

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. 24: MAPLIS: An On-Line Materials Resource Planning System Tailored to the Shipbuilding and Offshore Industry

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

Report Documentation Page				Form Approved OMB No. 0704-0188	
Public reporting burden for the collection of information is estimated to average 1 hour per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to Washington Headquarters Services, Directorate for Information Operations and Reports, 1215 Jefferson Davis Highway, Suite 1204, Arlington VA 22202-4302. Respondents should be aware that notwithstanding any other provision of law, no person shall be subject to a penalty for failing to comply with a collection of information if it does not display a currently valid OMB control number.					
1. REPORT DATE SEP 1982		2. REPORT TYPE N/A		3. DATES COVERED -	
4. TITLE AND SUBTITLE The National Shipbuilding Research Program, Proceedings of the IREAPS Technical Symposium Paper No. 24: MAPLIS: An On-Line Materials Resource Planning System Tailored to the Shipbuilding and Offshore Industry				5a. CONTRACT NUMBER	
				5b. GRANT NUMBER	
				5c. PROGRAM ELEMENT NUMBER	
6. AUTHOR(S)				5d. PROJECT NUMBER	
				5e. TASK NUMBER	
				5f. WORK UNIT NUMBER	
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) Naval Surface Warfare Center CD Code 2230 - Design Integration Tools Building 192 Room 128-9500 MacArthur Blvd Bethesda, MD 20817-5700				8. PERFORMING ORGANIZATION REPORT NUMBER	
9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)				10. SPONSOR/MONITOR'S ACRONYM(S)	
				11. SPONSOR/MONITOR'S REPORT NUMBER(S)	
12. DISTRIBUTION/AVAILABILITY STATEMENT Approved for public release, distribution unlimited					
13. SUPPLEMENTARY NOTES					
14. ABSTRACT					
15. SUBJECT TERMS					
16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT SAR	18. NUMBER OF PAGES 23	19a. NAME OF RESPONSIBLE PERSON
a. REPORT unclassified	b. ABSTRACT unclassified	c. THIS PAGE unclassified			

DISCLAIMER

These reports were prepared as an account of government-sponsored work. Neither the United States, nor the United States Navy, nor any person acting on behalf of the United States Navy (A) makes any warranty or representation, expressed or implied, with respect to the accuracy, completeness or usefulness of the information contained in this report/manual, or that the use of any information, apparatus, method, or process disclosed in this report may not infringe privately owned rights; or (B) assumes any liabilities with respect to the use of or for damages resulting from the use of any information, apparatus, method, or process disclosed in the report. As used in the above, "Persons acting on behalf of the United States Navy" includes any employee, contractor, or subcontractor to the contractor of the United States Navy to the extent that such employee, contractor, or subcontractor to the contractor prepares, handles, or distributes, or provides access to any information pursuant to his employment or contract or subcontract to the contractor with the United States Navy. ANY POSSIBLE IMPLIED WARRANTIES OF MERCHANTABILITY AND/OR FITNESS FOR PURPOSE ARE SPECIFICALLY DISCLAIMED.

**Proceedings
IREAPS Technical Symposium
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

MAPLIS: AN ON-LINE MATERIALS RESOURCE PLANNING SYSTEM
TAILORED TO THE SHIPBUILDING AND OFFSHORE INDUSTRY

Henrik Bucher
Chief Consulting Engineer
Management Systems
Shipping Research Services
Oslo, Norway

Mr. Bucher has 16 years of experience which includes ship performance analysis, structural design of large oil carriers, AUTOKON development customer support, shipyard management systems analyses, consultant in shipyard development projects, and development and marketing of management systems software.

Mr. Bucher attended the Technical University of Norway, and majored in naval architecture and marine engineering.

ABSTRACT

MAPLIS is an on-line computer system for material management in yards building ships and offshore constructions. It consists of five modules or subprograms which may be installed separately or together as one integrated system. Material planning and control in MAPLIS starts in the design office with drawing files, material specification and purchase requests, continues with purchase orders, expediting, receiving, storage status and cost control and ends in work preparation with work orders, drawings and bill of materials. The system handles outfit and steel materials, both direct and stock items.

