the 'preventive' reference has been dropped and the project is now referred to as the 'Maintenance Study.' Preventive maintenance is considered to be just one part of an overall maintenance program.

### 2.2 Data Collection

As a base for defining the scope of the maintenance problem, it was decided to inventory P&PD's equipment through use of the Condoliated Material Records (CMR's). The inventory was divided into the same two categories shown on the CMR printout; namely, Controlled items and Non-Expendable items. Each Division component was inventoried by CMR Sub-account. The results are shown in Figure 1. Additional discussion of this subject is contained elsewhere.

### 2.3 Maintenance Definitions

P&PD has several hundred CMR-defined pieces of equipment which require various levels of maintenance. Since this equipment mix has never been defined before, this study attempted to provide an arbitrary means of cataloging the types and sources of maintenance that apply to Division equipment. Five categories were decided upon as best summarizing the maintenance situations

**NUMBER OF EQUIPMENT ITEMS AND DOLLAR VALUE**

Acct. No.		Total No. of Items on CMR		Total No. of Controlled Items		Total No. of Non-ex. Items		No. of Items Requiring P.M.	
			\$Value		\$Value		\$Value		\$Value
11	Planning	9	2,364	7	1,473	2	891	0	0
12	Systems	10	2,706	8	1,300	2	1,406	0	0
14	Front Office	8	4,590	3	540	5	4,050	0	0
40	Offset Photo	59	272,539	14	2,663	45	269,876	28	149,950
51	Microfilm	60	425,098	2	299	58	424,799	56	424,159
52	Graphics	76	435,007	6	1,338	70	433,669	67	431,507
53	Color	74	241,811	15	2,300	59	239,511	64	235,871
54	Motion Picture	119	305,856	47	7,536	72	298,320	84	291,617
55	Q.C. & Chem Mix	24	213,462	2	358	22	213,104	20	204,164
56	Photography Br. Off.	13	2,725	10	1,212	3	1,513	4	1,278
57	Studio	93	46,841	55	9,940	38	36,901	69	33,608
58	Com Center	10	33,120	1	200	9	32,920	7	31,695
59	Copy Center	18	38,175	2	300	16	37,875	14	36,748
61	Maintenance Shop	58	35,441	26	3,132	32	32,309	51	32,028
62	Supply & Services	29	102,178	9	1,387	20	100,791	26	97,905
70	Press	38	1,059,273	5	923	33	1,058,350	35	1,056,808
80	Composing	133	1,275,040	10	121,267	123	1,153,773	121	1,268,992
90	Bindery	57	510,877	4	618	53	510,259	40	492,667
100	Graphics & Visual Aids	41	30,243	25	2,792	16	27,451	4	18,229
	<b>TOTAL:</b>	<b>929</b>	<b>5,037,346</b>	<b>251</b>	<b>159,578</b>	<b>678</b>	<b>4,877,768</b>	<b>690</b>	<b>4,807,226</b>
	<b>% of Total</b>	<b>100</b>	<b>100</b>	<b>27</b>	<b>3</b>	<b>73</b>	<b>97</b>	<b>74</b>	<b>95</b>

FIGURE 1

and methods occurring in P&PD. Although there is some overlap in that more than one category can apply to a particular piece of equipment, the basis for determining which category best applies to each equipment piece was determined by the branch chief or his delegated authority. The definitions are as follows:

2.3.1 Category NR - None Required. This means that the equipment does not routinely require any type of scheduled maintenance by anyone; i.e., offset cameras, light tables, camera lenses, etc. This category doesn't mean things never break or malfunction. They do. But the equipment put in this category is, in the opinion of the respective branch chief, characterized by continuing reliable daily operation.

2.3.2 Category VC - Vendor Contract. This category identifies those pieces of equipment which are serviced by outside vendors, under contract, on a scheduled basis such as monthly, bi-monthly, or quarterly. In addition to the scheduled preventive maintenance coverage, the contractual agreement also provides remedial repair service, which means response to breakdowns as required.

2.3.3 Category MS - Maintenance Shop. This category refers to equipment items which can be and usually are serviced by the Maintenance Shop personnel. Except for some of the more sophisticated electronic equipment in the Division, the MS category could be applied to almost everything else in a broad sense. However, for the purposes of this study, the MS category has been established as the major source of repair and maintenance for designated equipment items, and is considered separate and distinct from the NR category defined above.

2.3.4 Category BJ - Branch Journeyman. This description is applied to those equipment items which require some type of preventive maintenance and/or periodic service, which because of its relatively simple nature, is performed by branch journeyman-level personnel instead of in-house maintenance personnel. The equipment in this category may also fall into one or more other categories by virtue of the nature of the problem. But, for the purposes of this study, it is assumed that the BJ category adequately defines the most frequent and usual type of service that these equipment items require.

2.3.5 Category VR - Vendor Remedial. This category is for those equipment items which are dependent upon outside, non-contractual, vendor support to accomplish repairs. This is usually because of the complex nature of the equipment, meaning that in-house capabilities are not sufficient to provide the necessary service. It also means that the frequency or occurrence rate is minimal; consequently, it is not cost-effective to have these equipment items serviced on a regular contractual basis by a vendor. The 100-S (Service) Numbers used throughout the Agency for general repairs is probably the best example of items falling into this category. Another example would be the situation where the problem is so difficult as to need an outside expert and the estimated cost of repairs exceeds the limits of the 100-S Number, necessitating a purchase order or one-time contract.

## 2.4 Category Determination

The next step was to task the branch and staff chiefs with determining the one category that best fits the type of maintenance usually required for each piece of equipment. It is obvious that there are many equipment items where more than one maintenance category would fit the item, depending upon the nature of the problem. For instance, an item normally serviced by branch personnel may develop a problem that cannot be resolved at that level. The next logical step would be to call for assistance from the P&PD maintenance shop and if they can't fix it, it would then be necessary to obtain the services of a qualified outside vendor. Such a scenario shows what could happen, but for the purpose of this study, the "first choice" determination has been used. The results of categorizing the equipment are shown in Figure 2.

