

SHIP PRODUCTION COMMITTEE
FACILITIES AND ENVIRONMENTAL EFFECTS
SURFACE PREPARATION AND COATINGS
DESIGN/PRODUCTION INTEGRATION
HUMAN RESOURCE INNOVATION
MARINE INDUSTRY STANDARDS
WELDING
INDUSTRIAL ENGINEERING
EDUCATION AND TRAINING

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U.S. DEPARTMENT OF THE NAVY
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VOLUME I



INSTITUTE FOR RESEARCH AND ENGINEERING FOR AUTOMATION AND PRODUCTIVITY IN SHIPBUILDING

I R E A P S

INTERACTIVE COMPUTER SUPPORT FOR THE IMPROVEMENT OF PLANNING
AND PRODUCTION CONTROL IN THE SHIPYARD ENVIRONMENT

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Captain Bihr holds a BS degree in mechanical engineering from Rensselaer Polytechnic Institute. He holds a MS degree in management service from the U.S. Naval Postgraduate School. He has undertaken postgraduate studies in communications engineering and in mathematics.

ABSTRACT

Planning Research Corporation has been working with the U.S. Navy for the past 2½ years in providing a unique production management system for Navy Intermediate Maintenance Activities (IMAs). This system, successfully adapted from commercially proved techniques and underpinned by engineered labor performance standards, is in use at the Shore Intermediate Maintenance Activities (SIMA) Norfolk, Virginia and Mayport, Florida. Additionally, implementation of the system is underway on an incremental basis at SIMA, San Diego, California.

The engineered labor performance standards, developed as Engineered Time Values (E.T.V.), provide a means to accurately plan, schedule and progress work, to exercise production control on a real-time basis and to analyze factors affecting productivity in order to effect remedial action. A key feature of the Engineered Time Values (ETV) System is the Productivity Management Information Component (PMIC) which supports these functions through the use of interactive computer equipment.

In the planning function, ETV information resident in the PMIC is accessed by the assigned planner using a visual display terminal. The planner selects the operations required for the accomplishment of the work based on his job investigation. Using a conversational dialogue, the system provides a structured methodology guiding the planner through his normal mental process of planning the job while storing the planned data for further manipulation in a Jobs -in-Progress life cycle file. The ETV planning data is constructed around a permanent core of work steps based on a job hierarchical structure of key operations, tasks and components of work. Therefore, planning at all job levels is readily achieved. Once the job is planned and reviewed on the terminal, the planner releases the job to a printer for automatic printing of the job order, known in the E.T.V. System as a worksheet. The worksheet, in addition to listing the planned operations, displays a planned man-hour figure for the job which includes time for travel to the job site, job preparation and other allowances.

Scheduling and workload forecasting functions are also accomplished dynamically in the PMIC providing managers a real-time display of each shop's projected workload based on the planned man-hour figures generated for each job and the shop projected labor loading.

Work progressing and status information on each job are entered in the PMIC daily., Planned man-hours are automatically converted to earned man-hours as work on the job is completed. The resulting percentage of work completed on each job reflects actual job status in that the planned man-hour figure used is an aggregate of the engineered time values for the actual work steps involved in accomplishing the job,

As a result of the aforementioned PMIC applications, maintenance managers are provided an on-line production control capability by having at their fingertips actual remaining man-hour capacities in all shops for any given day of the current work week and for the upcoming work weeks. Therefore, the ability to optimize loading is available. This coupled with the additional PMIC functions of materials management, technical documentation support, status of labor availability, and plant/equipment capability provide a significant enhancement to the production control function. Dynamic, real-time computer assistance in the shipyard production management process can significantly improve the planning and control functions.