Fig.1 . MAPLIS Materials Resource Planning System

As indicated in the title of this paper MAPLIS is a computer system developed to suit the material management procedures in yards dealing with new building or repair of ships or offshore constructions. MAPLIS is project oriented, it is particularly suitable for follow up of direct ordered materials and allows a detailed product breakdown for cost control purposes.

Fig. 2. MAPLIS Projects.

The ships and platforms showed on this figure have at least one thing in common: The material management and control has been handled by MAPLIS. The system is flexible in the sense that it may be used on several levels of detailing, depending on the requirements. It is well suited for traditional shipbuilding, but it will also satisfy the strict follow up and documentation requirements in offshore and navy projects.

Fig 3. MAPLIS modules and functions

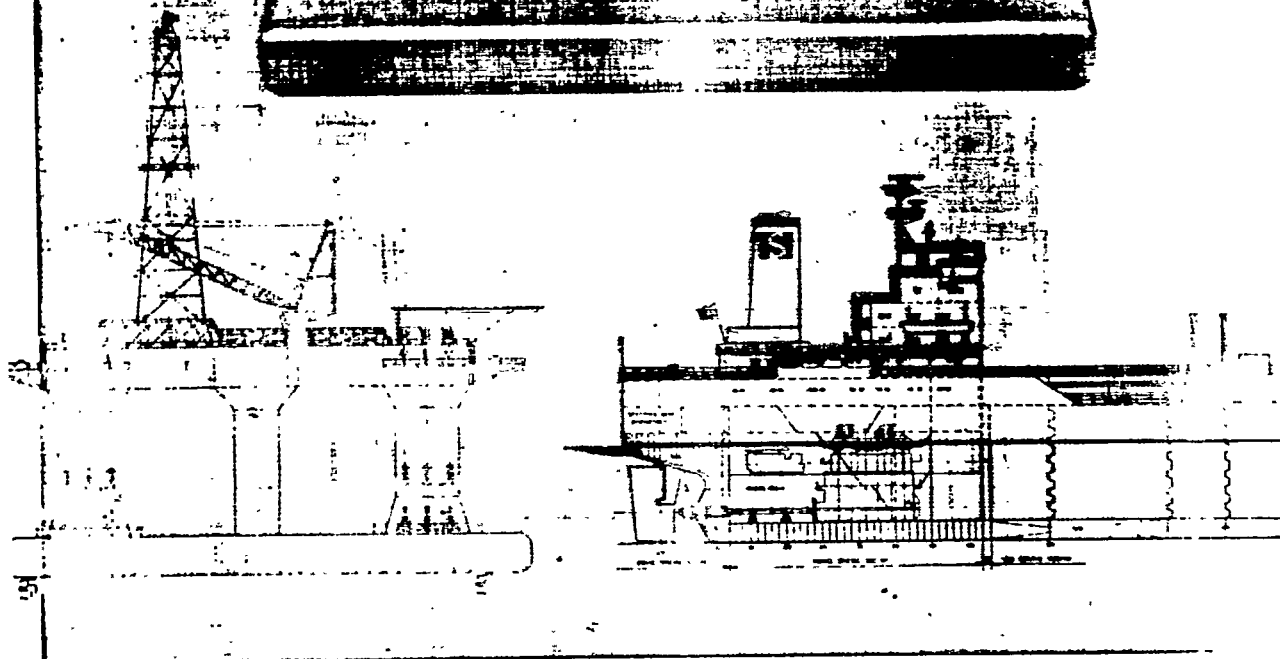
MAPLIS consists of 5 different modules, each comprising a logical set of management functions. Each module may be used separately. Together they work as one integrated system, communicating through a common database. In MAPLIS the term 'material management' means more than purchasing and warehouse control. Also the design and work preparation functions are involved. MAPLIS is a tool both for detailed physical follow up of materials and complete cost control for one or several projects.