## NO. OF P&PD EQUIPMENT ITEMS BY MAINTENANCE CATEGORIES AND CMR SUB-ACCOUNTS

	11	12	14	40	51	52	53	54	55	56	57	58	59	61	62	70	80	90	100	Totals	% of Total
Category 1 None Required	9	10	8	31	4	9	10	35	4	9	24	3	4	7	3	3	12	17	37	239	26
Category 1 Vendor Contract	0	0	0	0	5	0	1	0	0	1	0	0	0	1	7	0	73	0	2	90	10
Category 3 Maintenance Shop	0	0	0	21	49	46	48	29	1	0	0	5	10	50	16	31	28	24	1	359	39
Category 4 Branch Journeyman	0	0	0	7	0	18	6	52	19	3	69	2	1	0	0	0	3	11	0	191	20
Category 5 Vendor Renewal	0	0	0	0	2	3	9	3	0	0	0	0	3	0	3	4	17	5	1	50	5
<b>TOTALS</b>	<b>9</b>	<b>10</b>	<b>8</b>	<b>59</b>	<b>60</b>	<b>76</b>	<b>74</b>	<b>119</b>	<b>24</b>	<b>13</b>	<b>93</b>	<b>10</b>	<b>18</b>	<b>58</b>	<b>29</b>	<b>38</b>	<b>133</b>	<b>57</b>	<b>41</b>	<b>929</b>	<b>100</b>

FIGURE 2

2.4.1 Statistics - Figure 2 presents some interesting statistics. Of the 929 items identified, more than one-third (359 items, 39%), are identified as being the primary responsibility of the maintenance shop, while only 90 items (10%) are identified as being under vendor contract. Twenty-six percent, or 239 items, have been defined as not needing scheduled preventive maintenance. The maintenance responsibility of branch personnel accounts for 21%, or 191 items. The remaining 5%, or 50 items, is assigned to the Vendor Remedial repair category. The combined figures for the maintenance shop and the branch personnel-level maintenance total 550 items and 59% of P&PD's identified equipment. This fact alone justifies the establishment of a maintenance program.

2.4.2 Preventive Maintenance - Preventive Maintenance (PM) is basically defined as those routine tasks which are regularly required to keep equipment in maximum operating condition, and which can be scheduled at various periodic times. Based on the statistics in Figure 2, 59% or 550 pieces of equipment within the Division require some type of preventive maintenance. For example, simple tasks might be required daily or weekly while other tasks, depending upon their complexity, might be required monthly or quarterly. These maintenance tasks are considered to be PM when they can be performed by in-house production personnel or the P&PD maintenance personnel. Also to be included in the definition of PM are those problems which can be identified and corrected before a complete breakdown occurs. In this context, repairs, adjustments, and parts replacement constitute a means of preventing more serious problems.



2.4.3 Vendor Contracts - It is also interesting that the Vendor Contract category, representing the second smallest percentage (10%) and number of items (90), represents the largest expenditure of funds. This cost has been increasing every year, as existing equipment gets older and presumably more susceptible to breakdowns, and newer equipment gets more technically advanced and further removed from the skills of our in-house maintenance personnel. The budgetary costs of P&PD repair and maintenance contracts and services for Fiscal Years 80 and 81, and projected costs for FY-82 are shown in Figure 3.

### MAINTENANCE/REPAIR COSTS BY SOC FOR FY-80, 81, and 82\*

	FY-80 (Actual)	FY-81 (Actual)	FY-82 (Projected)
SOC 2502-Maintenance/Repair	105,920	92,569	92,885
SOC 2503-ADP Maintenance/Repair	92,065	110,266	174,315
SOC 2540-Miscellaneous Contracts	128,400	34,500	34,000
SOC 2541-Census Bureau Contracts	<u>0</u>	<u>6,000</u>	<u>301,200</u>
Totals:	326,385	243,335	301,200

\*Copier Maintenance is not included

FIGURE 3

## 2.5 In-House Capabilities & Training

The P&PD Maintenance Shop is under the supervision of the Chief, Logistical Support Staff, although there is no formal organization of a Maintenance Shop on the Table of Organization. There are four full-time personnel assigned, one of whom serves as the first-line supervisor and carries the position title of Mechanic-Machinist Group Chief. The others are classified as General Mechanic-Machinists. The shop is well equipped with a variety of tools, machines, test equipment, and parts. Over the years, the Maintenance Shop has earned an enviable reputation for solving problems, fixing equipment failures, and enabling production deadlines to be met. This capability has been particularly noteworthy in making parts to support the operation of 20-25 year old printing presses. In many instances, these parts are simply no longer available from the press manufacturer or commercial supply houses. Nevertheless, P&PD's maintenance crew is being challenged by the technological sophistication of today's equipment.

2.5.1 Maintenance Training Record - The Maintenance Shop has not had a particularly impressive record in obtaining and attending maintenance related training, as seen in Figure 4.

**TRAINING SUMMARY OF MAINTENANCE SHOP  
PERSONNEL SINCE JOINING P&PD**

PERSONNEL	TOTAL COURSES ATTENDED	NON-MAINT. COURSES ATTENDED	MAINT.-RELATED COURSES ATTENDED	MAINT. COURSES DENIED	SELF-STUDY COURSES
STAT	5	3	2	1	1
	1	0	1	1	1
	1	1	0	2	1
	3	2	0	1	1
	3	3	0	0	1
TOTAL	13	9	3	5	5

\* REASSIGNED WITHIN P&PD

FIGURE 4

As can be seen from above, there have been more denials of requested maintenance-related training than approvals. Obviously, this has had its negative impact upon the maintenance crew, particularly when they are criticized for not being able to resolve problems with which they are unfamiliar. In this respect, it should be remembered that much of P&PD's equipment has advanced into the electronic age. Consequently, the skills of yesteryear do little to cope with the sophistication and complexity of today. Keeping up with the state-of-the-art requires dedicated training, and frequent application of this training to provide useful results and cost-effectiveness.

