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HUMAN RESOURCE INNOVATION
MARINE INDUSTRY STANDARDS
WELDING
INDUSTRIAL ENGINEERING
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CARDEROCK DIVISION,
NAVAL SURFACE WARFARE CENTER

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Proceedings
IREAPS Technical Symposium
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San Diego, California

VOLUME I



INSTITUTE FOR RESEARCH AND ENGINEERING FOR AUTOMATION AND PRODUCTIVITY IN SHIPBUILDING

I R E A P S

**COMPUTERVISION INTERFACE
TO BATCH ELECTRIC BOAT PIPING PROGRAMS**

**Laurence J. McKee
Senior Software Engineer
General Dynamics/Electric Boat Division
Groton, Connecticut**

Mr. McKee is currently responsible for development of interfaces to and from the Electric Boat Division piping design analysis and assembly programs to computervision. He has developed an interface between computervision and AUTOKON.

Mr. McKee holds a BS degree from Hofstra University Hempstead, New York.

**Robert Sciallo
Manager Material
General Dynamics/Electric Boat Division
Groton, Connecticut**

Mr. Sciallo's functions include computer system development and control and computer generation of pipe details which provided a logical conversion from batch to graphic terminals. Additional responsibilities are in the areas of material identification and sourcing; drawing control and issues; and contract definition and budgets. Data systems interface provides for involvement in virtually all aspects of engineering products and the interfaces with shipyard construction activities.

Mr. Sciallo attended Thames Valley State Technical College and Carnegie Institute of Technology.

ABSTRACT

The design and implementation of the computervision interface to the batch electric boat piping design analysis and assembly programs will be described. This interface will allow three-dimensional piping models produced on computervision to be processed by the Electric Boat Piping programs on the UNIVAC. The end result of this processing would be assembly details which are delivered to the pipe shop for assembly.

Background

COMPUTERIZED PROGRAMS FOR PIPING SYSTEM EVOLUTION

1. Provided pipe bending data for length, bend angles, roll angles, and distance between bends.
2. Added fitting, valve, and hanger locations to both bent and straight pipe by match marking and creating pipe details.
3. Combined details into assemblies.
4. Generated isometric and orthographic drawings.
5. Added welding identification and data.
6. Extracted and added material information.
7. Expanded to include work authorizations, trade work instructions, feed relationships, test boundaries, and serialization.
8. Generated tapes for data transfer to work authorization files and reports for manufacturing and installation.

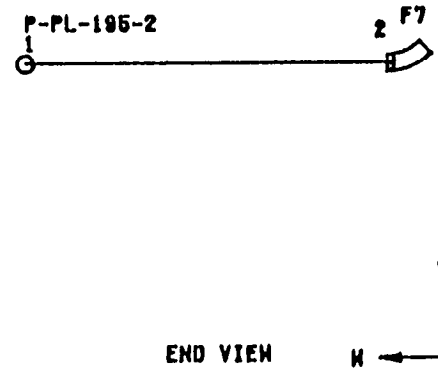
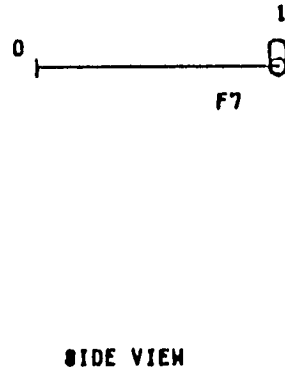
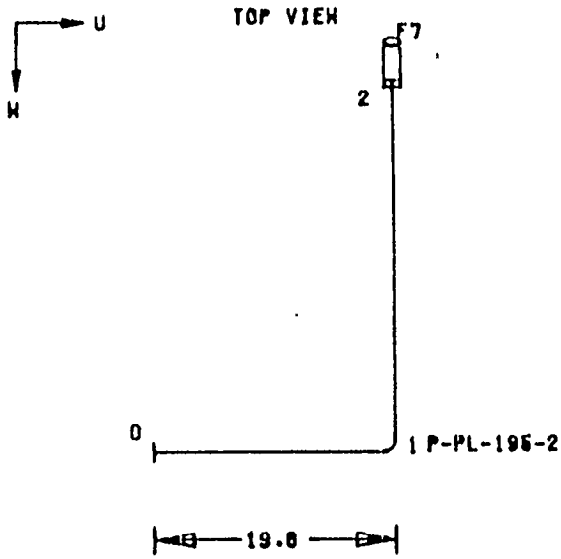
JUL 31, 1970 600-4644096 DET FMC TRIM SAN TK 1 & 2
 DATE _____ BOAT NO. _____ S.O. _____
 PIPEFITTER & BADGE NO. _____
 SUPERVISOR _____

GENERAL DYNAMICS / ELECTRIC BOAT DIVISION
 PLAN PIPE DET REV APPLICABILITY
 87523-1307 P-PL-195-2 QR A
 MBR 2.5 FLOOR 36

PT NO	U	DELTA V	H
0-1	19.8	.0	.0
1-2	.0	.0	-30.1

BEND	ROLL ANGLE	BEND ANGLE	DIST WIRE	PBR	DIST PIPE	STRAIGHT PIPE	CLAMPING OR FITUP	END JOINT
1	0	90	17.3	60 7.6	12.3	12.3	.0	SB
	90		48.8		48.7	22.8	.0	SB

