

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

September 1982  
NSRP 0009

# **THE NATIONAL SHIPBUILDING RESEARCH PROGRAM**

## **Proceedings of the IREAPS Technical Symposium**

### **Paper No. 28: Standardization and Integration of Shipyard Processes and Procedures**

U.S. DEPARTMENT OF THE NAVY  
CARDEROCK DIVISION,  
NAVAL SURFACE WARFARE CENTER

# Report Documentation Page

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**September 14-16-1982**  
**San Diego, California**

**VOLUME I**



**INSTITUTE FOR RESEARCH AND ENGINEERING FOR AUTOMATION AND PRODUCTIVITY IN SHIPBUILDING**

**I R E A P S**

**STANDARDIZATION AND INTEGRATION OF SHIPYARD  
PROCESSES AND PROCEDURES**

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Engineering Duty Officer  
Industrial Facilities Management Directorate  
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Captain Fisher is a member of the Naval Institute, The American Society for an Engineering Education, and The Institute of Industrial Engineers. He is on the Education and Industrial Engineering Panels of the Ship Production Committee of SNAME. He is also a member of ASNE and was Chairman of the Charleston Chapter in 1976-77. He is a graduate of the U. S. Naval Academy and the Industrial College of the Armed Forces and has a MA degree in Business Management.

**ABSTRACT**

NAVSEA's ongoing efforts to improve, standardize and integrate shipyard process instructions are outlined. This plan, will combine the best features of various DOD, Navy and Private programs including for example: (1) the navy technical information presentation programs, (2) DOD computer aided time standards, (3) Navshipyd/Ordnance Station EM&S automated support (NEAS), (4) the Carnegie Mellon/USS CARL VINSON CUN 70 ZOG program (5) shipboard nontactical ADP system (SNAP), (6) NAVSHIPYD Norfolk - work planning and control systems - PROMPT, and (7) technical repair standards (TRS) program. Specific aspects of these programs will be discussed including computer aided authoring, group technology, and common vocabularies, and a status report of these efforts as well as future plans will be provided.

"IT'S TIME FOR CHANGE IN THE WAY WE BUILD SHIPS"

, , , BANGS, , , IREAPS

O B J E C T I V E S

- 1 STANDARDIZE & AUTOMATE PROCESSES & PROCEDURES FOR SHIPYARD WORK
- 1 INCORPORATE BEST FEATURES OF EXISTING & FUTURE AUTOMATED DATA INPUT, STORAGE & RETRIEVAL PROGRAMS

S H I P Y A R D P R O C E S S I N S T R U C T I O N

- AN AID FOR THE MECHANIC THAT GIVES HIM CONFIDENCE IN THE FACT THAT HE IS DOING A JOB CORRECTLY AT A REASONABLE RATE AND UTILIZING THE RIGHT TOOLS AND MATERIAL .
- A LOGICAL COLLECTION OF BOTH OPTIONAL AND MANDATORY TECHNICAL INFORMATION AND GUIDANCE FOR PERFORMING WORK, SUCH AS OVERHAULING A PUMP, WELDING A SEAM, FABRICATING A JOINER BULKHEAD.
- A FRAMEWORK THAT A SHIPYARD SHOULD BE ABLE TO USE TO ORGANIZE ITS WORKFORCE, FACILITIES, EQUIPMENT, AND MATERIAL IN AN EFFICIENT MANNER FOR A PARTICULAR TASK.
- A LOGICAL FRAMEWORK FOR PRODUCTIVITY IMPROVEMENTS.

## **G O A L S**

- COMMON FORMAT FOR PROCESSES, PROCEDURES, ALTERATIONS, ETC.
- ONE PRINT OUT YIELDS ALL INFORMATION NEEDED TO PERFORM THE JOB AND NO UNNECESSARY INFORMATION
- ABILITY TO EXTRACT WORKSHEET THAT CONTAINS ALL DATA COLLECTION TAG OUT, SAFETY, ETC. REQUIREMENTS
- ELIMINATE CODES & VAGUE ACRONYMS & PRINT INFORMATION IN CLEAR TEXT
- INFORMATION RECORDED IN ONLY ONE LOCATION
- ALL DATA NEEDED ON THE SUBJECT PRINTS OUT ON ONE INQUIRY

## **DESIRED RESULTS**

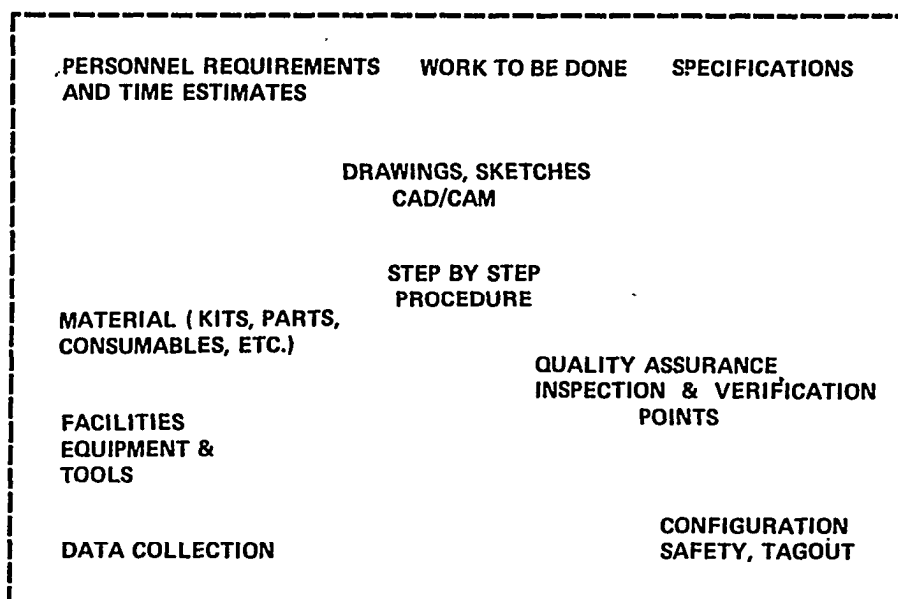
- **EASY TO USE**
- **INCREASED EFFICIENCY BY STANDARDIZING OPERATIONS**
- **ADAPTABLE TO PLANNING, ESTIMATING, BUDGETING, TRAINING, ETC.**
- **INTERFACE WITH OTHER SYSTEMS:**
  - **SPECIFICATIONS & STANDARDS**
  - **SUPPLY**
  - **3M**
  - **QUALITY ASSURANCE**
  - **TRAINING**
  - **FACILITIES, TOOLS, SHIPYARD MODERNIZATION, MILCON ETC.**