2.5.2 List of Training - The listing below details the training accomplishments of the maintenance personnel, both before and since joining the Agency as of mid-1981:

STAT

<u>Course</u>	<u>Dates Attended</u>	<u>Maint. Related</u>
AB Dick Press Maintenance	2 wks. 1966	Yes
A&M Multilith Press Main.	2 wks. 1970	Yes
Cleveland Institute of Electronics	1973-75 (self-study)	Yes
Kodak 8-S Printer Maint.	1975	Yes
*Effective Written English	9-20 April 1979	No
*Managing Your Building Maint. Dollar	24-25 May 1979	Yes
*Performance Appraisal Workshop	11 Dec. 1979	No
*The R&E Maint. Roundtable	20-21 Feb. 1980	Yes
*Fundamentals of Supervision	22-26 Sep. 1980	No
*Managing a P.M. Program	(Nov. 1980)	(Yes- Rejected)

STAT

<u>Course</u>	<u>Dates Attended</u>	<u>Maint. Related</u>
Automotive & Diesel Mechanics Correspondance Course (53 lessons) Commercial Trades Institute, Chicago)	1960	Yes
Auto Mechanics (U.S. Army Armor School, Fort Knox, Ky.)	1961 (16 weeks)	Yes
Military Tracked Vehicle Recovery Mechanic, U.S. Army	1961-64 assignment	Yes
Industrial Equipment Mechanic, Western Electric Co.	1965-69	Yes
Methods Analyst, Western Electric Co.	1969-71	Yes
Refrigeration and Air Conditioning Correspondance Course, Advance Schools Inc., Chicago	1971	Yes
Kodak 8-S Printer Maintenance Course --	--	Yes
*Davidson Press Maintenance	2-6 Dec. 1974	Yes
*Electronic Technology Correspon- dence Course, Cleveland Institute of Electronics	Aug. 1980-81	Yes
*OCR Maintenance, ECRM, Inc.	(Aug. 1980)	(Yes- rejected)

STAT

<u>Course</u>	<u>Dates Attended</u>	<u>Maint. Related</u>
Fundamental Electronics (Diploma)	--	Yes
Communications Electronics (Diploma)	--	Yes
Itek Service School	--	Yes
COBOL Programming	--	No
EAM Equipment	--	--
Machine Logic and Design	--	--
Sleuth Programming	--	--
Fundamental Data Processing	--	--
Analog Programming	--	--
*Intelligence and World Affairs	--	No
*Fundamentals of Supervision & Mgmt.	--	No
*Video Tape Recording	--	Yes
*Advanced Color TV Service	--	--
*Introduction to Micrographics	--	--
*Master Course in Electronics (Self-Study)	Jan.1976-Jan.1978	Yes
*College English	Jan-May 1980	No
*APS-5 Maintenance, Autologic, Inc.	(June 1980)	(Yes- Rejected)
*OCR Maintenance, ECRM, Inc.	--	(Yes- Rejected)

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<u>Course</u>	<u>Dates Attended</u>	<u>Maint. Related</u>
*3M Microfilm Processing Clinic	5-9 March 1973	No
*Photographic Department Mgmt.	29 May - 3 Jun 1977	No
*EDP Orientation	4-6 Jan 1978	No
*Fundamentals of Supervision	9-13 Jan 1978	No
*Trends and Highlights	21-24 Feb 1978	No
*Effective Written English	3-14 April 1978	No
*Supervision of Handicapped Employees	28 April 1978	No
*Computer Topics for OL Mgmt	9-12 Dec 1978	No
*Leadership Styles and Behavior	17-21 Sep 1979	No
*Electronic Correspondence Course, <input type="text"/> (self study)	April 1980	Yes

STAT

\*Denotes CIA Training or self-training during CIA employment.

2.5.3 Training Discussions - One way to deal with this lack of training of maintenance personnel might be to make formalized training an extra-cost item as part of any new equipment procurements. This procedure has, according to Procurement Division, been used by other components without any problems. An added benefit, at least in terms of P&PD's budget distribution, is that the expense of the maintenance training, including manuals, schematics, parts lists, etc. can be part of the contract purchase order and charged as an equipment expense rather than come out of our limited training funds.

Somewhere in the compilation of data on this project, a previous recommendation on training was unearthed which stated in substance that "providing sufficient training for the Maintenance Staff to support the repair and maintenance of the complex electronic equipment in use throughout the Division would save many dollars in contract and administrative costs." The problem here is the age-old situation of limited personnel resources. The maintenance personnel have expressed the feeling that in order to develop any kind of proficiency in coping with complex electronic equipment, it will be necessary to have a person assigned full-time to this responsibility. It has also been advocated that "if the maintenance staff electronics specialists could perform all maintenance on this equipment, the maintenance contracts could be reduced to parts and repair contracts." This is a very broad and general statement that finds little support by the maintenance staff and is viewed as having little insight in the practicalities of dealing with various proprietary designs. Some vendors simply will not release such information; others will but at a high cost; and still others fall somewhere inbetween by releasing only partial information. But regardless of the skills of the electronics specialist, there is a strong feeling that one simply cannot be expected to flip-flop from equipment "A" to equipment "B" on a moments notice and resolve all problems. To be a competent mechanic, it is necessary to devote full-time to mastering the equipment. And to master all the existing equipment, plus the future enhancements planned for the Division, and provide maintenance coverage commensurate with P&PD's operating schedule, would require a staff of full-time specialists in excess of our allotted Table of Organization.

## 2.6 Contractual Maintenance Service

P&PD relies upon two types of vendor-supplied maintenance/repair service...contract and remedial.

2.6.1 Contract Repair Service - Contract service involves an annual agreement, usually at a fixed price, between a vendor and the Agency for preventive maintenance service at scheduled intervals, and repair service as required during the contract period. Agreements on parts replacement vary from vendor to vendor. Usually the vendor will include the replacement of

specified parts, if necessary, in the fixed price cost of the contract. Unspecified parts replacement is an extra-cost item.

2.6.2 Remedial Repair Service - Non-contract or remedial repair service is the type of situation where a vendor is called upon only as needed. The usual method is through the use of the Agency's 100-S (Service) Number system. This system is limited to a fixed dollar amount, usually \$1000.00. If the costs are going to be above this amount, then a one-time contract is written for the necessary services.

2.6.3 Repair Service Evaluation - Are we getting what we pay for from contractor maintenance? The general assesment of P&PD Branch Chiefs is that we are getting good service, particularly in those disciplines where in-house service is not capable of satisfying all requirements, i.e., ETECS maintenance. Since the cost of this type of contractor dependence continues to be a highly visible budget item (See Figure 5), a maintenance program should consider monitoring vendor response, quality of service, frequency of repair, repetitiveness of repair, etc. The research for this report has been able to identify only the vendor's work order receipt as the means of tracking maintenance effectiveness. However, this receipt frequently only verifies that a service rep was on location; the illegibility of the receipt oftentimes make it impossible to decipher what was actually done. And apparently no one is standing over his shoulder recording his accomplishments. Do we need this level of data? That hasn't been decided, but it does seem that if we are to track historical (chronological) maintenance/repair, and record component breakdowns and the cost of parts, then such considerations are justified.