LENGTH END TO END = 36.0 INCHES



327

LIST OF MATERIALS

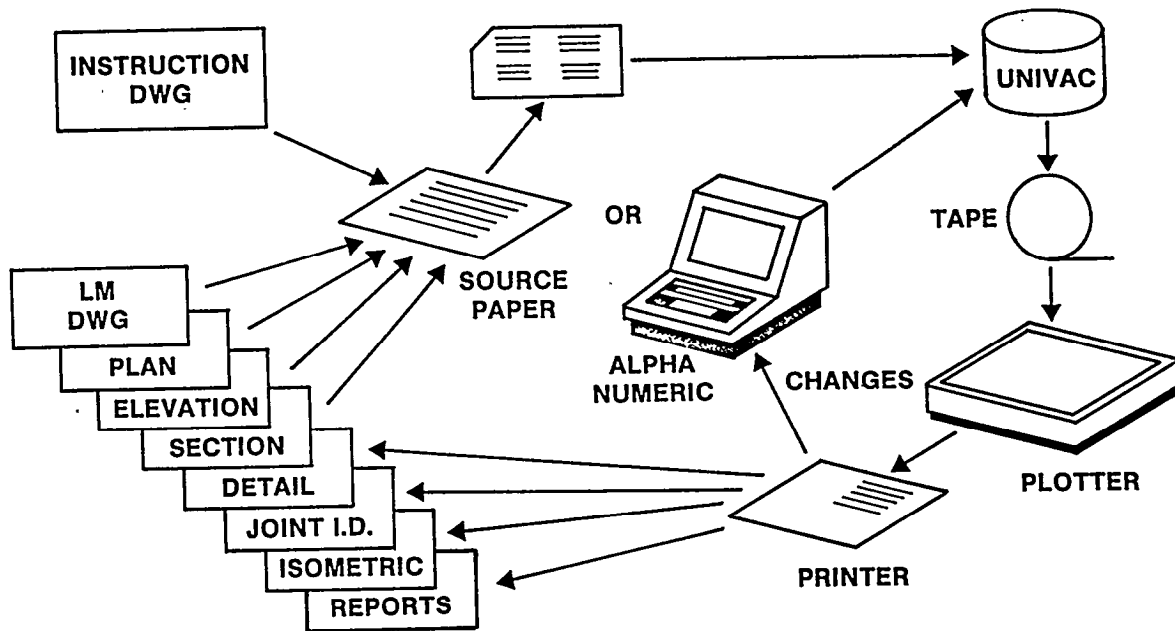
ITEM NO	QTY	UM	MF	QTY	UOM	NAME	TYPE	MODIFIER MATERIAL	DOCUMENT OR DRAWING	PART NO SOURCE	ROUTING REMARKS
P-PL-195	47	IN				TUBE			MIL-T-16420	48-65-0081	
0005	1	PC	NA			1.0000 X 0.134MIN		CUNI	TY 1 OR 2 70-30		
F7	1	PC	NA			ELBOW	45	SB	MIL-F-1183	15-00-4519	
2007	1	PC	NA			1.500IPS 400PSI		BRZ	TY A		
F1	1	PC	NA			SLEEVE	PEN		2621-601-09	262160109-0055	
2001	1	PC	NA			1.500IPS 4.500LO		STL	PC 63	HAA-A7020005000	

FABRICATION

ATTACH F7 AT POINT 2 AT JOINT IDENT. NO. 048-01-033
 F7 (AT POINT 2) ATTACHED TO P-PL-195-1 OF DETAIL 2 AT JOINT IDENT. NO. 048-01-032
 ATTACH F1 TO P-PL-195-2