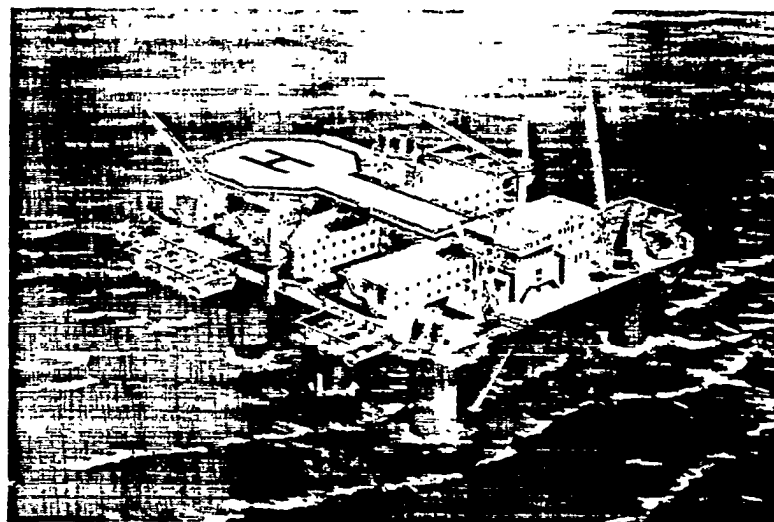
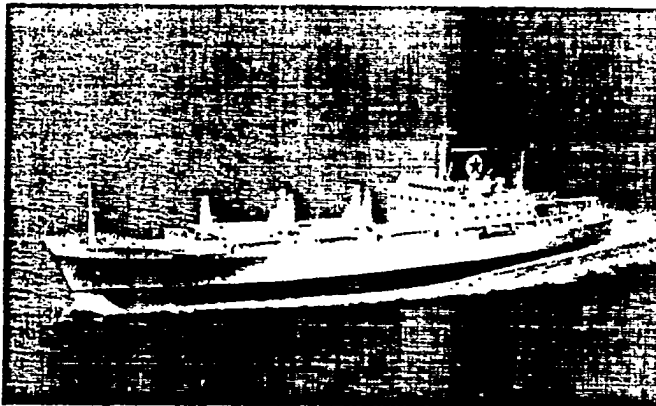
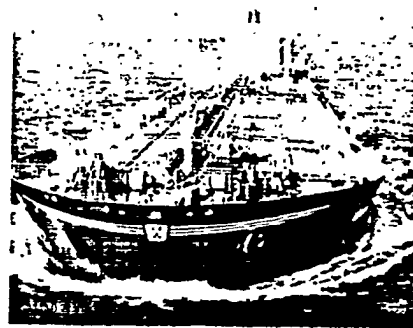
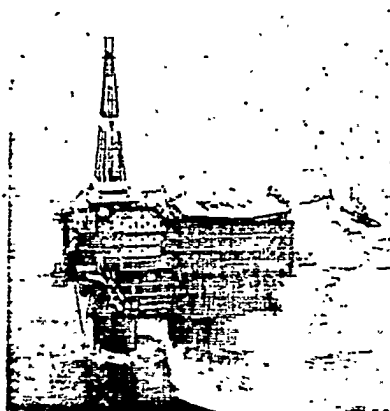
Fig. 4. Information flow in the vard

The information flow between departments using MAPLIS does not differ from standard shipyard practice. The difference lies in the fact that all departments involved have instant access to up to date information in the database, and that paperwork is reduced to a minimum.