BACKGROUND

SYSTEM FEATURES TO BE DESCRIBED BASED ON:

- ENGINEERED TIME VALUES SYSTEM FOR U.S. NAVY INTERMEDIATE MAINTENANCE ACTIVITIES
- REQUIREMENTS OF THE REPAIR ENVIRONMENT - NOT NEW CONSTRUCTION
 - RELATIVELY SHORT LEAD TIMES
 - FLEXIBILITY TO PLAN AND CONTROL WORK IN SUPPORT OF VOLATILE SHIP OPERATING SCHEDULES

HOWEVER:

- ADAPTABLE TO SHIPYARD REPAIR/OVERHAUL REQUIREMENTS
- APPLICABLE IN CONCEPT TO NEW CONSTRUCTION YARDS

IMPROVEMENTS

IN

PLANNING

PROVIDED BY

- STANDARDIZED PLANNING DATA
- STRUCTURED PLANNING PROCESS
- SIMULTANEOUS MATERIALS
IDENTIFICATION

STANDARD PLANNING DATA IN COMPUTER

BASED ON

- INDUSTRIALLY ACCEPTED ENGINEERING STANDARDS

AND

- APPLICATION TO LOCAL SHOP WORK METHODS/PROCESSES

STRUCTURED, PLANNING PROCESS

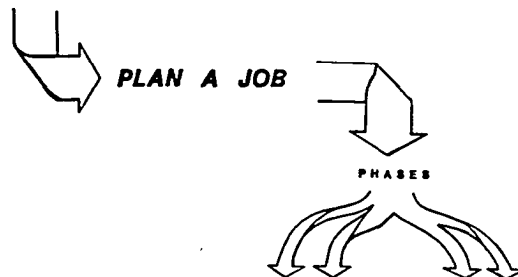
PLANNER ACCESSES STANDARD DATA AND PLANS

- UNIQUE/CUSTOMIZED JOB
- REPETITIVE JOB

FOR UNIQUE/CUSTOMIZED JOBS

- STANDARD DATA ORGANIZED AND SELECTED HIERARCHIALLY
 - KEY EVENT
 - JOB
 - KEY OPERATION
 - TASK
 - COMPONENT OF WORK
 - WORK OPERATION
- PLANNER SELECTS WORK ELEMENTS AT LEVEL DESIRED BY MENU SELECTION - COMPUTER ACCUMULATES TASK TIMES
- COMPUTER PROMPTS PLANNER THROUGH HIS NORMAL MENTAL PLANNING PROCESS
- COMPUTER ADDS ALLOWANCES TO GENERATE PLANNED TIME
 - JOB PREPARATION
 - SHOP/SHIP/SHOP TRAVEL
 - SHIPBOARD WORK ENVIRONMENT COMPLEXITY FACTOR
 - PERSONAL/REST/DELAY