# SHIPYARD PROCESSES

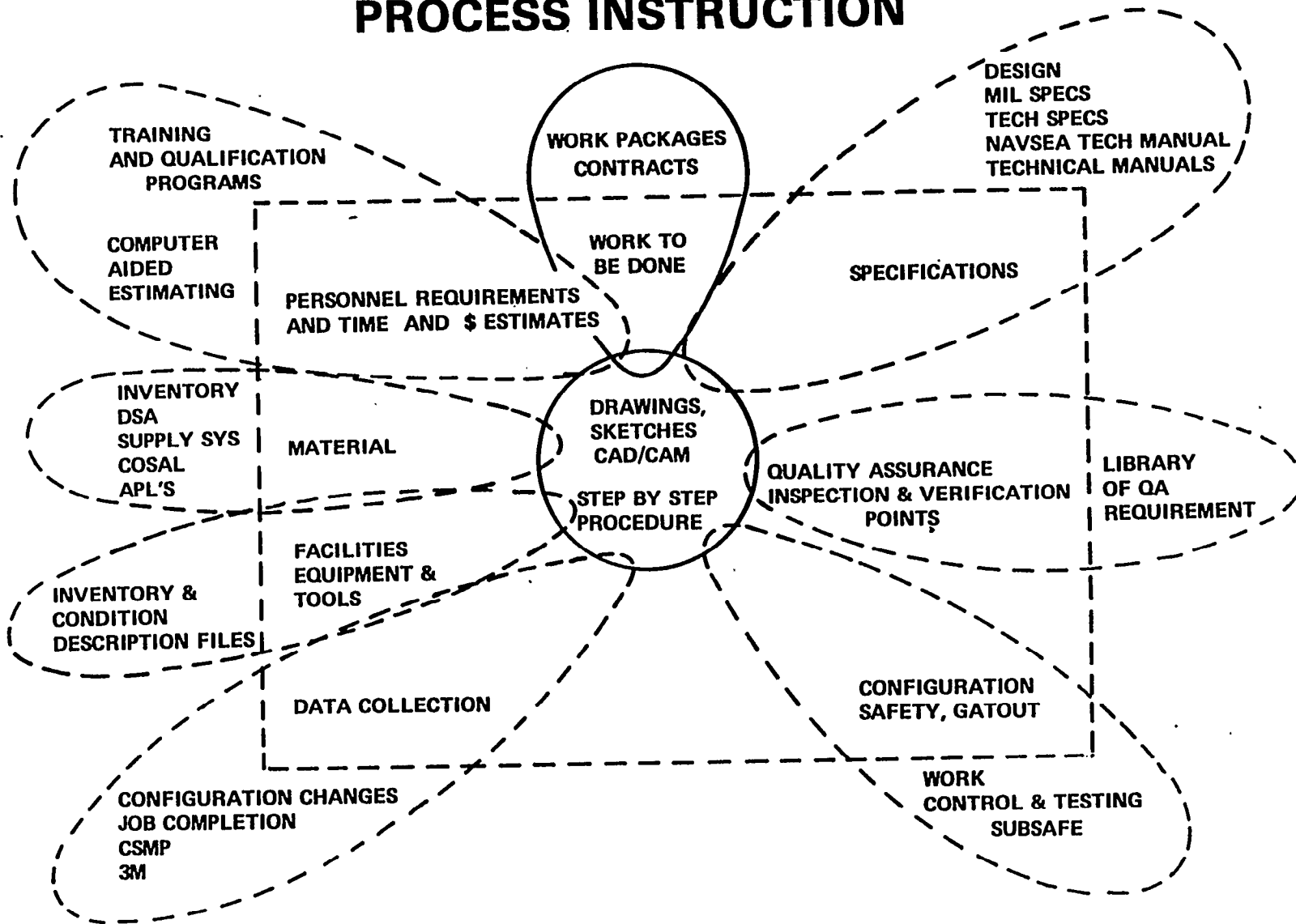
SHIPYARD PROCESSES INCLUDE SPECIFIC EQUIPMENT, COMPONENT, MODULE OR SYSTEM FABRICATION, OVERHAUL, REPAIR MAINTENANCE, MODIFICATION AND TEST PROCEDURES

THESE PROCEDURES CAN BE BROKEN DOWN INTO GENERIC PROCESSES SUCH AS PAINTING, WELDING, SILVER BRAZING, PIPEBENDING, ETC.