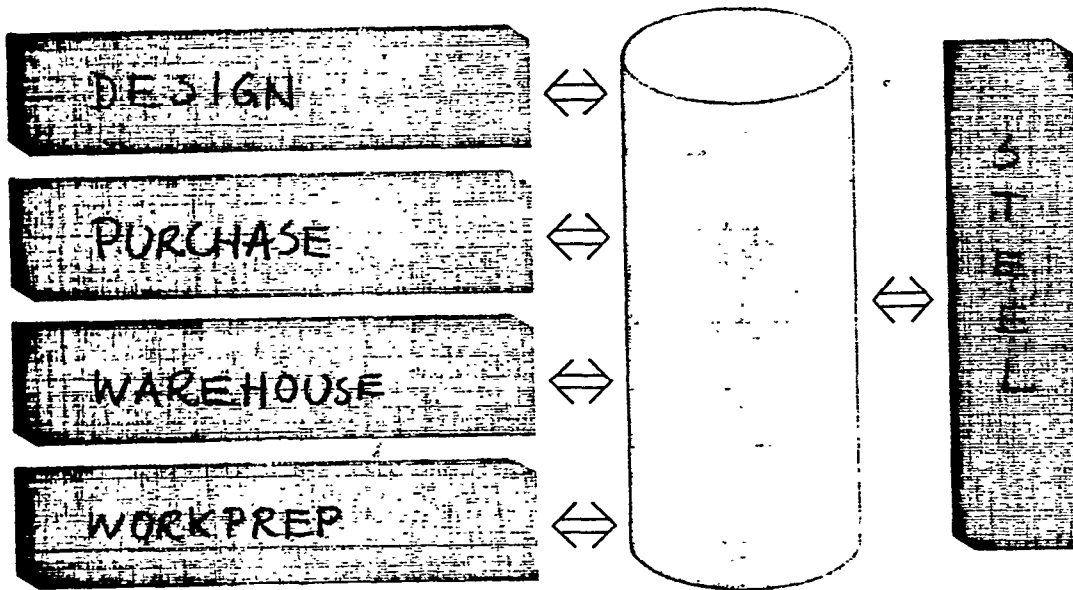
INMADAM

MATERIALS ADMINISTRATION SYSTEM





MAPLIS MODULES



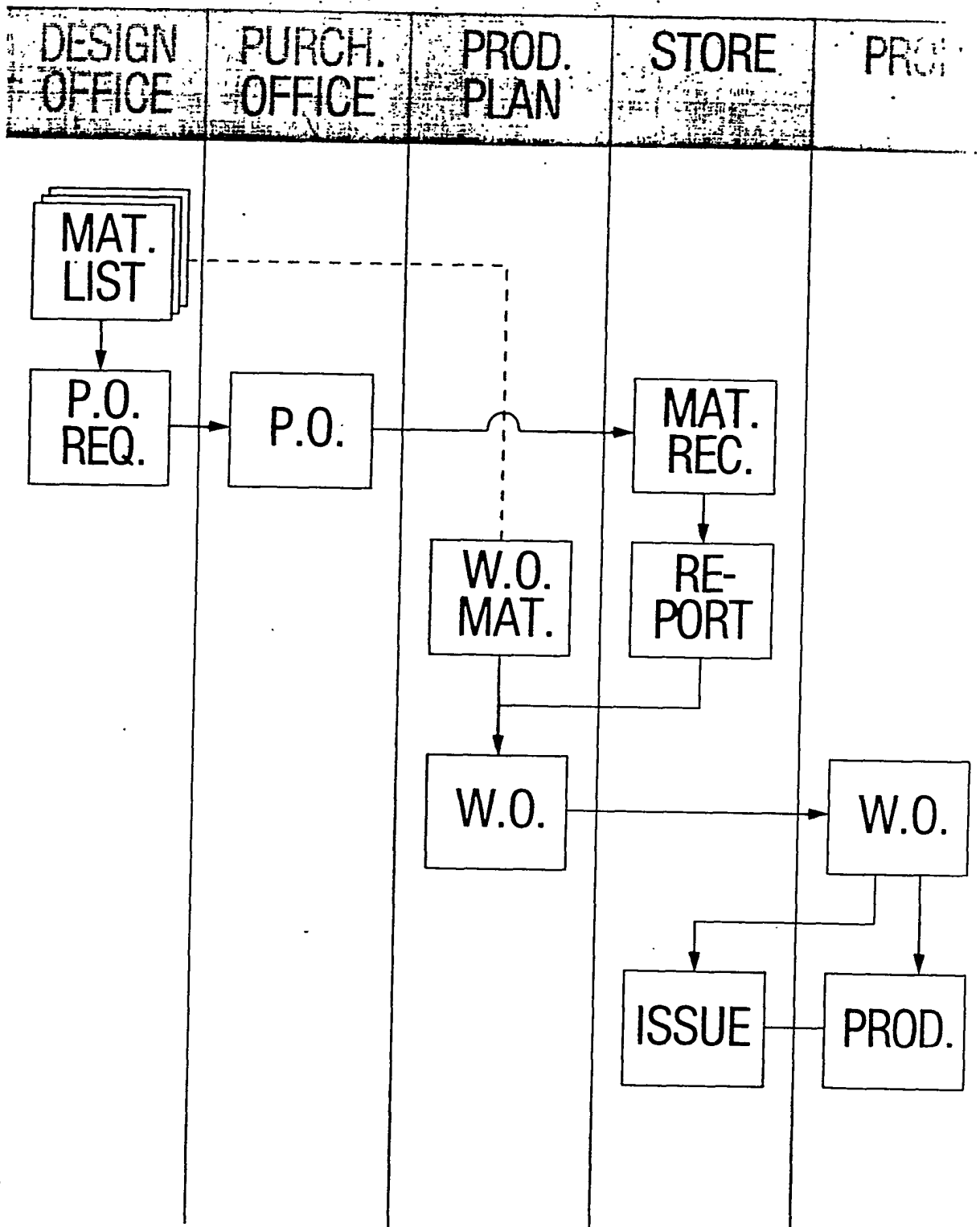


Fig. 5. Hardware configuration

The terminal (alphanumeric display) will be the 'work station' for personnel daily engaged with MAPLIS. This means that terminals must be distributed in the departments in sufficient number to allow easy access to the system. The standard version of MAPLIS is delivered on PRIME minicomputers.

Fig. 6. The DESIGN module

This module serves two main purposes in the design office as shown on the figure. The drawing register keeps a record of the drawings with related key data items. The other function is material specification. Material lists are defined per drawing.

Fig. 7. The drawing register

The figure shows data items filed in the drawing register. The system also keeps track of the revision history of each drawing, from the first to the last revision. Each of the data items may be used as sorting key for drawing reports.

Fig 8. Material

The lists are written line by line just as one does manually on a drawing. It is possible to modify or expand the lists in the database at any time. Once the material list is stored in the system, it may be displayed on the terminal or on the printer.

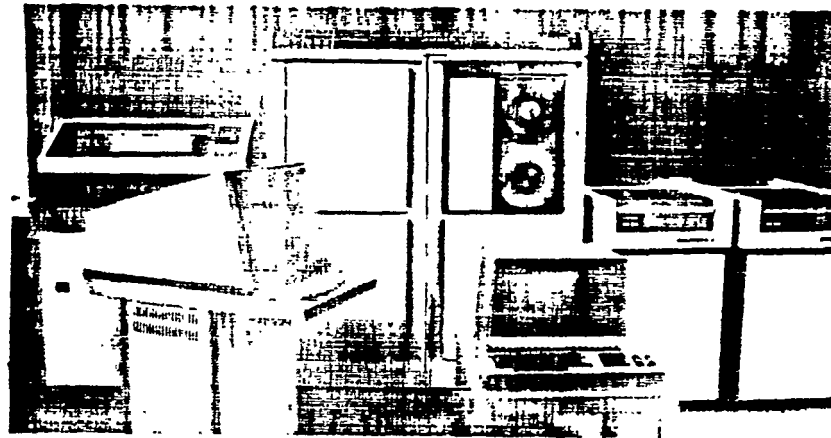
Fig 9. Planned to CAD/CAM systems

The next step in our development, which is scheduled for **1983**, is to link MAPLIS to the AUTOKON (steel) and AUTOFIT (piping) systems. The material 'take off' from these systems may then be transferred directly to MAPLIS through a 'material take off' communication program.

DESIGN
OFFICE



RECEIVING/
STORE



PURCHASING
OFFICE



PLANNING/
WORK
PREPARATION



MANAGEMENT/
ACCOUNTING



Fig. 10. The PURCHASE module

All purchases of direct materials or warehouse items goes through this module. The expediting and receiving functions are also included here, and the module gives cost control reports either per project or combined for all projects. The module keeps track of direct materials from the vendor, through receiving, storage and issuing into production.

Fig. 11. Purchase Orders (P.O.'s)

The purchase orders are edited on the display, when completed they are printed on P.O. forms (snap-sets), ready for mailing. The system allows several payment dates per P.O. and separate delivery date and currency per P.O. item. It is also possible to distinguish between calculated and order confirmed prices. It is possible to describe each item with unlimited text.

Fig. 12. Expediting and receiving

The expediting process using NAPLIS is, as shown in the figure, basically similar to the standard manual procedure.