2.6.4 In-House Versus Contract Service - Every once in a while someone asks if we couldn't do the job cheaper and better in-house. The answer to that depends upon the equipment in question. The Logistical Support Staff has cancelled several maintenance/repair contracts for FY-82 and shifted the responsibility to the Maintenance Shop, or will rely upon the 100-S Number system. ETECS maintenance was mentioned previously as a good example of contractor maintenance. P&PD doesn't have the personnel to support around-the-clock maintenance staffing for the ETECS operation, nor the in-depth knowledge of the software or the accessibility to the manufacturer that an Atex (Inc.) technician has. This rationale is also applicable to other P&PD equipment and vendors. And it is becoming increasingly more apparent as each new piece of equipment received becomes more electronically controlled. This does not mean that such obstacles couldn't be dealt with at least with some degree of success. Proper training and motivation can go a long way. But if we look at the Maintenance Shop's success rate in obtaining training, one cannot readily reach an optimistic conclusion. What does become obvious is P&PD's dependence upon vendor contract support despite the cost.

## COMPARISON OF MAINTENANCE/REPAIR COSTS FOR FY-80 THRU FY-82\*

	FY-80 (Actual)	FY-81 (Actual)	FY-82 (Projected)
<b>SOC 2502: Maintenance/Repair</b>			
Itek-400 Camera repair	500	—	—
Machinists-Press repairs and parts	10,000	9,500	10,000
GAF-Ozalid repairs/pm	1,000	—	—
Kodak VCNA-pm	3,000	3,769	3,615
Harrigan-Press roller repair	10,300	10,000	10,000
Werres-Forklift pm	6,410	5,700	—
Itek-430 Camera/Processor pm	810	—	—
AM International-Bruning OP 59/88 pm	3,860	3,250	—
Compugraphic-Typesetter pm/repair	1,000	1,000	—
Bell & Howell-Envelope Stuffer pm	1,260	—	—
Vari Tech-Varityper pm	360	—	—
TDC Documate II and 1010 Teriminal pm	8,160	11,300	13,000
Imprest Fund & 100s Numbers	25,000	9,500	12,000
Autologic APS-4 & 5 pm	34,260	38,550	42,270
Video Tape Replication System repairs	—	—	2,000
Sub-total:	<u>105,920</u>	<u>92,569</u>	<u>92,885</u>
<b>SOC 2503: ADP Maintenance/Repair</b>			
ECRM-Optical Character Reader pm	8,000	6,156	8,040
Atex-Etecs maint.	84,065	86,665	82,000
DEC-MIS Hardware maint. (11/70)	—	14,645	10,700
RLG-MIS Software maint. (11/70)	—	2,800	14,000
Dicomed-Dicomedia	—	—	27,560
DSI-MIS Hardware maint. (11/70)	—	—	9,515
MIS Software enhancements	—	—	22,500
Sub-total:	<u>92,065</u>	<u>110,266</u>	<u>174,315</u>
<b>SOC 2540: Miscellaneous Contracts</b>			
CTI-Slide reproduction	9,850	1,500	—
Press rag cleaning	2,300	2,700	3,000
Kodak-Color Film Processing	6,900	6,000	7,000
Byron-Motion Picture Processing	109,000	21,500	24,000
Capital Film Labs-Film Processing	350	2,800	—
Sub-total:	<u>128,400</u>	<u>34,500</u>	<u>34,000</u>
<b>SOC 2541:</b>			
Census Bureau	—	6,000	—
Sub-total:	—	<u>6,000</u>	—
Grand-total:	<u>326,385</u>	<u>243,335</u>	<u>301,200</u>

\*Copier maintenance costs are not included

FIGURE 5

2.6.5 Future Equipment Concerns - Future equipment acquisitions involving lasers are a maintenance concern. P&PD is currently involved in procuring a laser platemaker, which will be the first equipment of its type in the Division. The manufacturer provides operational and maintenance training at his facility. Present plans are for two personnel to attend this training, one from maintenance and one from prepress. This venture into the most advanced technology in the graphic arts industry should be an interesting experience upon which to gauge our in-house capabilities and further evaluate future requirements.

2.6.6 Seybold Report Excerpts - In the July 28, 1980 issue of The Seybold Report (Vol. 9, No. 22), there were some interesting comments concerning the problem of qualified maintenance personnel and some possible approaches to coping with the situation. The following quotes summarize the article:

"Like the shortage of programmers mentioned above, there is currently a shortage of qualified electronics maintenance personnel. This shortage can only be expected to worsen in the coming years. Vendors are aware of this problem and are trying to design new products so as to minimize its effects. Some of the possible strategies include:

- Self-diagnosis. Equipment which includes a microprocessor can, with minimal additional cost, also include a set of diagnostic routines in read-only memory or on disk... The operator is informed... of the location of any detected problems. (The APS- $\mu$ 5 typesetter is an example...).

- Remote diagnosis. Some multi-user systems with telecommunications capability can be tested remotely over the phone lines...One...vendor...combines self-diagnosis with telecommunications so that the equipment dials its service center to report failures as they occur!

- Modular repair. Most electronic equipment...designed in modules...a single printed circuit board. If a stock... is kept on hand, a spare can be substituted... No attempt is made to track down the faulty part of the circuit... shipped back to the factory for repair or replacement.

- Redundancy. Duplicated equipment has been a way of life in the newspaper industry for a long time... quite expensive... prices falling... expect to see more outright duplication... in many cases duplicated components will be built in and the good one will take over automatically..."



These comments from a highly respected publication echo some of our concerns and should be considered in the final determination as to the direction and scope of any maintenance program undertaken by P&PD.

## 2.7 Spare Parts.

The question has been raised several times in the past as to the feasibility of the P&PD Maintenance Shop stocking spare parts for all equipment. There are several things to consider in addressing this question.

2.7.1 Printed Circuit Boards - Stocking printed circuit boards (PCB"s) for electronic gear is one of the concerns most frequently discussed. The biggest obstacle is cost. The boards are not cheap, and there are many different types in use throughout Division equipment. Some of them do go bad from time to time; however, it is virtually impossible to predict with any degree of accuracy which boards are most likely to need replacement. This, plus the cost consideration, has been the major negating factor towards stocking PCB's.