## PROCESS & PROCEDURE INSTRUCTION



# INTEGRATED PROCESS INSTRUCTION



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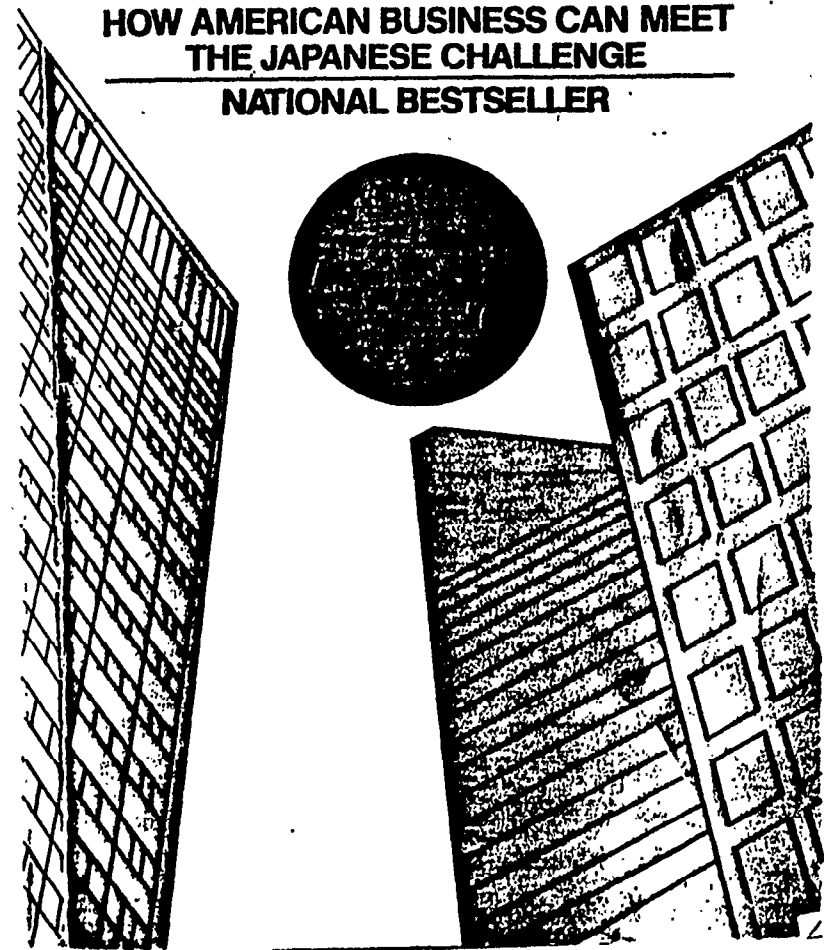
# THEORY Z

842  
95  
144

## BY WILLIAM G. OUCHI

### HOW AMERICAN BUSINESS CAN MEET THE JAPANESE CHALLENGE

NATIONAL BESTSELLER



519

**"HERE, FINALLY, IS A BOOK THAT EXPLAINS, IN FUNDAMENTAL TERMS, WHY PRODUCTIVITY IN JAPAN IS SO MUCH HIGHER . . . In the years ahead, common use of the term 'Theory Z' will attest to the significant contribution of this important work."**

*Arjay Miller, Director, Ford Motor Company*

**"The Buick assembly plant in Flint, Michigan, used the Theory Z approach . . . Within two years, the plant had become the most efficient General Motors facility."**

*Time*

**"Theory Z concentrates on the organizational and behavioral side of management. One of the central tenets is that the traditional adversarial relationship between American management and workers is badly outdated."**

*The New York Times*

**"A hot new plan to revitalize corporate America."**

*The Los Angeles Times*

**"Powerful answers for American firms struggling with high employee turnover, low morale, and falling productivity."**

*Dallas Times-Herald*

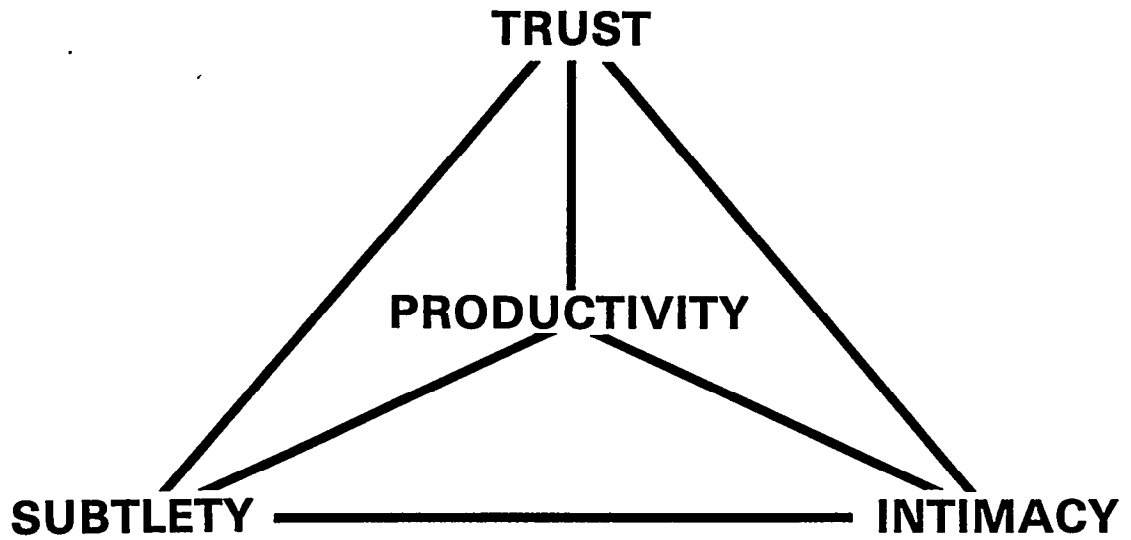
**"Combines the best of the American and the Japanese business styles."**