NAPLIS gives automatic warnings for P.O. reminders after a plan predefined by the users themselves. The intensity of expediting is decided for each P.O. The system allows separate follow up of P.O. items and related certificates. The expeditor may at any time use the database as a 'notebook', i.e. he may write text with messages concerning the vendor or P.O. status. This text may then be available as information for other yard functions.

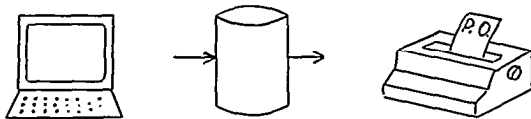
Receiving of materials are also entered on a display, with direct reference to the P.O. items concerned. The receiving personnel also has the possibility to enter text messages in the system, f.inst. if any damages are discovered. The system handles part deliveries of P.O. items.

This module also handles issuing of direct materials for production. The system will give complete documentation for each project concerning direct materials ordered, received, issued, as well as a survey of surplus materials left on the site (quantity and location).

PURCHASE FUNCTIONS

- PURCHASE ORDERS
- EXPEDITING
- RECEIVING
- COST CONTROL

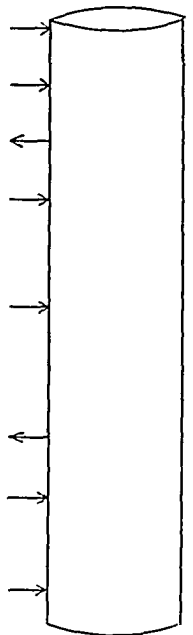
PURCHASE PURCHASE ORDERS



- UNLIMITED TEXT
- CURRENCY, PRICE, DEL. TIME PER P.O. ITEM
- SEVERAL PAYMENT DATES PER P.O.
- CONFIRM./ESTIM. PRICES

PURCHASE EXPEDITING

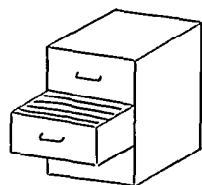
- ENTER P.O.
- ORDER CONFIRM.
- VENDOR WARN.
- " ANSW.
- MAT. DELIVERY (TOTAL/PART)
- VENDOR REMIND.
- " ANSW.
- ISSUES



DESIGN

FUNCTIONS

- **DRAWING FILES**



- **MATERIAL SPECIFICATION**



DESIGN:

DRAWING FILE INFO

- **PROJECT NO. (HULL NO.)**
- **DRAWING NO.**
- **FILE IDENT. (ORIG., COPY)**
- **REVISION NO., DATE**
- **AREA, LINE, GROUP NO.**
- **RECEIVING DATE**
- **DISTRIBUTION INFO.**
- **DRAWING TEXT**

DESIGN :

MATERIAL LISTS

- ONE LIST PER DRAWING
- ONE LINE PER ITEM
- PREFAB., INSTALL.
- RESERV. STOCK ITEMS
- ALLOC. OF P.O. ITEMS
- MODIFICATION
- P.O. REQUISITION

DESIGN

PLANNED LINK TO CAD/CAM SYSTEMS

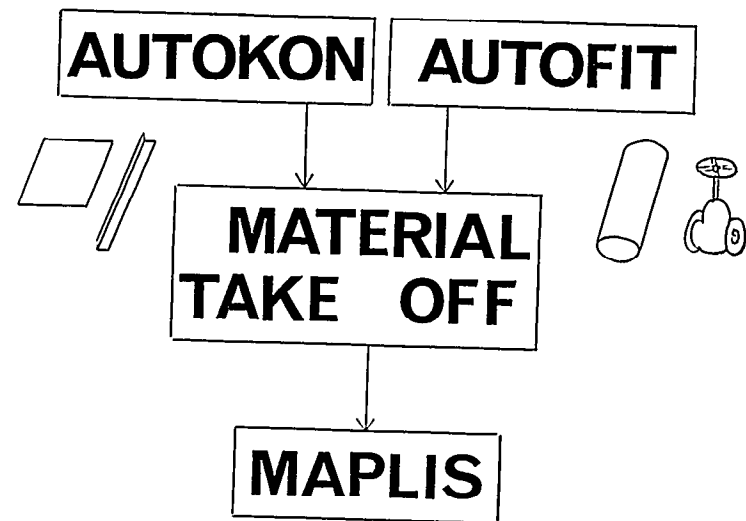


Fig. 13. Material cost control

The price information (calculated or confirmed) in the P.O.'s may be used to report payment forecasts for chosen periods.