2.7.2 Contract Limitations - Another reason is because the Division has so much of its electronic equipment under maintenance contract. This type of arrangement usually precludes Division maintenance personnel from getting involved in servicing and/or repairing contractually-covered equipment. This is because of the proprietary nature of much of the equipment, and the vendor's policy of controlling who works on their equipment. Tied in with this restricting factor is the simple fact that P&PD's maintenance personnel do not have the expertise to perform in-depth service on much of this type of equipment.

2.7.3 Space Limitations - Still another reason given for the lack of an extensive stock of spare parts is space limitations. The Maintenance Shop carries quite an assortment of general purpose parts to cover electrical, plumbing, mechanical, and other types of problems. Some of the parts are for specific purposes, such as Miehle printing press parts, most of which are no longer made by the manufacturer or must be special ordered from Germany. Other parts, such as electric motors, have been cannibalized from old equipment and may be usable in more than one piece of equipment. Generally speaking, maintenance orders those component parts which have been identified as most likely to fail, or by virtue of experience, have been found most difficult to obtain. Also influencing spare parts procurement is the life-cycle of the equipment. If it has been relatively trouble-free and still fulfills the production requirements, chances are that it has not been identified for replacement. In this instance, a small quantity of spare parts would be kept available. On the other hand, if the machine had a history of problems and was identified for early replacement, a more select

assortment of trouble-prone parts would be stocked until the equipment can be disposed of. Unfortunately, these parts are "money-down-the-drain" when the equipment is turned in.

2.7.4 Vendor Policies - In this day and age, rapid procurement of parts shouldn't be any problem, particularly if one believes in the Federal Express TV commercial. But experience over the years has not always been favorable in rapidly securing parts and avoiding production interruptions. Most vendors will openly state that their policy is to service their own technicians and maintenance-contract customers first; then they will service those customers who chose to perform service in-house. In this context, the benefits of annual maintenance contracts become more appealing despite the constantly escalating costs. Convenience and vendor-dependability take on new meaning as equipment grows older and more susceptible to breakdown.

2.7.5 Vendor Warranties - Another factor to consider is warranty protection. Parts purchased for inventory and installed at a later date are usually not warrantied by the manufacturer. This is because they were not installed by the manufacturers' representative and because of the time interval between purchase and actual use. Consequently, there is a financial risk involving this type of parts inventory control. But on the other hand, these are the problems stated previously regarding manufacturer's or supplier's attitude towards prompt response to our needs--which always seem to be of an emergency nature due to our mission and function. It would appear that there is no totally satisfying solution to this aspect of a maintenance program.

## 2.8 System

As stated previously, the revised purpose of this study is not to develop a total system for running a maintenance program, but rather to develop background information to support a management decision. The data processing considerations have been delegated within the PP&SS. At this time, no firm position has been reached regarding the best computer system, VM or MIS, to satisfy all of the considerations of a maintenance program.

2.8.1 NSA Trip Reference - In April 1980, NSA was visited to seek advice and guidance on this project. A copy of the trip report is included as Attachment 1. Basically, NSA has a world-wide, fulltime maintenance program which has been active for about 10 years. They started off with an off-the-shelf Hewlett-Packard system, and then took two years of vendor and in-house development to achieve an operational system. Since then it has undergone considerable modification and expansion. Engineering, ADP, and other professional and technical skills are represented in a dedicated workforce. Obviously their accomplishments far exceeds anything that P&PD would require, but their offer for further assistance is still open.

2.8.2 NPIC Trip Reference - The NPIC Equipment Services Branch (ESB) was visited in November 1981. A copy of a Memorandum for the Record appears as Attachment 2. Their personnel complement is 2 1/2 times greater than P&PD's. Although they also have been addressing a computerized database for over two years, they have not progressed beyond a manual card system. Their efforts are primarily in support of the photo interpretation effort. Computer support is almost entirely a function of contractors, and the ESB technicians play an important role as COTR's in monitoring contract compliance and costs. Spare parts inventory is still a big problem at NPIC, but training is stressed and apparently more readily attainable than at P&PD. No formal support is provided to the printing and photography functions, although both are important operations at Building 213. NPIC seems to share a lot of our problems and concerns, and has offered to provide whatever additional assistance they can in the future.

2.8.3 HEB/AEMMS Reference - The Headquarters Engineering Branch, LSD/OL, is the originator and manager of the Agency Equipment Monitoring and Maintenance System (AEMMS). Their system is highly developed, even down to the point of defining how many men and what tools are necessary to perform a given task. Their operating manual and engineering vendor handbooks on PM systems have been utilized in reviewing the requirements for a P&PD system. A specific reference to the AEMMS will be included in the recommendations portion of this study.

2.8.4 Commercial Reference - Literature from Werner and Associates, Inc. in Arlington, Va., was reviewed during the compilation of data for this study. They are a commercial firm specializing in developing PM systems for hospitals. Their system is known as "pmas/30" (Preventive Maintenance Administration System). Basically, they review one's needs, set up a system, and administer via telecommunications link to their computer. They produce periodic reports and maintenance schedules which are communicated to the user, who in turn provides feedback on the results to Werner. This system was considered by branch management to be unsuitable to our needs, although the use of this vendor on a consultant basis remains a viable option.

2.8.5 PIA, GATF, GPO References - In the early stages of this project, both the Printing Industries of America (PIA) and the Graphic Arts Technical Foundation (GATF) were contacted regarding advice and suggestions on setting up a maintenance program. PIA had little to offer except that the general attitude throughout the commercial printing industry seems to be that "if it breaks, fix it!" PIA also stated that business runs on the theory that if a press is running, its making money and can't afford to be shut down. GATF pretty much echoed that sentiment, but did go ahead and send several reprints of articles pertaining to maintenance. One local concern, Judd & Detwilder, has an

effective maintenance program which was well described in one of the reprints (See attachment 3). In addition, only two other major printing companies in the mid-west were offered by GATF as having known preventive maintenance programs. Since the Government Printing Office (GPO) was well covered in a Systems Staff Study conducted in 1979 on P&PD Maintenance Programs, no additional information was sought for this study. GPO's operation is so large and its maintenance force so diversly structured, that there seemed little to be gained from additional contact and fact-finding.

### 3.0 CONCLUSIONS

#### 3.1 Training

A successful maintenance program will require more training of P&PD maintenance personnel. An identification of in-house maintenance responsibilities and the training necessary to support such duties is necessary.