*Akio Morita, Chairman, SONY Corporation*

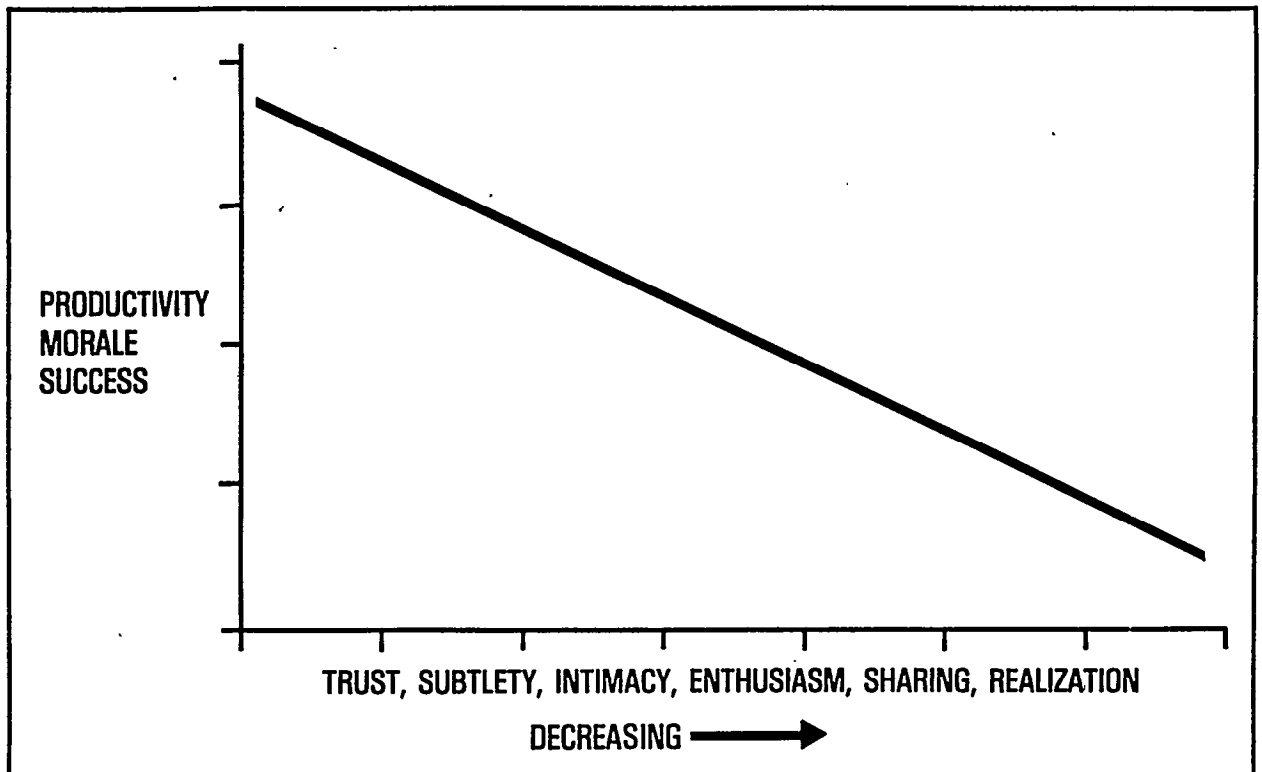
**"Theory Z has to do with important matters—productivity, the welfare of corporations and their employees, and, by extension, the competitiveness of the national economy."**

*Fortune*

# LESSONS FROM THEORY Z



## LIFE & WORK



## RELATED EFFORTS AND INITIATIVES

### THIS PLAN INTERFACES WITH AND DRAWS ON OTHER ONGOING INITIATIVES

- TECHNICAL REPAIRS STANDARDS (TRS)
- NAVAL TECHNICAL INFORMATION PRESENTATION PROGRAM (NTIPPS) – PROVIDES FORMAT COMPUTER AIDED AUTHORING
- DOD COMPUTER AIDED TIME STANDARDS (CATS) – PROVIDES SEARCH BY WORD; LIBRARY OF ESTIMATED TIME BY PROCESS
- SOCIETY OF NAVAL ARCHITECTS & MARINE ENGINEERS (SNAME) SHIP PRODUCTION COMMITTEE
- MARAD'S INITIATIVES-MOST © AT NNEWS – USED FOR BOTH STUDS & AUTOMATIC MUST AT BIW ISSUE OF WORK
- MANUFACTURING-SHIPBUILDING TECHNOLOGY (MT/ST) PROGRAM – \$1M EBDIV CAD CAM
- SHIPBUILDING STANDARDS PROGRAM
- CARNEGIE MELLON-ZOG-USS CARL VINSON CVN 70 – HUMAN COMPUTER INTERFACE
- SHIPBOARD NON TACTICAL ADP PROGRAM (SNAP) – HONEYWELL HAS CONTRACT
- NAVAL AVIATION LOGISTICS DATA ANALYSIS (NALDA)
- NAVAL AVIATION LOGISTICS COMMAND MANAGEMENT INFORMATION SYSTEM (NALCOMIS) – WILLOW GROVE
- NAVAL SHIPYARD/ORDNANCE STATION ENGINEERED METHODS AND STANDARDS AUTOMATED SUPPORT SYSTEM