Vendor invoice information is entered into the system, and the invoice items may be checked against the related P.O. items.

The system has numerous report alternatives for payment status, project cost accounts and vendor oriented accounts, all based on ordered and invoiced prices.

Fig. 14. Material traceability

The trend in offshore projects (and also navy projects) points towards stricter requirements concerning material traceability. This applies mainly to steel products (plates, pipes). MAPLIS is now prepared to follow such items from the steelmill (each item marked with a 'charge' or 'melt' no.), through intermediate storage, receiving at the site and installation in the finished product. This means that the P.O. item level, which has been the lowest level so far in the P.O.'s, is split into a sub-item description. For instance, one P.O. item consisting of 2 pipes with equal dimensions and qualities, but different charge no's, is split into 2 different sub-items.

Fig. 15. The WAREHOUSE module

This module controls the standard warehouse or stock items. The module requires that some kind of stock item code is used.

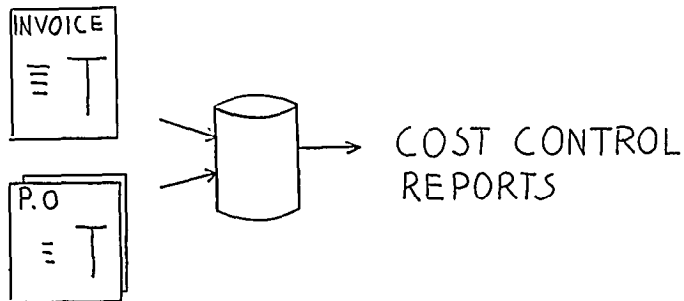
Fig. 16. stock level control

Each stock item is described with a code, name, dimensions, order point, price etc. The stock level is adjusted by entering information about issues, items returned to the warehouse, returned to vendor or reserved by the production departments. Automatic order impulses are given when available stock level gets below the defined order point. Consumption reports are given in many different alternatives. ARC-analysis based on consumed volume is possible.

PURCHASE

MATERIAL COST CONTROL

- PAYMENT FORECAST
- INVOICE CONTROL
- PAYMENT STATUS
- PROJECT COST ACCOUNT
- VENDOR STATUS



PURCHASE

MATERIAL TRACEABILITY

MANUFACTURER



↓
RECEIVING

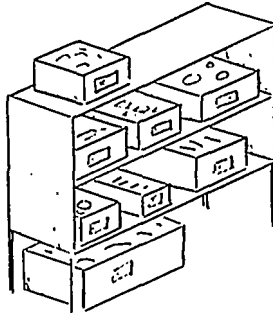
↓
WORK PREP.

↓
INSTALLATION

W A R E H O U S E

F U N C T I O N S

- S T O C K L E V E L C O N T R O L
- W A R E H O U S E C A T A L O G U E
- C O S T R E P O R T S
- I T E M S T R U C T U R E S



W A R E H O U S E

S T O C K L E V E L C O N T R O L

- I T E M D E S C R I P T I O N
- I S S U E , R E S E R V . , R E T U R N
- C O N S U M . R E P O R T S
- P . O . I M P U L S E
- A B C - A N A L Y S I S

Fig. 17. The WORKPREP module

This module is a tool for preparing a work order with related drawings and materials (the work order scheduling is not done here).

Fig. 18. Assign materials

To have full benefit from this module it is required that the pertaining drawing material lists are stored previously in the database. The bill of materials for a work order is then composed by manipulating these lists. A drawing list may be split between several work orders. Even a line (item) in a drawing list may be split this way. When the bill of materials is completed, it may be printed and used as a requisition for issuing.

Fig. 19. The STEEL module

Steel plates and bars in standard formats are handled by the DESIGN, PURCHASE, WAREHOUSE and WORKPREP modules just like any other item. But in the case of 'tailored' steel specifications the task is a little different. A large number of non-standard formats requires extensive sorting, marking and pricing routines. The STEEL module is made for this purpose, and combines in a way the properties of the other 4 modules. The actual purchase order for the steel materials are prepared in the PURCHASE module.