#### 3.2 Preventive Maintenance Need

Since at least 50% of P&PD's equipment is maintained primarily in-house, the need for a controlled and well-structured PM program seems obvious. Establishment of a computerized database to record PM activities would be beneficial to P&PD in many ways.

#### 3.3 Spare Parts

This issue presents several avenues of response, ranging from a thorough inventory and value accounting of present parts to a more selective assessment of future needs. The decision as to the level of involvement rests with the using component, Logistical Support Staff.

#### 3.4 Contract Services

Contractor maintenance of some equipment will always be necessary within P&PD. Consequently, inclusion of monitoring information into an automated MP will enhance Division management decision making.

### 4.0 RECOMMENDATIONS

#### 4.1 Specifics

The recommendations regarding this study involve both LSS and PP&SS. The LSS, in conjunction with the PP&SS, should identify the scope and level of responsibility of a Maintenance

Program as a means of developing specific requirements for an automated database to include monitoring:

- Spare parts procurement, use, and inventory
- Maintenance history, including costs and downtime, of individual equipment items
- Maintenance requests and responses
- Scheduled preventive maintenance
- Contractual maintenance history and costs
- Remedial maintenance history and costs

In addition, the LSS should identify those training courses considered essential to the proper performance of designated maintenance responsibilities, and seek P&PD management approval for this training. This concern is particularly applicable to future equipment acquisitions involving new technologies.

Based on the above monitoring requirements, the PP&SS should develop a user-oriented computerized system -- VM, MIS, or other -- to establish a database capable of handling the identified requirements and satisfying future enhancements.

#### 4.2 General

The LSS, in conjunction with the Production Manager and the Branch/Staff chiefs, should implement a structured and well-defined preventive maintenance program to insure the timely and periodic servicing of those equipment items identified as needing some type of PM attention.

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MEMORANDUM FOR: Chief, Printing and Photography Division, OL

FROM: [redacted] Systems Staff, and [redacted]  
Supply and Services Staff, Printing and  
Photography Division, OL

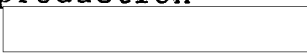
SUBJECT: Computerized Preventive Maintenance System

1. On Wednesday, 15 April, [redacted] visited NSA for the purpose of reviewing NSA's Computerized Preventive Maintenance System. NSA has been involved in this program for nearly ten years; however, several of the early years were devoted to research, planning, and software development. Their System is basically an off-the-shelf system developed by Hewlett-Packard, and customized over the years by NSA personnel to satisfy their expanding worldwide requirements. NSA personnel estimated that they had over 100,000 accountable pieces of equipment in their inventory, and a headquarters maintenance staff of nearly 300 people. Obviously, their operation is considerably larger than our objective of developing a system for P&PD equipment. One very noticeable fact was what seemed to be unlimited resources in terms of facilities, equipment, personnel skills, training, budget, and organization.

2. The visit was beneficial in that it was the first opportunity for us to experience an operational system outside of CIA. The NSA personnel were informative and cooperative in exchanging information, and they left the door open for additional contact and advice in the future. We were hosted by the Chief of their Maintenance Operation. We were given a demonstration of the H-P System's capabilities and how their "Dispatcher" System works in recording information to the database. A visit to the computer center, and a briefing by the Maintenance System Engineer, with the use of samples of the various reports printouts, was included in our visit. This part of the trip was impressive, but we wished that [redacted] had accompanied us to facilitate understanding the more technical aspects of developing, implementing, and enhancing the actual computer operation. However, this may be possible at a later date, considering NSA's invitation to share information. The Engineering Manager suggested that rather than "reinvent the wheel", that it might be possible for us to use their system, should further evaluation show that to be a feasible alternative. Of course, this would require concurrence by higher level management of both agencies. So at this time it should be considered merely as a possible option. NSA stressed that many years of software development and refinement went into their system before it achieved a satisfactory operational level.

SUBJECT: Computerized Preventive Maintenance System

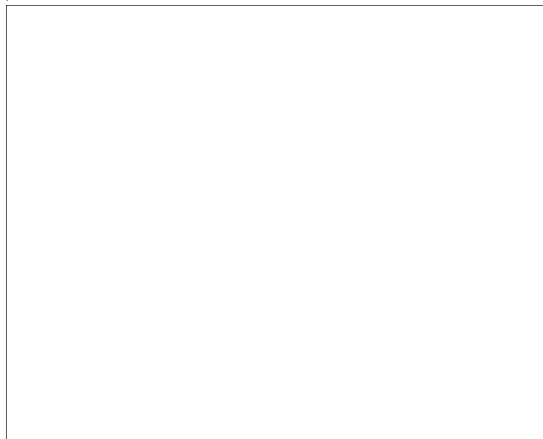
3. The output of NSA's system seemed to be very much in line with what we envision the P&PD system should be. The various types of reports cover a wide range of information on costs, frequency of repairs, individual equipment item histories, nature of the problem, manhours and repair hours, and a cumulative repair cost ratio to original purchase cost. Also of interest was the fact that the maintenance personnel entered the necessary data via the terminal for each maintenance occurrence. It was indicated that there had been some resistance by the maintenance personnel to this new responsibility, but that this was no longer a problem.

4. Although not originally planned, the NSA personnel were able to include a tour of their printing and production facilities. The size of their operation, in terms of equipment and capability, would appear to surpass ours. But the nature of their product is more stereotyped, being mostly black and white and repetitive in nature. This part of the tour offered an opportunity to share some maintenance problems with the NSA production personnel. This was especially meaningful to 

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5. In summary, the visit provided an opportunity to exchange information and gather advice from personnel who have been through the "trial-and-error" frustrations of building a system. It also offered the opportunity to share experiences with people who have similar constraints regarding product, security, and vendor accessibility. As previously stated, NSA's resources seem to be considerably larger and more varied than ours. The encouraging factor was the invitation to continue an informative exchange and further evaluate NSA's H-P System as a basis for patterning P&PD's anticipated system.