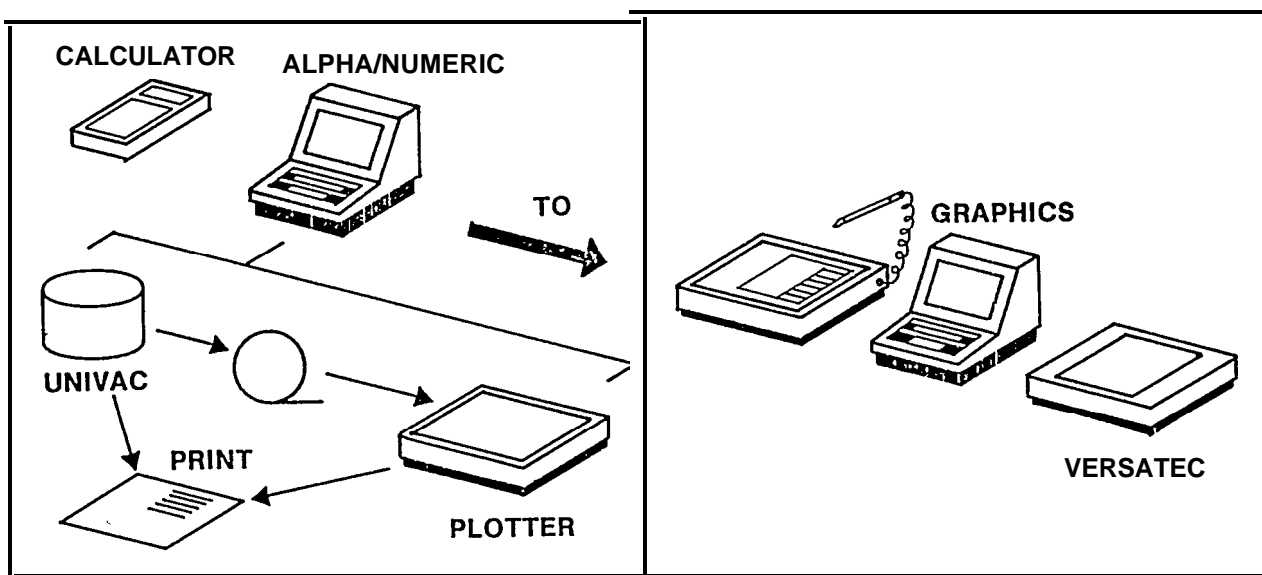
NOTE: INCLUDES
 CONTROLLED AND
 NON-CONTROLLED JOINTS

Background (Cont'd)



Transition

STATE OF THE ART ALLOWS A CHANGE IN SKILL LEVEL AND REDUCTION IN WALL TIME.



Approach

- MUST BE TECHNICALLY EQUAL TO EXISTING PRODUCTS.
- MUST BE COST-EFFECTIVE WITH REAL BENEFITS (MANHOURS AND WALL TIME).
- ESTABLISH PLAN AND MILESTONES

1. Training on CADDs 3

2. Execution on CADDs 3



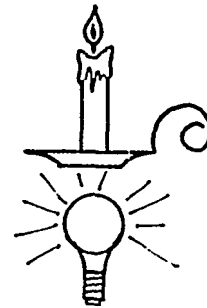
3. Mods/workarounds CADDs 3



whenever
CADDs 3

4. Training on CADDs 4

5. Execution on CADDs 4



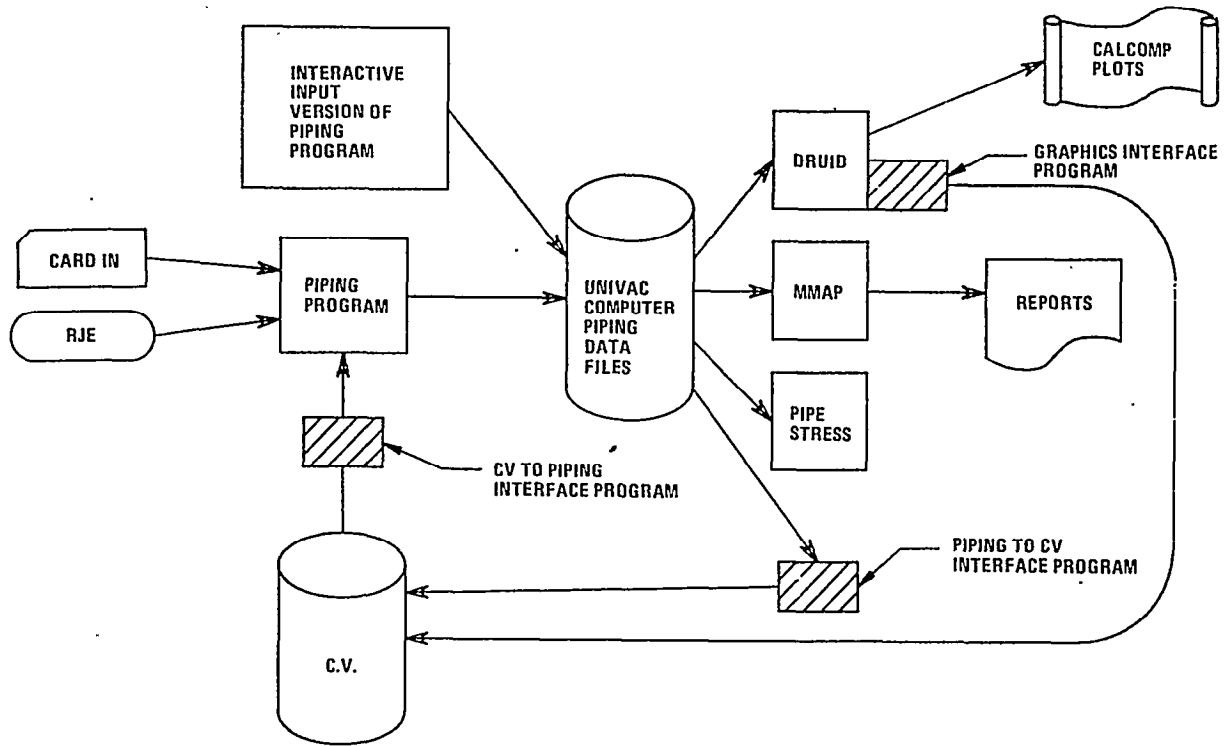
6. Mods/workarounds CADDs 4

7. CADDs 4 → IN / UNIVAC → OUT



8. Committee programming/data flow

Computervision/Univac System Flow Chart



Approach (Cont'd)