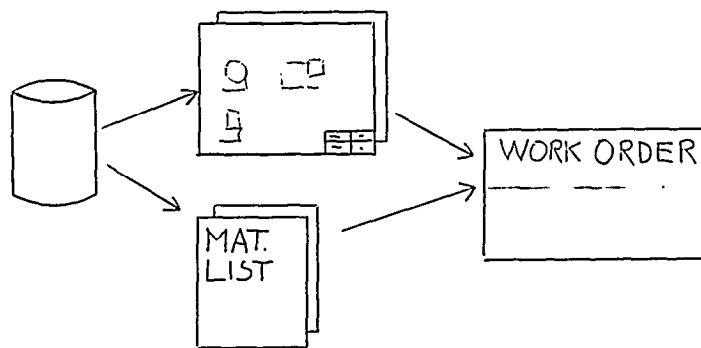
Fig. 20. Specification/ordering

In order to rationalize the specification task it is possible to prepare a library in the database consisting of steel quality codes (classification codes), bar section standards and overprice tables. The specification (plates/bars) is done block by block, and marking no's are given automatically. Before preparing the purchase order, it is possible to run 'price simulations'. Through variation of the steel formats it is possible to find a near minimum price level. It is possible to prepare a storage (piling) plan already at the time of ordering. This must be made according to a steel production plan.

WORKPREP

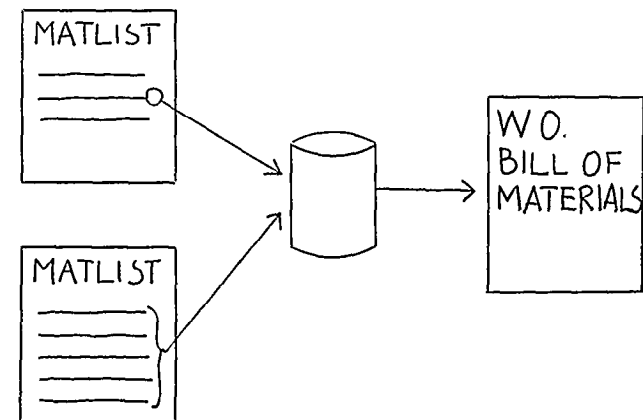
FUNCTIONS

DEFINE W.ORDER
 ASSIGN DRAWINGS
 ALLOCATE MATERIALS



WORKPREP

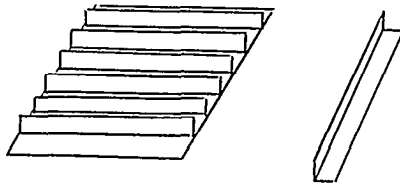
ALLOCAT. MATERIALS



STEEL

FUNCTIONS

- SPECIFICATION
- RECEIVING, STORAGE
- ENTRY INTO PROD.
- STEEL CONSUMPTION



STEEL

SPECIFICATION



BLOCK LISTS
AUTOMATIC MARKING
PRICE SIMULATIONS
STORAGE PLAN

Fig. 21. Receiving, storage, production

STEEL is used to check received materials against the P.O., and then to monitor the piling in the storage area and entry into production. It is also possible to specify steel part list in STEEL, and link a charge no. to each part. STEEL will provide complete consumption reports for each project.

STEEL

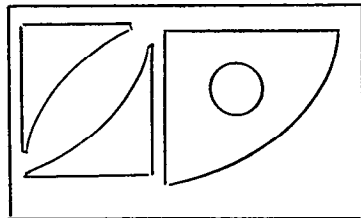
RECEIV., STORAGE, PROD

RECEIV. CONTROL

PILING

ENTRY PREFAB.

PART LISTS



Additional copies of this report can be obtained from the
National Shipbuilding Research and Documentation Center:

<http://www.nsnet.com/docctr/>

Documentation Center
The University of Michigan
Transportation Research Institute
Marine Systems Division
2901 Baxter Road
Ann Arbor, MI 48109-2150

Phone: 734-763-2465
Fax: 734-763-4862
E-mail: Doc.Center@umich.edu