MENU CYCLE



JOB IDENTIFICATION

WORK COMPONENT SELECTION

WORK QUANTIFICATION DETERMINATION

PLANNING FACTORS APPLICATION

MENU CYCLE

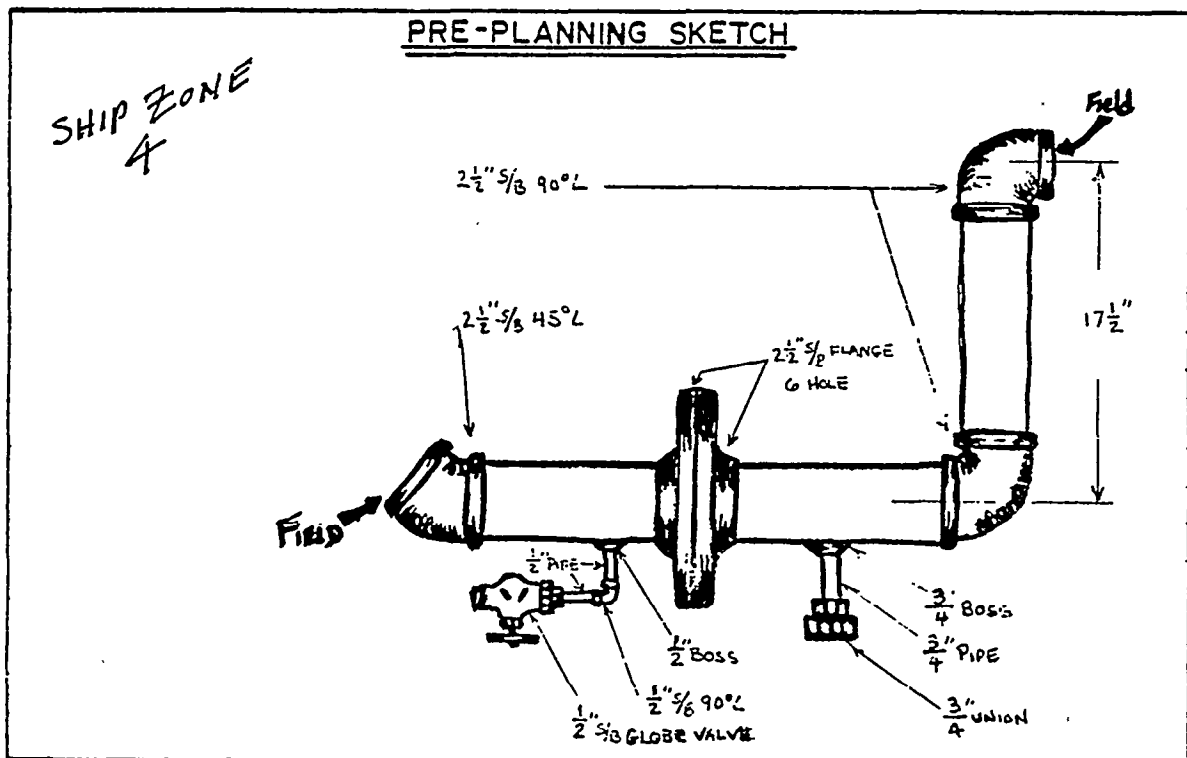


PLANNING / ESTIMATING MENU
SELECT ONE OF THE FOLLOWING :

1. MAINTAIN PLANNING FILE
- * 2. PLAN A JOB
3. MAINTAIN SCHEDULING FILE
4. MAINTAIN PRE-PLANNED JOB FILE
5. REVIEW PRE-PLANNED JOB CATALOG
6. MAINTAIN JOBS-IN-PROGRESS FILE

SELECTION : 2

SIMULATED CRT MONITOR SCREEN (SLIGHTLY REDUCED)



PLAN A JOB
SELECT ONE OF THE FOLLOWING TASKS :

- * 1. LWC-NEW JOB PLANNING
 - 2. AWC-NEW JOB PLANNING
 - 3. PRINT VERIFICATION LIST
 - 4. ENTER CORRECTIONS
 - 5. REARRANGE WORK OPERATIONS
 - 6. PRINT WORKSHEET (RELEASE TO JIP)
 - 7. REVIEW JOB PLANNING FILE
- SELECTIONS : 1**

SIMULATED CRT MONITOR SCREEN (SLIGHTLY REDUCED)

PLAN A JOB
NEW JOB PLANNING
DATE : 09/03/82 JULIAN : 2462

UIC : 52702 W/C : ERO4 JSN : 0582

NAME : USS JOSEPHUS DANIELS

LWC : 56A

JOB DESC. DATA

DO YOU WISH TO PLAN THIS LWC :Y

SIMULATED CRT MONITOR SCREEN (SLIGHTLY REDUCED)

LWC PLANNING
56A - TASK AREAS

001 SOCKET WELD

002 BUTT WELD

*** 003 SILVER BRAZE**

SELECTIONS :003

SIMULATED CRT MONITOR SCREEN (SLIGHTLY REDUCED)

PLAN A JOB

NEW JOB PLANNING - 52702 ER04 0582
SILVER BRAZE 56A

- * 001 TARGET / PRE TARGET**
- * 002 DRAW MATERIAL**
- * 003 CUT PIPE W/BANDSAW**
- * 004 REMOVE PIPE BY SWEATING**

015 FIT/CLEAN/FLUX & BRAZE

SELECTION(S) : 004

SIMULATED CRT MONITOR SCREEN (SLIGHTLY REDUCED)

PLAN A JOB

NEW JOB PLANNING - 52702 ER04 0582

56A PIPE SHOP

003 SILVER BRAZE

004 REMOVE PIPE BY SWEATING

**001 SWEAT UP TO 1 1/2" JOINT
PER JOINT**

ARE YOU PLANNING THIS ITEM :N

SIMULATED CRT MONITOR SCREEN (SLIGHTLY REDUCED)

PLAN A JOB

NEW JOB PLANNING - 52702 ER04 0582

56A PIPE SHOP

003 SILVER BRAZE

004 REMOVE PIPE BY SWEATING

**002 SWEAT UP TO 3" JOINT
PER JOINT**

ARE YOU PLANNING THIS ITEM :Y

SIMULATED CRT MONITOR SCREEN (SLIGHTLY REDUCED)