- PROGRAMMING - IN-HOUSE OR CV? ~~CV~~

- DATA FLOW

1. CV → IBM → UNIVAC
2. UNIVAC → CV
3. UNIVAC → IBM → CV

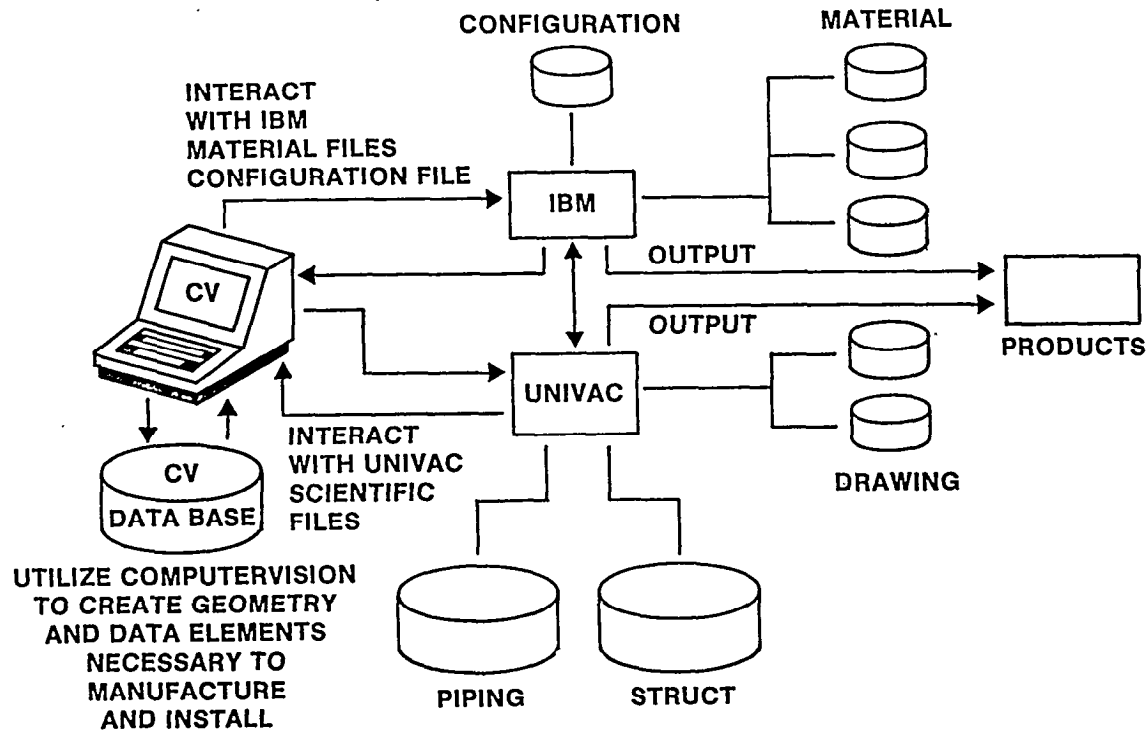
INTELLIGENCE
DUMB
INTELLIGENCE

- TEST AND ACCEPTANCE

1. Equal products
2. Time trial - Machine
3. Time trial - Human

~~6 vs 5~~

Proposed Detail Data Flow For CAD/CAM



Creating A Pipe Detail With Bend and Match Mark Data

COMPARISON OF BATCH TO COMPUTERVERSION

Step 1

BATCH (8 hrs, 1 day)

Obtain Cartesian coordinates from mockup, layout, shipcheck, etc.

COMPUTERVERSION (8 hrs, 1 day)

Obtain Cartesian coordinates from mockup, layout, shipcheck, etc.

S t e p 2

BATCH (20 hrs, 2-1/2 days)

Fill out source paper for key punch.

COMPUTERVISION (12 hrs, 1-1/2 days)

Model piping system.

Step 3

BATCH (3 hrs, 1-1/2 days)

Run PIPER program until error-free. Run DRUID program for isometric or orthographic plots.

COMPUTERVISION (2 hrs, 1 day)

CV data base interfaced to DRUID for isometric or orthographic plots.

Step 4

BATCH (2 hrs, 1 day)

MMAP Interface program - pipe details

COMPUTERVISION (2 hrs, 1 day)

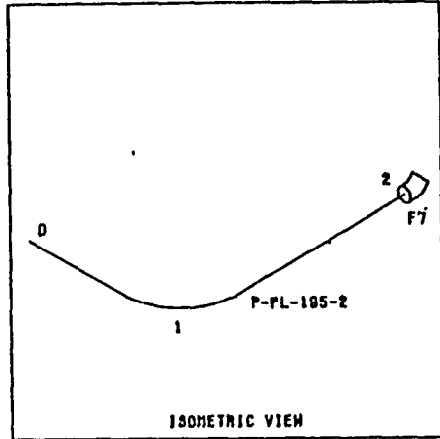
MMAP Interface program - pipe details

Totals

BATCH - 36 hrs, 7 days

COMPUTERVISION - 24 hrs, 4-1/2 days

335

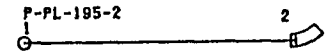
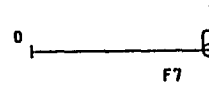
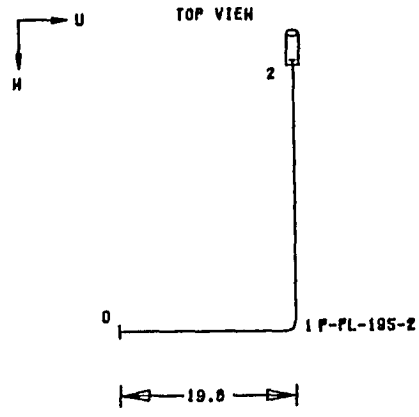
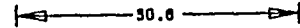