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November 18, 1981

MEMORANDUM FOR: The Record

FROM :

[REDACTED]  
Plans, Programs, and Systems Staff (PP&SS)  
Printing and Photography Division, OL (OL/P&PD)

SUBJECT : Visit to NPIC to Review Maintenance Procedures

On Thursday, 12 November 1981, [REDACTED]

[REDACTED] of P&PD visited [REDACTED] Chief, Equipment Services Branch (ESB), NPIC for the purpose of exchanging information and viewing NPIC's facilities, as related to in-house maintenance and repair of NPIC's equipment. Their maintenance effort is directed almost entirely towards supporting the photo interpreters and their equipment. Much of their time is spent in responding to phone-in service requests, all of which is recorded manually on a card system. A sequential job number is assigned at the time of the service request. The caller is responsible for furnishing the following:

- a. Equipment Serial Number
- b. Name
- c. Room Number
- d. Extension
- e. Logical Equipment Number (LEN NO.) - this is a computer entry for future use.
- f. Equipment Type

In addition, ESB personnel record:

- a. Date/Time of call
- b. Date/Time started
- c. Date/Time finished
- d. Total man hours
- e. NPIC Component
- f. A narrative of the problem and the solution.

Weekly reports are compiled by the deputy branch chief from the technicians data. A monthly report and statistical summary is prepared by the Branch chief and forwarded to higher management. No detailed records of costs are kept by the technician or the branch in relation to each service call. However, the branch does maintain general cost information through the use of Form 88 for routine purchases through Procurement Division, OL, and the extensive use of their petty



SUBJECT: Visit to NPIC to Review Maintenance Procedures

cash fund to expedite parts procurement without all the normal procurement "mumbo-jumbo". In more serious cases, it may be necessary to call in a vendor for repairs or maintenance. This is usually done via the "100-S Number" routine, or through a Procurement Purchase Order in more costly cases.

One thing that hasn't been mentioned yet is vendor contract maintenance. This is a big item at NPIC. The ESB technicians play an informal role in diagnosing problems on equipment that is under contract, and serve a formal role as COTR's in monitoring the maintenance contracts AND COSTS. Some of these statistics are included in the weekly and monthly reports referenced previously.

The question of computer maintenance was also addressed. ESB essentially provides no maintenance or repair service to the computers. They are too specialized, the state-of-the-art is constantly changing, and it requires total dedication by the technician to understanding both the hardware and software of the computer system. ESB will assist in diagnosing a problem and trying to service it via telephone "talk-thru" from the vendor, but that's all.

ESB does get into the business of developing modifications to light tables and supporting equipment. They also service video display terminals, both in-house and with vendor support.

STAT Most of ESB's technicians received their basic training from the military. Local college courses and participation in manufacturer's maintenance courses are emphasized. The Branch consists of 8 technicians, plus a secretary, and Mr. [redacted] Positions are in the GS-scale and currently consist of mostly GS-11's and 12's. Two of the technicians are close to being engineers by virtue of their schooling, experience, and expertise. The Branch is actively seeking to recruit an electronics engineer, but is encountering the usual problems with this profession and commercial recruitment benefits.

Parts inventory is a big problem. The ESB does not have a firm handle on what it has, and has been attempting to manually inventory its parts stock with an eye towards a computerized system in the future. Again, time and lack of personnel are heard as limiting their current efforts.

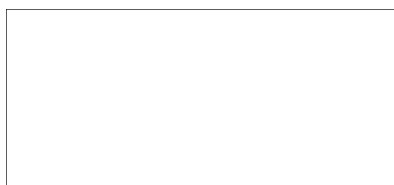
Of particular interest was the fact that ESB does not support the printing and photography facilities at NPIC, except on an informal and occasional basis. Nor do they support the other site. They are fully equipped in terms of electronic

SUBJECT: Visit to NPIC to Review Maintenance Procedures

test equipment, machine shop fabrication facilities, and considerable space in comparison to P&PD's small shop. It was quite obvious that their training budget and participation rate are noticeably greater than P&PD's, especially when they can afford \$10,000 for one in-house manufacturer's maintenance and service course.

The visit was informative and interesting. Due to the specialized mission of NPIC and its equipment, the possibility of personnel and/or training exchange did not seem feasible, nor was it mentioned.

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# Regular maintenance cuts press downtime

by Vincent O'Neal

PLAGUED WITH press stops, paper spoilage and schedule delays? Judd & Detweiler Inc. of Washington, DC may have an answer for you. Over the past 10 years, J&D has been taking a hard look at various press maintenance programs. "We finally think we've hit on a combination that really works," notes Kenneth King, J&D plant manager. Judd & Detweiler has adopted what they call a 12-hour-per-month maintenance program. In the past few months, the new J&D program has decreased the breakdown on a six-unit web offset by over 50 percent.

"That's one half as much breakdown as under any previously tried J&D maintenance arrangement," notes King. "And, over the last 111 years, we've tried more than one way to maintain a press."

## Downtime was cut 60 percent

Since implementing the 12-hour-per-month program, total breakdowns on the press have gone from an average of 60 hours per month to the present 12 hours per month.

To calculate the actual amount of time the press is now unavailable for use, the 12 hours the press is shut down each month for maintenance must also be added in. So the actual downtime is now 24 hours per month—12 hours of actual breakdown time plus a second 12 hours shutdown for maintenance.

However, the press' new down time of 24 hours per month is still 36 hours or 60 percent more efficient than under any previous Judd & Detweiler maintenance program. A hefty savings, no matter how you look at it.

"If you figure that out for a year," notes King, "that should give us about 432 hours, or 18 extra days, of running time on the press. That's a big leap in productivity."

Once during each month, all J&D maintenance support staff—pressmen, engineers, and maintenance people—assemble. They dis-

cuss what has been going on with each J&D press, what might be potential breakdown problems in the near future, and what might be done to prevent them.

At the meeting's end, a 12-hour maintenance shut down time is scheduled into each press schedule. Maintenance personnel, pressmen, and engineers then spend the next several weeks gathering replacement parts that will be needed for the shut down, coordinating the jobs that will be accomplished during the 12 hour period, and synchronizing which team will do what and when.

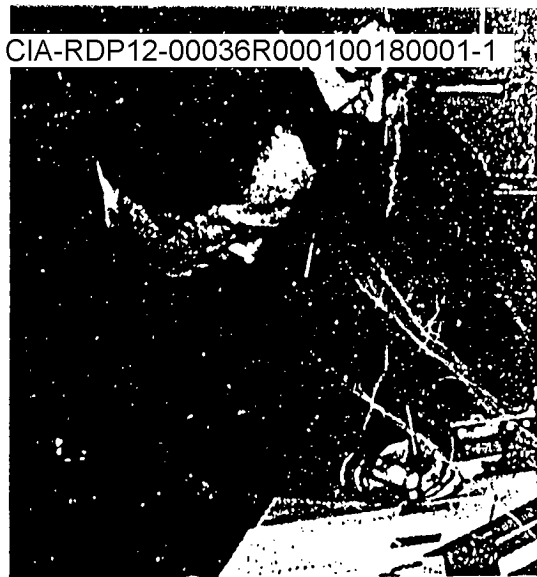
On the scheduled day, the press is shut off and work begins. What about results? "We've only been at it three months so far," notes King, "but the results to date have been very good."