## SPECIFIC EQUIPMENT OVERHAUL AND REPAIR PROCEDURES

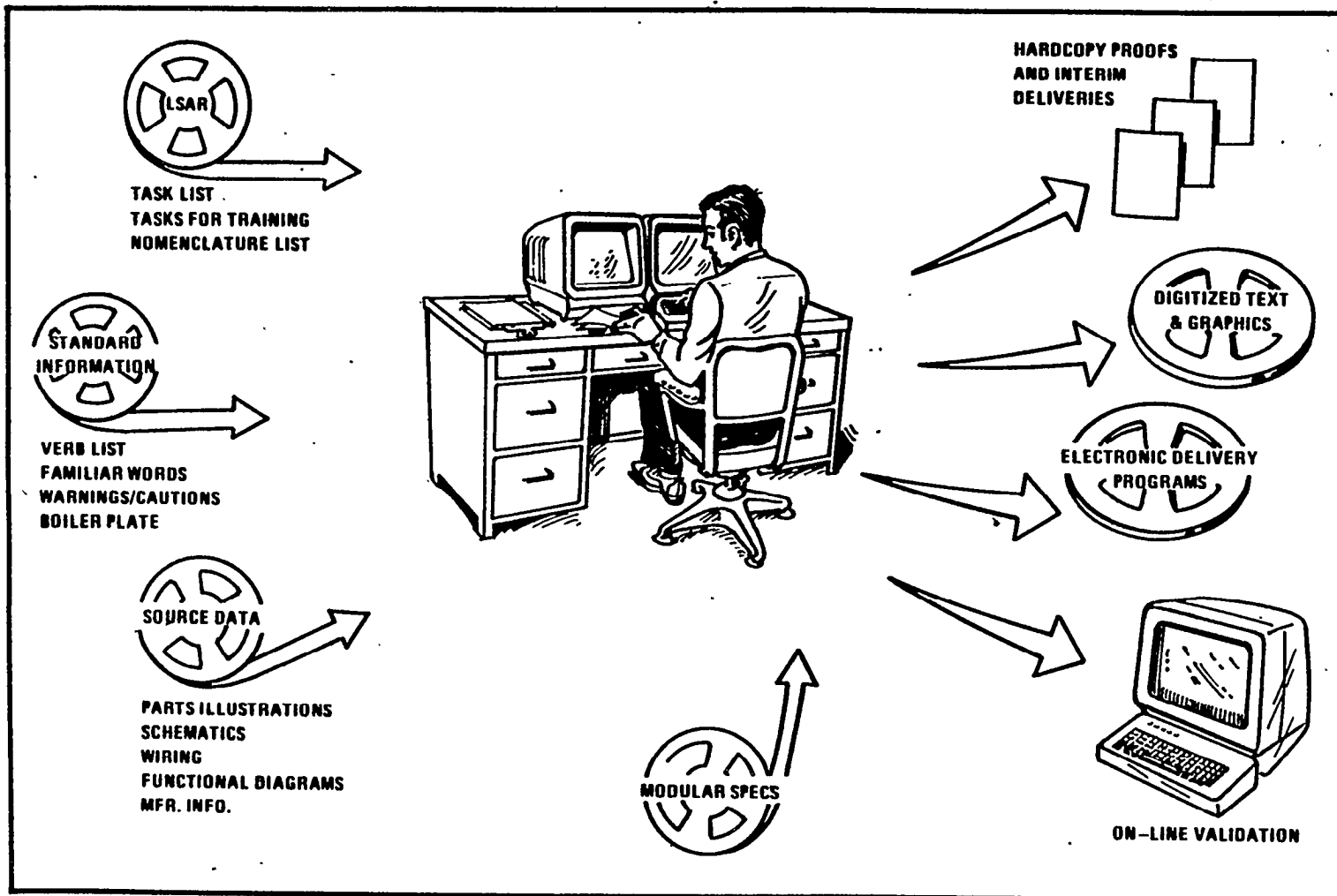
### TECHNICAL REPAIR STANDARD (TRS) IS THE TOP LEVEL DOCUMENT

- NAVSEA INSTR 4160.2 PROMULGATED PROGRAM
- NAVSHIPYD NORFOLK COORDINATING PREPARATION EFFORTS OF NAVAL SHIPYARDS
- APPLICABLE TO PUBLIC & PRIVATE YARDS
- WILL BE NON DEVIATION (ND) WHEN INVOKED FOR CLASS B OVERHAUL
- WILL INCLUDE I & V POINTS
- WILL BE THE PRIMARY NAVSEA DOCUMENT FOR CONDUCTING CLASS B OVERHAULS OF MACHINERY

### OTHER PROCEDURES ARE EXPECTED TO EVOLVE INTO TRSs

- METHODS AND STANDARDS, UNIFORM METHODS AND STANDARDS, ENGINEERED METHODS & STANDARDS
- TECHNICAL OVERHAUL PROCEDURES (TOPs)
- STANDARD ITEMS (SI's)
- CLASS STANDARD WORK ITEMS (CSWIs)
- MRCs

# NTIPS COMPUTER-BASED AUTHORING SYSTEM



# NTIPS COMPUTER-BASED AUTHORING SYSTEM

- ① PROMPTED INTERACTIVE DATA ENTRY
- ② ON-LINE EDITING (FOR TEXT AND GRAPHICS)
- ③ PROJECT MANAGEMENT AND INDEXING
- ④ AUTOMATED QUALITY INSPECTION
- ⑤ AUTOMATED OUTPUT FORMATTING
- ⑥ ACCESS AND SECURITY CONTROL
- ⑦ INTERACTIVE COMMUNICATIONS
- ⑧ ON-LINE USER TRAINING AND SUPPORT
- ⑨ ACCESS TO FLEXIBLE AUTHORING TOOLS

## PROCESS INSTRUCTION VARIABLES

UNDER NTIPPS, NAVY TECHNICAL INFORMATION  
PRESENTATION PROGRAM, PROCESS INSTRUCTION  
VARIABLES ARE:

- CONTENT
- FORMAT
- STYLE
- MEDIUM

## **CONTENT CONSIDERATIONS**

**ACCOMPLISHMENT OF SYSTEM-RELATED TASKS REQUIRES INFORMATION OF ONLY FOUR GENERAL TYPES:**

1. **DESCRIPTIVE** – TELLING HOW A GIVEN PART OF A SYSTEM WORKS.
2. **PROCEDURAL** – TELLING A TECHNICIAN HOW TO DISASSEMBLE A GIVEN COMPONENT OR REPAIR AN IDENTIFIED FAULT.
3. **TROUBLESHOOTING** – TELLING A TECHNICIAN HOW TO LOCATE THE SOURCE OF A MALFUNCTION.
4. **PARTS DESCRIPTION** – ILLUSTRATED PARTS BREAKDOWN (IPB) PARTS CATALOGUES, LISTS.