■ AUG 25, 1982 508-4844095 DET FWD TRIM BRN TK 1 4 2
 DATE BOAT NO. 8.0.
 PIPEFITTER & BADGE NO. _____
 SUPERVISOR _____

GENERAL DYNAMICS / ELECTRIC BOAT DIVISION
 PLAN PIPE DET REV APPLICABILITY SHEET
 87523-1907 P-PL-195-2 AA K ABCDEF 27
 .NBR 2.5 FLOOR 38

PT NO	U	DELTA V	W	BEND ANGLE	ROLL ANGLE	BEND ANGLE	DIST WIRE	PDR	DIST PIPE	STRAIGHT PIPE	CLIPPING OR FITUP	END JOINT
0-1	19.8	.0	.0	1	0	90	17.3	SD 7.5	12.3	12.3	.0	68
1-2	.0	.0	-30.1	1	90		48.8		48.7	22.8	.0	88

LENGTH END TO END = 36.0 INCHES



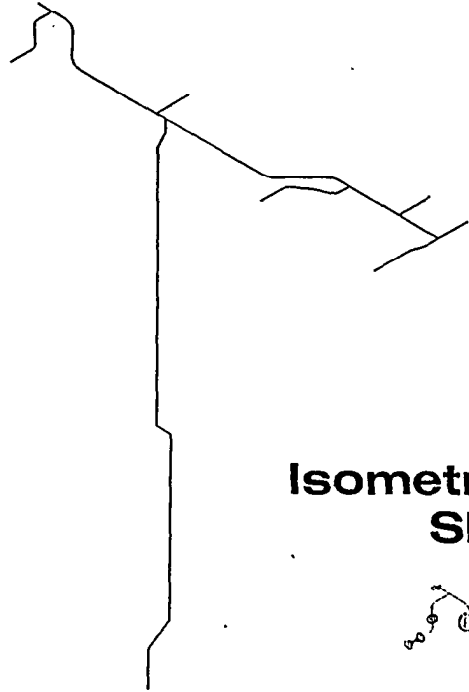
LIST OF MATERIALS

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NO	SEQ	CLASS	LV SIZE		MATERIAL		TON-M REQ
P-PL-195	47		IN TUBE			MIL-T-16420 CL 1650	48-85-0081
	0005	P-3B	NO 1.9000 X 0.134MIN		CUNI	TY 1 OR 2 70-30	
F7	1		PC ELBOW	45	S8	MIL-F-1183	15-00-4513
	2007		NA 1.500IPS 400PSI		BRZ	F10 7 1Y A	
F1	1		PC SLEEVE	PEN		2821-601-09	ASTM-A441
	2001		NA 1.500IPS 4.500LO		STL	PC 53	262160109-0059

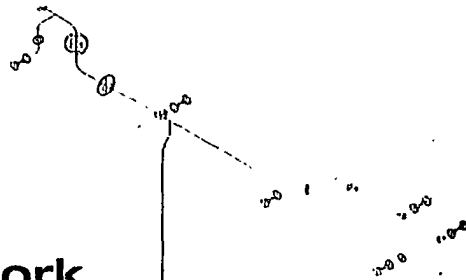
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ATTACH F7 AT POINT 2 AT JOINT IDENT. NO. 048-01-033
 F7 (AT POINT 2) ATTACHED TO P-PL-195-1 OF DETAIL Z AT JOINT IDENT. NO. 048-01-032
 ATTACH F1 TO P-PL-195-2
 PAINT WITH EPOXY COATING SYSTEM