PLAN A JOB		
NEW JOB PLANNING - 52702 ER04 0582		
56A PIPE SHOP		
003 SILVER BRAZE		
004 REMOVE PIPE BY SWEATING		
002 SWEAT UP TO 3" JOINT		
PER JOINT		
	SHOP	SHIP
1. NO. OF MEN REQ'D.		2
2. HOW MANY ITEMS :		2
		3.9230 E.T.V.
ANY CHANGES :N		

SIMULATED CRT MONITOR SCREEN (SLIGHTLY REDUCED)

PLAN A JOB		
NEW JOB PLANNING - 52702 ER04 0582		
56A-LWC E.T.V.		
	SHOP	SHIP
SUB TOTAL:	16.5540	10.5208
COMPLEXITY FACTOR: C		1.5781
TOTAL E.T.V.	16.5540	12.0989
1. SHIP ZONE: 4		
2. JOB PREP FACTOR-SHOP: A		
	-SHIP: C	
3. NO. OF ROUND TRIPS PER DAY: 1		
PLANNED MANHRS :	20.5	19.1
PLANNED MANDAYS :	04	03

SIMULATED CRT MONITOR SCREEN (SLIGHTLY REDUCED)

FOR REPETITIVE JOBS

- SELECT PRE-PLANNED JOB ORDER
- ADD/DELETE WORK ELEMENTS AS NECESSARY
- SELECT ALLOWANCES AS IN CUSTOM JOB

THEN PLANNER

VERIFIES PLANNING STEPS ON VIDEO TERMINAL

PRINTS JOB ORDER

544 - IJC SHIP / SHOP WORKSHEET
 USS JOSEPHUS DANIELS STMA NORFOLK
 UTC: 52702 W/C: ER04 JEN: 0762 PAGE: 1
 SHIPBOARD COMPLEXITY FACTOR: C
 FOR JESS: REPLACE SECTION OF CHT SYSTEM

09/03/02 0 1140
 PLAN: IOW MC ANTRCU
 SHIP TRAVEL TIME ZONE: 4
 PT-SHIP = C SHOP = 1
 RT-SHIP = 1 SHOP = 1

REF WORK TO BE PERFORMED P L A N N E D
 NO SHIP SHOP
 M QTY C M QTY C
 E.T.U. E.T.U.

SILVER BRAZE

001	VERIFY SYSTEM TIGHT CHECK TIGHT (CONSTN) PER JOB	*	1	5010
002	SYSTEM DRAIN TOWN CRACK UNION/FLANGE PER UNION OR FL	*	3	3576
003	REMOVE PIPE BY SWEATING SWEAT UP TO 3" JOINT PER JOINT	*	2	39230
004	TARGET/PRE-TARGET (PER FL/PR) UP TO 4" (FLANGE) PTR FLANGE OR BRACE	*	5	57980
005	DRAW MATERIAL S DRAW MATERIAL PER NOF PARTS	*	15	0922
006	CUT PIPE W/RANDSAW CUT UP TO 1 1/2" PIPE PER CUT	*	5	1322
007	CUT UP TO 3" PIPE PER CUT	*	6	2050
008	FIT/CLEAN/FILUX/A BRAZE FITUP (UP TO 1 1/2" JOINT) PER JOINT	*	8	5760
009	FIT/CLEAN/FILUX/A BRAZE FITUP (UP TO 3" JOINT) PER JOINT	*	6	6770
010	FITUP (UP TO 3" JOINT) PER JOINT	*	2	57392

 START STOP **
 DATE: ** P L A N N E D - MANHOURS: 19.1 20.5
 TIME: ** DAYS: 03 04
 ** TOTAL - MANHOURS: 39.6
 **

 UNPLANNED COMPONENTS OF WORK:

NOTE: 1. COLUMN 'M' INDICATES NUMBER OF MEN IF MORE THAN 1 MAN FOR SHOP WORK OR
 2 MEN FOR SHIP WORK.
 2. USE COLUMN 'C' TO CHECK-OFF WORK COMPLETED.
 3. UNPLANNED COMPONENTS OF WORK - LIST MASTER WORKSHEET INDEX NUMBER OF THE
 COMPONENTS OF WORK COMPLETED BUT UNPLANNED. ALSO SHOW QUANTITY IF APP