**MANY TASKS WILL REQUIRE SOME CONTRIBUTION OF SEVERAL OF THESE TYPES. FOR EACH INFORMATION TYPE, SPECIFIC FORMAT AND STYLE GUIDANCE SHOULD BE PROVIDED.**

## **FORMAT CONSIDERATIONS**

**ALL INFORMATION REQUIRED TO PERFORM A TASK SHOULD BE INCORPORATED IN THE SAME SECTION.**

- **USE TEXT/GRAPHICS MODULES. RELATED TEST AND GRAPHICS MUST BE IMMEDIATELY ADJACENT TO OR INSCRIBED ON THE GRAPHICS.**
- **TROUBLESHOOTING IS A SPECIAL CASE, REQUIRING LOGIC TREES OR THEIR EQUIVALENT. PROVIDE ALL LOGIC CHAINS AND IMPLICIT DECISION POINTS.**
- **ELIMINATE ERRORS THROUGH VALIDATION, REPEATED CHECKING AND INSTANT FEEDBACK OF CORRECTED DATA.**
- **BE SURE PROCEDURES, EQUIPMENT, TOOLS, TEST EQUIPMENT & FACILITIES CALLED OUT ARE/CAN BE MADE AVAILABLE AT THE MAINTENANCE LEVEL INVOLVED.**
- **PROVIDE FOR WORKSHEET WITH THE MINIMUM INFORMATION REQUIRED TO COMPLETE THE TASK.**
- **BREAK DOWN INTO LOGICAL TASKS AND SUBTASKS.**

## STYLE CONSIDERATIONS

- CALL A GIVEN PART, TOOL, OR ACTION ALWAYS BY THE SAME NAME.
- WRITE THE ENTIRE PROCESS INSTRUCTION USING A CONTROLLED VOCABULARY; I.E., USE ONLY THOSE WORDS ON A PREDETERMINED LIST. NOTE: THE NTIPP OFFICE HAS DEVELOPED A CONTROLLED VOCABULARY MADE UP OF:
  1. A BASIC VOCABULARY
  2. A SPECIALIZED VOCABULARY
  3. A SYSTEM-UNIQUE VOCABULARY
- USE SIMPLE SENTENCES ONLY; NO COMPLEX OR COMPOUND SENTENCES. SAMPLE: REMOVE THE FACEPLATE USING A SCREWDRIVER.  
  
(NOTE THAT A COMPUTER CAN BE PROGRAMMED TO CHECK FOR COMPLIANCE WITH THE ABOVE RULES.)
- USE QUALITY PRINTING, COMPETENT DRAWING STYLE, ETC.

## MEDIUM CONSIDERATIONS

**BEST MEDIUM FOR EACH APPLICATION MUST BE ASCERTAINED IN ADVANCE**

**ELECTRONIC PRESENTATION IS AVAILABLE NOW**

**COMPUTER DISPLAYED TECHNICAL INFORMATION**

- CAN BE VERY INTERACTIVE ON USER-FRIENDLY HARDWARE
- AMENABLE TO LOCAL TAILORING
- APPLICABLE TO BOTH TRAINING AND JOB EXECUTION

**MICROFILM USES**

- LOOK UP INSTRUCTIONS ON A RELATIVELY INFREQUENT BASIS

**MOTION PICTURES – SUITABLE FOR SOME TYPES OF TRAINING**

**HARD COPY EXAMPLE: CIRCUIT DIAGRAMS**

## **RELATED EFFORTS AND INITIATIVES (CONT)**

- **LOGISTICS MANAGEMENT INSTITUTE STUDIES TO EXPLOIT NEW INFORMATION TECHNOLOGY**
- **NALC 05 – WORKLOAD CONTROL SYSTEM (WCS)**
- **DOVER AIR FORCE BASE – 436TH MILITARY AIR WING AUTOMATED MAINTENANCE SYSTEM**
- **NAVSHIPYD MARE ISLAND – NAVSEA MATERIAL INVENTORY, STORAGE AND TRACKING SYSTEM (SEA MIST)**
- **NAVSHIPYD NORFOLK – WORK PLANNING & CONTROL (PROMPT)**
- **NATIONAL ACADEMY OF SCIENCE – STUDY OF NAVY ADP NEEDS**
- **ALL ACTIVITIES – REVISIONS AND UPDATES OF ALMOST ALL MIS AND ADP SYSTEMS**

## **RELATED EFFORTS AND INITIATIVES (CONT)**

- **SHIPYARD SKILL TRAINING PROGRAM**
- **NAVSEA SPECIFICATION UPGRADE PROGRAM**
- **MODIFIED OVERHAUL PLANNING PROCESS (MOPP)**
- **SMMSO – SSBN + SSN**
- **PERA EFFORTS**
- **DOIP, SOIP, SORT**
- **EBDIV MANUFACTURING TECHNOLOGY CAD-CAM PROJECT**
- **LONG BEACH TOTAL INTEGRATED CAD CAM SYSTEM**
- **MARE ISLAND CAD PROJECTS**
- **AFLC INTEGRATED COMPUTER AIDED MANUFACTURING PROJECTS**
- **DEERS**
- **NAVMAT**
- **CLASS STANDARD WORK ITEMS**

# NEXT STEPS

1. ASSIGN RESPONSIBILITY FOR SPECIFIC PROCESS TO EACH NAVAL SHIPYARD (BELOW ASSIGNMENTS ARE THE SAME AS THOSE FOR THE SKILLS TRAINING PROGRAM) .