Isometric of Modeled Pipeline Routed with Bends



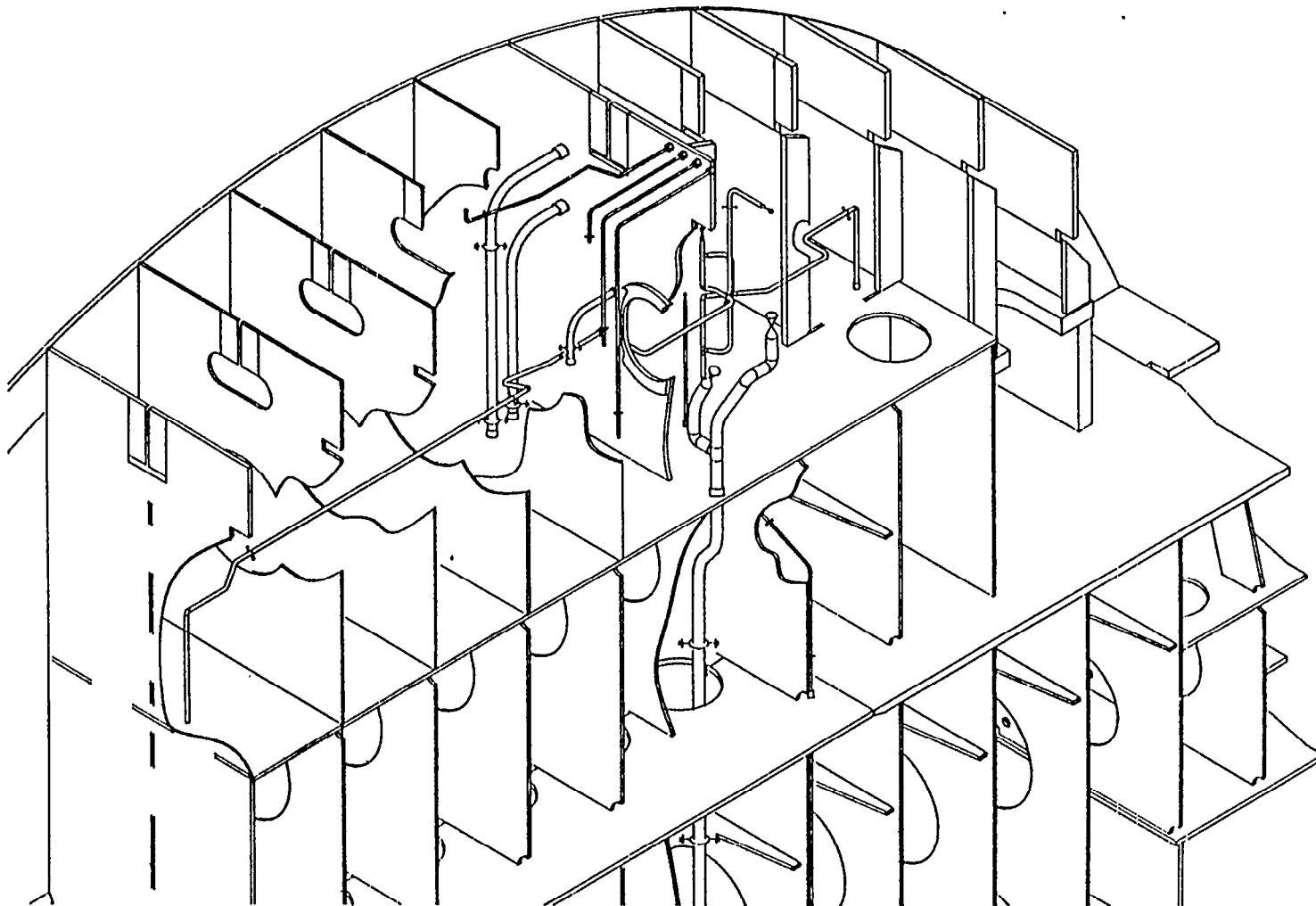
Isometric of Piping Network Showing Fittings