SYSTEMATIC MATERIALS IDENTIFICATION

MADE AT PLANNING TIME,

- PLANNER ENTERS MATERIAL REQUIREMENTS AGAINST
JOB ORDER NUMBER
- INVENTORY AUTOMATICALLY ACCESSED FOR STATUS

IF ITEMS ON HAND:

INVENTORY ACCOUNT ADJUSTED

REQUIRED QUANTITY ADDED TO SUSPENSE ACCOUNT

PICKING TICKET PRINTED FOR PRE-STAGING

IF ITEMS NOT ON HAND:

JOB MATERIALS LIST (JML) PRINTED AT SUPPLY ORDER
POINT FOR ACQUISITION ACTION

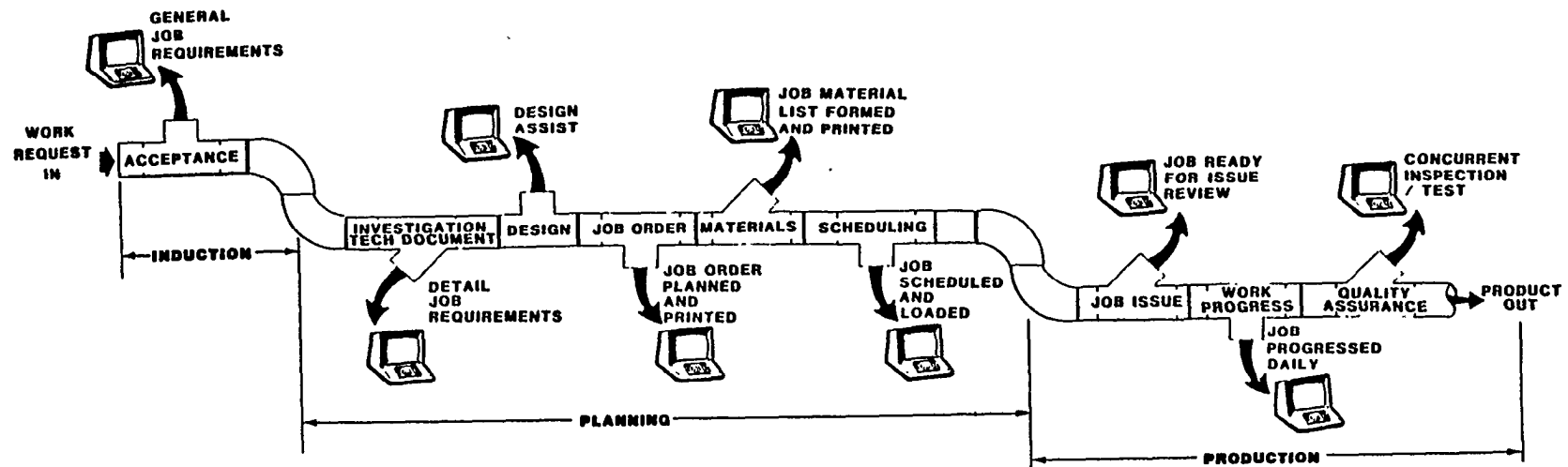
IMPROVEMENTS

IN

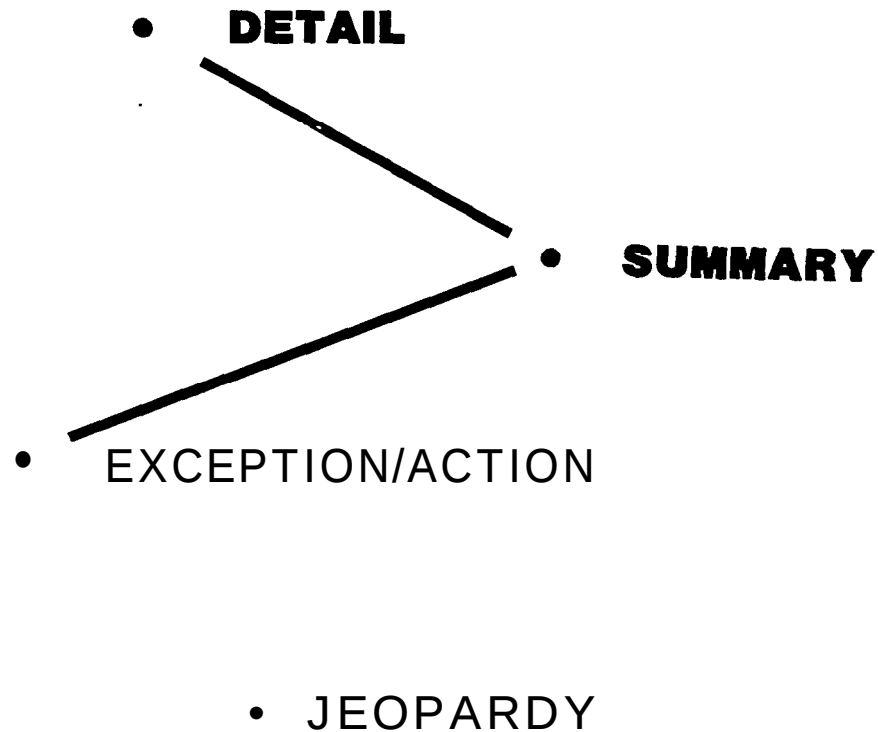
PRODUCTION CONTROL

PROVIDED BY
REAL-TIME DISPLAYS/REPORTS
SHOWING STATUS
DURING ALL PHASES OF THE
PRODUCTION CONTROL PROCESS

THE FLOW OF PRODUCTION CONTROL



DISPLAYS/REPORT STRUCTURE



INFORMATION PRODUCTION DISPLAYS/REPORTS

DISPLAY - DYNAMIC SCREEN PRESENTATION

REPORT - HARD COPY

ETV-PMIC/062	STATISTICAL SUMMARY - BY REPAIR DIVISION/GROUP							SIMA NORFOLK
	UNASG	R1	R2	R3	R4	R5	OTHER	TOTAL
INDUCTED -----	0	11	15	4	3	1	4	38
PLANNING -----		96	334	41	25	52	5	553
OVRDUE -----		0	0	0	0	0	0	0
SCHEDULING ---		94	225	40	4	26	3	392
PLN HRS ---		2947	6585	1368	256	1064	92	12312
PREP TO ISS --		21	61	5	7	21	1	116
PLN HRS -		779	1839	132	250	113	16	3129
JOBS-IN-PROG -		131	269	55	31	110	0	596
REM HRS -		3973	6520	1457	843	2231	0	15024
TOTAL JOBS ---	0	353	904	145	70	210	13	1695