"We looked at a lot of ways to upgrade our productivity," King continues. "We looked at, for instance, running the presses faster—but that hampered our quality and actually increased our downtime. So we started taking a long, hard look at what we had and how we could make it better. This resulted in the 12-hour-per-month maintenance program."

## The end to problems . . .

As he talked about the 250 employee, three-story plant, King hinted at some future benefits he might see in the J&D 12-hour plan. "For instance, we're finding out that 50 percent of our problems are happening every month. So, we are looking at ways to correct these problem areas permanently. That could decrease our 12-hour-per-month period to possibly eight hours down the line. Also, as we get further into this as a team—engineers, pressmen, and maintenance crew—we're learning to spot potential problems more accurately before we actually go into the press. We can then correct the problem more swiftly once we're into the 12-hour shutdown period."

King feels that possibly the eight



Ron Loey, assistant pressroom superintendent, and Ralph Picolo, pressroom foreman, set cylinder bearers by checking an impression made on strips of aluminum foil.

hour maintenance period, down the line, might even be cut shorter—possibly to five or six hours.

"It's hard to say right now," notes King. "We could have much bigger savings than we think later on, but it's difficult to predict just now . . . we'll need as much as a year to know for sure."

If the 12-hour-per-month maintenance effort does decrease to six hours, the additional savings obviously would make the program an even greater success. What this new program would do for our productivity, costs in spoilage, press quality and the like is really something," King notes.

Judd and Detweiler, which began printing parts of *National Geographic* magazine in the late 1890's, currently has three six-unit, multi-color web offset presses; one four-unit, and one eight-unit. So ultimately, the 12-hour-per-month program that King is now extending to all five presses should save the company about 66 days (over two months) in breakdown time—over their past maintenance/breakdown experiences (See Chart I, page 56 for calculations).

## Getting your own plan started

How can a program like this be established? "First of all," says King, "collect a history of each of the presses. How many hours per month, on the average, has each one been breaking down? What have been the three or four most frequent reasons for each press failure? Would a plan like this be worthwhile in your company's situation—or should the company begin with a modified version?"

"Once we got that far," notes



Robert Hanley, a press feeder at Judd & Detweiler, Inc., cleans an ink agitator to allow for more efficient ink flow to the press unit.

King, "I brought my case to management. I asked for a three-month trial for our oldest and most troubled press line."

**Teamwork made it happen**

"Once management gave us the green light, it was time to discuss the new maintenance possibility with our engineers, pressmen and maintenance crews. Essential to this plan is that the press management, in our case the day foreman, run the program," explains King. "But all three groups—engineers, maintenance and pressmen—must be willing to work as a team. That's almost as important."

Judd & Detweiler regards the pressroom management as ultimately responsible for maintenance of the presses. And, the engineering and maintenance staffs are seen as support staff to the pressmen. The pressmen watch the presses, run the monthly maintenance meetings, and decide the when's and where's for maintenance of their presses.

"It's certainly a group effort," notes King. "The pressroom management knows it needs the experience of the maintenance and engineer crews. They respect them. But having the final responsibility rest with the person actually running the press really started turning things around for us."

"At this point," observes King, "it was time for our first maintenance staff meeting."

"Here, each segment of the maintenance operation discussed their experiences with each J&D press. Among the things discussed were:

- What were the unique problems for each press?
- In each case, what seemed to break down continually each month?
- What could be done in a 12-hour period to insure that those three to four breakdown reasons just didn't appear for at least another month?

**Responsibility is divided**

Once this was summarized, the team determined priorities for the work that would be done during the 12 hours, how it would be synchronized and what the best 12-hour period would be for top management. "At this point," says King, "we were pretty much ready to go. But a maintenance team is needed before beginning."

"There are some things to watch for," cautions King. "You need to have a working team with a strong leader from press management." And, he notes the team needs to divide up responsibilities. "We made three decisions," King says. The press crew is responsible for cleaning, lubrication, rollers, and inspection and information. The maintenance crew takes care of inspection by machinist, breakdown problems, and work part repair. And the

engineering crew oversees problem solving, major rebuilds, and equipment replacement.

"We have all the parts we think we will need assembled and ready to go beforehand," says King "so that we are sure to schedule the 12-hour maintenance shutdown when all the parts and equipment we might need will be available."

"Even if you are not big enough to have your own engineering and maintenance crews, this plan can work with those you bring in. In fact, sometimes it works better than under normal emergency circumstances. This is true only if the company has the right pressroom leader," King emphasizes.

"The maintenance effort must be kept to a maximum 12 hours only," says King. "In other words, get agreement to shut the press down for the 12 hours and keep your side of the agreement—no matter what. That's worked well for us."

**Don't expect immediate results**

Finally, King cautions printers not to be disturbed after the first 12-hour shut down if nothing happens and the press breakdown frequency doesn't change. "It didn't change at all for us the first month," says King. "Once we were into the press, there was so much to do. We knew we'd just have to set our priorities and wait for a lot of it until our second month's try." The second 12-hour shift was when things started happening for the J&D 12-hour program. That month the test press breakdown time went from 60 hours to 30 hours, a 50 percent improvement. During the third month, the press went from 30 hours of breakdown time to 12 hours, a 60 percent additional improvement. "And that's where we are today," King states.

Can a company completely eliminate breakdowns in time? "I don't think so," King concludes. "I think we can always count on 10 to 12 hours of breakdowns per month... But, of course, I would be willing for it to happen."

**12 HOUR MAINTENANCE PROGRAM EXPERIENCE**

	Breakdowns: Average hours per month		Total downtime savings with new 12 hr. program	Percent breakdown savings
	Regular Maint. program	New 12 hr. program		
Older web offset (15 yrs. or older)	60 hrs.	12 hrs.	36 hrs.	60%
Average age web offset (1-14 yrs)	45 hrs.	10 hrs.	23 hrs.	49%