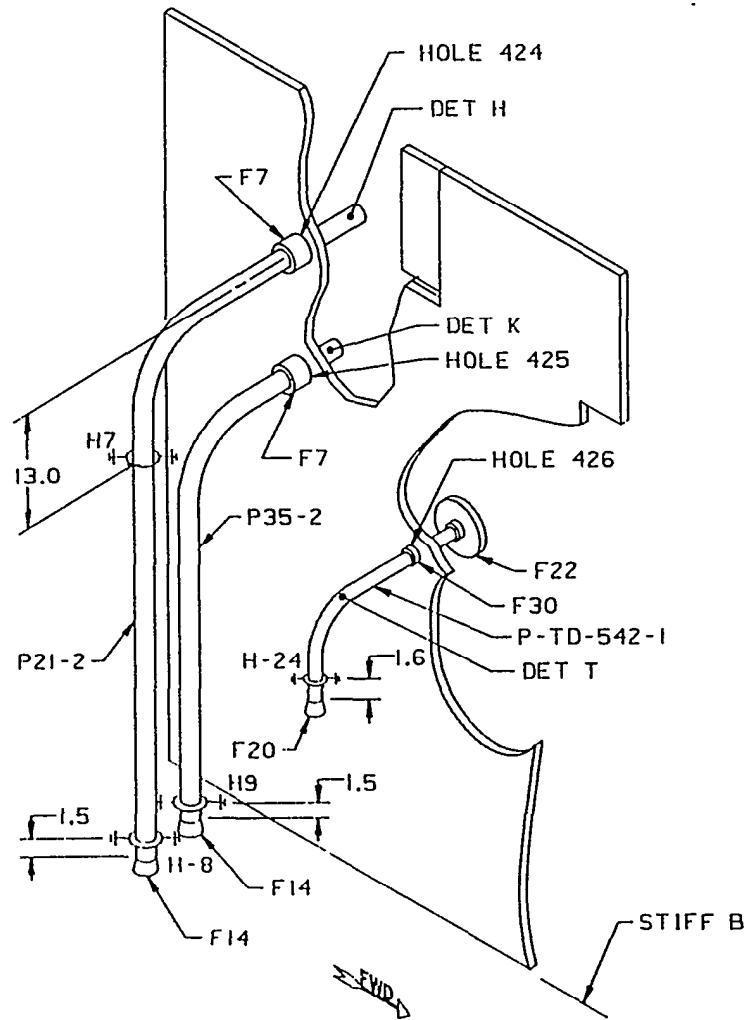
Plan View of Piping Network



Cutaway Isometric Showing Combination of Piping and Structural Systems



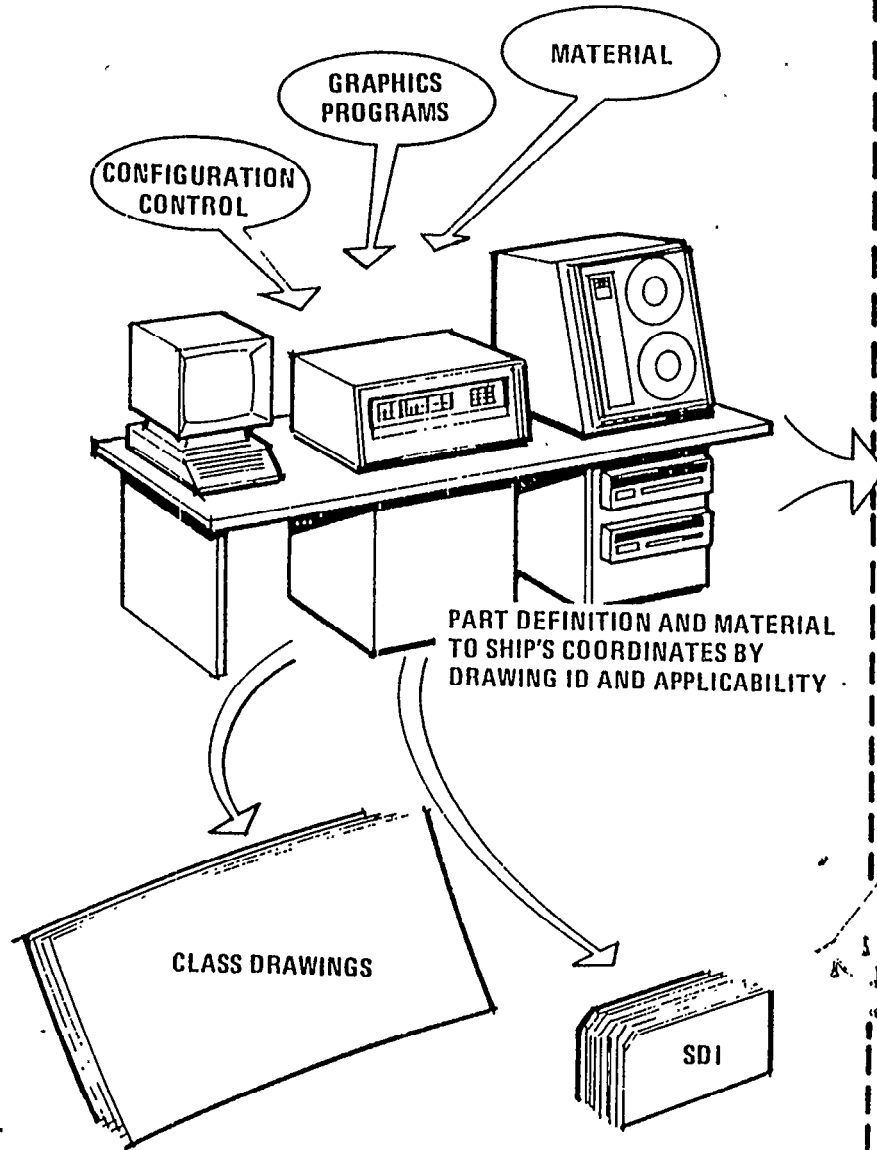
Labeled Isometric Showing Pipe Penetrating Structure



Results

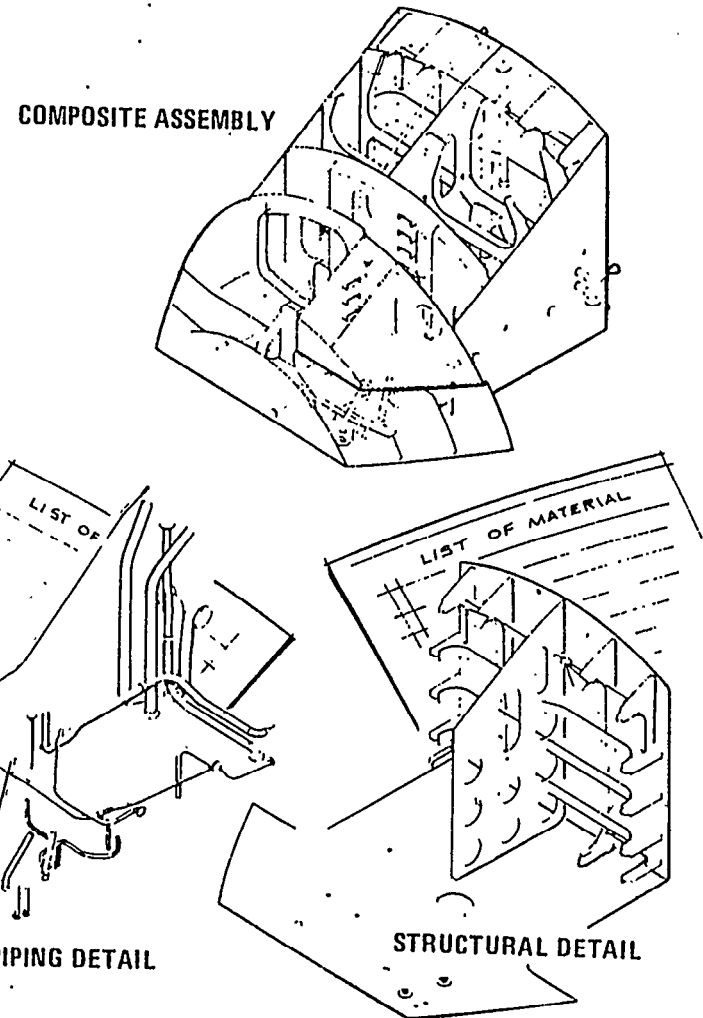
- PROMISING
- **CAN GENERATE PRODUCTS**
- MARRY EXISTING TECHNOLOGY WITH NEW **TECHNOLOGY**
- MODS/WORKAROUNDS ARE ESSENTIAL
- USERS AND PROGRAMMERS MUST WORK AS A TEAM
- SIDE BENEFITS