	SHIPYARD RESPONSIBLE FOR MODULE TRAINING DEVELOPMENT		NAVSEA TECHNICAL MANUAL CHAPTER	NAVSEA CODE
SHIPFITTING	PORTSMOUTH	100	HULL STRUCTURES	05D
		623	LADDERS	515
		624	ACCESS CLOSURES	515
		625	WINDOWS PORTLIGHTS & RELATED EQUIPMENT	515
		633	CATHODE PROTECTION	05D
WELDING	NORFOLK	074	VOL 1 WELDING & ALLIED PROCESSES	05D
SHEET METAL	PUGET	664	LOCKS KEYS & HASPS	515
MARINE MACHINIST	CHARLESTON	075	THREADED FASTENERS	532
		076	GASKETS PACKINGS & SEALS	513
		231	PROPULSION TURBINES	522
		233	DIESEL ENGINES	523
			MARINE GAS TURBINES	523
		234	REDUCTION BEARS	524
		243	SHAFTING	524
		244	BEARINGS	524
		245	PROPELLERS	524
		502	AUX STEAM TURBINES	522
			532	

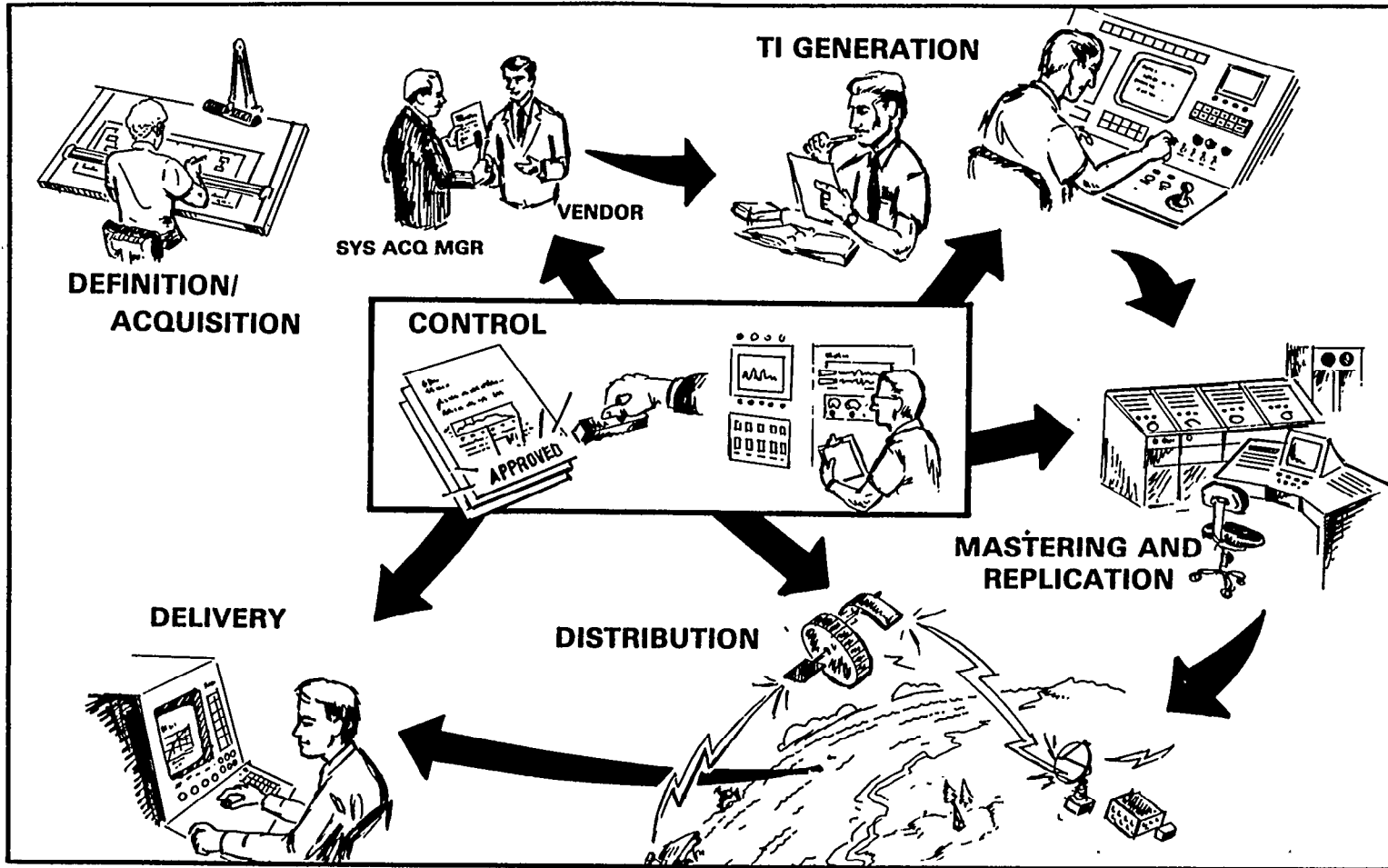
	SHIPYARD RESPONSIBLE FOR MODULE TRAINING DEVELOPMENT		NAVSEA TECHNICAL MANUAL (NSTM) CHAPTER	NAVSEA CODE
ELECTRICAL	LONG BEACH	223	SUBMARINE STORAGE BATTERIES	543
		235	ELECTRIC PROPULSION INSTALLATION	543
		300	ELECTRIC PLANT GENERAL	542
		302	ELECTRIC MOTORS & CONTROLLERS	544
		310	ELECTRIC POWER GENERATORS AND CONVERSION EQUIPMENT	544
		320	ELECTRIC POWER DISTRIBUTION	542
		330	LIGHTING	543
		461	ELECTRICAL MEASURING AND TEST INSTRUMENTS	544
		512	FANS	531
		ELECTRONICS	PEARL	
WOODWORK	PUGET			
FABRIC WORK	MARE ISLAND			
SURFACE PRESERVATION AND PAINTING	PEARL			
RIGGING	NORFOLK	613	RIGGING, WIRE & ROPES	613
ELECTROPLATING	CHARLESTON			