09/08/82 17:26:18

Simulated CRT Monitor Screen - Actual Size / Characters Slightly Reduced

ENGINEERED TIME VALUES
 JOB STATUS UIC SUMMARY BY SHIP
 DATE: 09/08/82 & TIME: 1829

SIMA NORFOLK
 RPT NO: ETV681JTA
 PAGE 1

UIC: 20068 USS AINSWORTH

HULL: FF1090

AVAILABILITY: 0000000 - 0000000

W/C JSN CSMP SUMMARY

T/A

LWC R/HR O/O

--- L A T E S T
 DATE CODE REASON

A C T I O N ---
 REMARKS

EB01 2374 1A BLR CAL YARWAY INDECATOR	I4AV	41A	9	12AUG		SCN 27SEP2-01OCT2
EB01 2375 1B 3LR YARWAY INDECATOR CAL.	I4AV	41A	9	12AUG		SCN 27SEP2-01OCT2
EB01 2391 OVHL VLV OPERATOR	E4RGNT	38A	1 90	31AUG 19	WAITG TECH DDC	RESCHEDULING
EB01 2414 REPLACE BACK FILL VLV	SIMAV	56A	100	07SEP		COMPLETED
EB01 2415 REPLC OUTLET 1/2" GLB VLV	SIMAV	56A	100	07SEP		COMPLETED
EB01 2423 MFG VEM S/W LINE	SIMAV	56A	5	08SEP		IN PROG-SC 12SEP2
EB01 2529 REPLACE BACK FILL VLV	SIMAV	56A	23 52	08SEP		IN PROG-SC 27AUG2
EB01 2534 REPLACE 1/2 INCH GLB VLV	SIMAV	56A	100	07SEP		COMPLETED
EM01 1284 BR133LE STUDS ON LP TURBIN	I4AV	38A	11 77	08SEP		IN PROG-SC 10SEP2
EY01 1285 LUBE SUMP INDICATOR REPAIR	I4AV	56A	100	08SEP		COMPLETED
EM01 1300 REPAIR L/O STRAINER BASKET	SIMAV	17A	18	07SEP		I/S 13SEP2-17SEP2
ER01 1256 LOAD TEST AIRCRAFT TIE DOWNS	E/CSRP	72A	2	03SEP		I/S 06SEP2-10SEP2
ER01 1295 REPAIR SEPTAR BOAT	E/CSRP	64A	199 100	08SEP		IN PROG-SC 13AUG2
EXJC R029 TSET INSPECT RELIEF VLV	I4AV	96A	3	17AUG R6I	CANX BY S/F	PE REC REJ
EXSA 1221 NONE	SIMAV	11A		02AUG R6I	MDC ERR	TYCOM REP REC REJ
EXSA N760 QAC INSTALL SHIPALT FF-1052-52	SIMAV	56A	56	07SEP		I/S 13SEP2-17SEP2
SX01 0366 MFG PLAQUE BACKS	SIMAV	64A	29	08SEP		IN PROG-SC 26AUG2
WD01 1155 MFG 10 SECUR BRACKETS	I4AV	11A	15	27AUG		I/S 06SEP2-10SEP2
WD01 1276 WEIGHT TEST BOAT DAVIT	E4RGNT	72A	31 31	02SEP		IN PROG-SC 13AUG2
WD01 1277 MFG PREVENTER SPAN LINE	E4RGNT	72A	11 47	31AUG		IN PROG-SC 20AUG2
WD01 1278 WEIGHT TEST BOAT DAVIT	E4RGNT	72A	30 33	13AUG		IN PROG-SC 13AUG2
WD01 1279 MFG DAVIT HEAD PREVENTER	E4RGNT	72A	12 40	31AUG		IN PROG-SC 20AUG2
WD01 1280 MFG DAVIT HEAD PREVENTER	E4RGNT	72A	4 81	31AUG		IN PROG-SC 20AUG2

IMPROVEMENTS IN PRODUCTION CONTROL

FURTHER PROVIDED BY

- ABILITY TO PROGRESS EACH JOB ACCURATELY
 - EARNED MAN-HOURS = % COMPLETE
- ABILITY TO MONITOR AND CONTROL WORKLOAD
 - BY SHOP
 - REMAINING LOAD VS UNUSED CAPACITY
 - OPTIMIZE RESOURCES
- ABILITY TO MONITOR PLANT CAPABILITY STATUS
 - END RUN CHOKE POINTS
- QUALITY ASSURANCE AUDIT TRAIL

IN SUMMARY

INTERACTIVE ADP EQUIPMENT OFFERS

- RESPONSIVE MANAGEMENT OF PLANNING/PRODUCTION CONTROL INFORMATION
- PROCESS DISCIPLINE
- READILY ACCESSIBLE HISTORY
- TRAINING CAPABILITIES
- PAPERWORK REDUCTION
- ENTRY TIME DATA VALIDATION/VERIFICATION
- GRAPHICS/NETWORKING CAPABILITY

INTERACTIVE SYSTEM DEVELOPMENT RULES

- MODULARIZE, MODULARIZE AND MODULARIZE
- BUILD-IN TRANSPORTABILITY
- USE STRUCTURED PROGRAMMING TECHNIQUES - FROM THE BOTTOM - BUBBLE UP, NOT TRICKLE DOWN
- PROVIDE FREQUENT USER INTERCHANGE
 1. DESIGN AND FIELD CHECK
 2. DEVELOP AND FIELD CHECK
 3. TEST AND FIELD CHECK
 4. PLACE IN OPERATION AND FIELD CHECK
 5. DE-BUG AND FIELD CHECK
 6. GO TO 1.
- AUTOMATE INTERFACES - ONE TIME DATA ENTRY
- USE VIDEO DISPLAYS - ESCHEW REPORTS
- PROVIDE INFORMATION - NOT DATA
- EMPHASIZE MBE - USER PROVIDED CRITERIA
- PROVIDE JOB STATUS CONTINUOUSLY

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