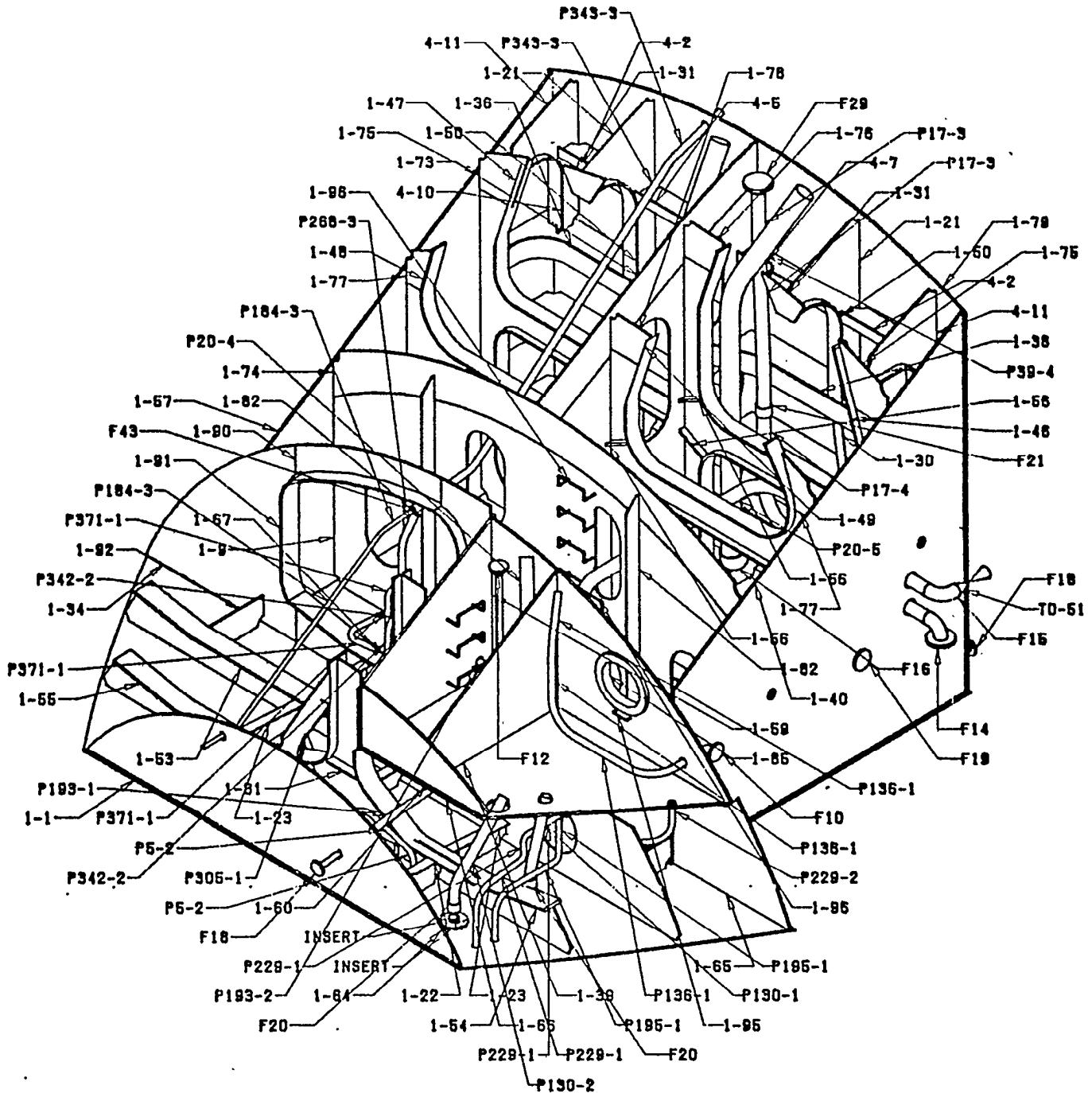
Capture & Control Data



Package Work

IN ACCORDANCE WITH SHIPYARD
WORK AUTHORIZATIONS AND SCHEDULES





ISOMETRIC
 1/32 SCALE 3/8 IN/FT

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