## NEXT STEPS (CONT'D)

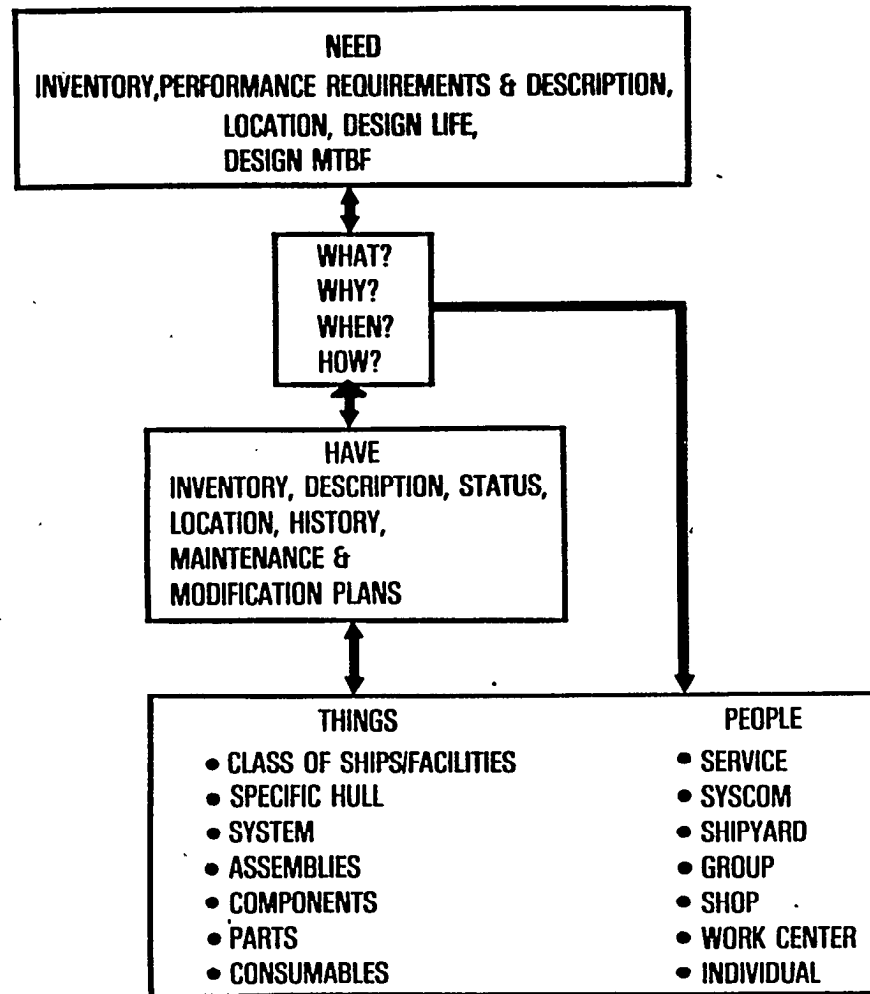
	SHIPYARD RESPONSIBLE FOR MODULE TRAINING DEVELOPMENT		NAVSEA TECHNICAL MANUAL (NSTM) CHAPTER	NAVSEA CODE
MACHINE SHOP <b>MACHINIST</b>	PHILADELPHIA	551	COMPRESSED AIR PLANTS	533
		554	BLOWERS	532
		556	HYDRAULIC EQUIPMENT POWER TRANSMISSION & CONTROL	513
		561	SUBMARINE STEERING & DIVING SYSTEMS	513
		562	SURFACE SHIP STEERING SYSTEM	513
		571	WINCHES AND CAPSTANS	514
BOILER WORK	LONG BEACH	221	BOILERS	522
		254	CONDENSERS HEAT EXCH. AND AIR REJECTORS	522
		531	DISTILLING PLANTS	522
PIPE FITTING	MARE ISLAND	505	PIPING SYSTEMS	532
		533	POTABLE WATER SYSTEMS	533
INSULATION	PHILADELPHIA	635	THERMAL INSULATION	635
AIR CONDITIONING AND REFRIGERATION	PORTSMOUTH	516	REFRIGERATION SYSTEMS	532
ORDNANCE EQUIP. MECHANICAL	NOS LOUISVILLE			

2. DESIGNATE OTHER SHIPYARDS FOR COGNIZANCE OVER OTHER SPECIFIC AREAS:
  - SUPPLY ---
  - PLANNING ---
  - ESTIMATING ---
  - SCHEDULING ---
  - WORKLOADING ---
  - PROGRESSING ---
  - TESTING ---
3. DETERMINE STANDARD FORMAT AND SPECIFICATION FOR PROCESSES INCLUDING IN PARTICULAR USEFULNESS BY ALL WORKERS, ADAPTABILITY TO WORD PROCESSING AND AUTOMATED DATA PROCESSING SYSTEMS, SIMPLICITY, UNIFORMITY, THE AVOIDANCE OF DUPLICATION AND INTEGRATION WITH OTHER SYSTEMS (MT; 3M, OA, NDE, ETC.).
4. TRIAL RUN COMBINATION OF BEST FEATURES OF NTIPS, CATS, PROMPT, SKILLS TRAINING PROGRAM UTILIZING BEST AVAILABLE ADP SYSTEMS FOR REACHING CONSENSUS ON BEST SYSTEM.
5. UTILIZE TRADE SKILLS WORK SHOP: TO PROMULGATE AND REFINE SKILLS TRAINING AND STANDARD PROCESSES.

## 6. CONTINUE TO DEVELOP AN EVOLUTIONARY PLAN THAT REFINES THE FOLLOWING ASPECTS:



# 7. INTEGRATE INTO A TOTAL INFORMATION AND DECISION SUPPORT SYSTEM:



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