

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

June 1977
NSRP 0003

THE NATIONAL SHIPBUILDING RESEARCH PROGRAM

Proceedings of the REAPS Technical Symposium

Paper No. 19: The SFI Coding and Classification System for Ship Information

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

Report Documentation Page

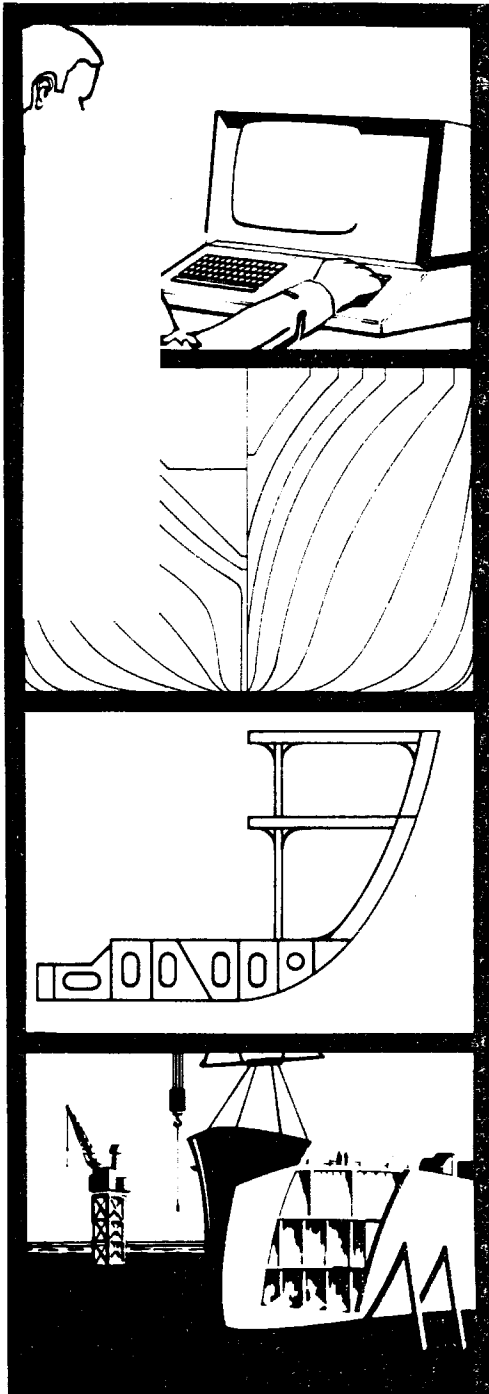
Form Approved
OMB No. 0704-0188

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 JUN 1977	2. REPORT TYPE N/A	3. DATES COVERED -	
4. TITLE AND SUBTITLE The National Shipbuilding Research Program: Proceedings of the REAPS Technical Symposium Paper No. 19: The SFI Coding and Classification System for Ship Information		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
a. REPORT unclassified	b. ABSTRACT unclassified	c. THIS PAGE unclassified	SAR
			18. NUMBER OF PAGES 19
			19a. NAME OF RESPONSIBLE PERSON

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.



R ESEARCH
E AND
NGINEERING
FOR
AUTOMATION
AND
PRODUCTIVITY
IN
SHIPBUILDING

**Proceedings of the
REAPS Technical Symposium
June 21-22, 1977
New Orleans, Louisiana**

THE SFI CODING AND CLASSIFICATION SYSTEM
FOR SHIP INFORMATION

Antonio Manchinu
and
Frank McConnell
Shipping Research Services, Inc.
Alexandria, Virginia

Mr. Manchinu is General Manager of SRS, Inc. In the past he managed the Management and Control Section of SRS A/S in Norway; served as project leader for studies of shipyard modernization, cost estimation, construction scheduling, planning; and worked as a production engineer. He has a B.S.C. degree in Industrial Engineering and Economics from the Horten Institute of Technology in Norway.

Frank McConnell is a senior consultant. Before joining SRS he managed the Program Planning and Manufacturing Engineering groups at Ingalls Shipbuilding. He has a B.S.M.E. degree from Lehigh University and is a former member of the Ship Production Committee.

This paper is about a classification system, or group, account, charge or whatever you call it in your organization. What is different about this system is that it was developed by a group of shipbuilders and shipping companies under the leadership of their national, non-profit research association. When completed and field tested, it was adopted by all members of the maritime community, both public and private. This country was Norway.

Today no one in Norway uses any other system for ship breakdown. In addition, the system is gathering a worldwide following.

The system is called the SFI Group System.

The SFI Group System is a classification system for ship technical and cost information.

During the life cycle of a ship - from conceptual design through detailed design and construction to operation and maintenance - much information must be exchanged

within an organization and between organizations. During the sixties, Norwegian shipbuilding was booming. In addition, electronic data processing had come into its own. Naval architects, shipbuilders, ship owners, regulatory bodies and marine suppliers were looking for a common ground for specification indexing, drawing, numbering and cost accounting.

The Norwegian shipbuilders took the lead, primarily because they were subcontracting to each other, and asked their national research association to sponsor an effort to develop a common ship breakdown system. The SFI Group System was, thus, sponsored by the Ship Research Institute of Norway.

The system was developed primarily by shipyards. It was correctly assumed to be difficult enough to create unanimity among the yards without involving other parties. Several yards provided representatives to help in the development of the SFI Group System lending expertise in estimating, engineering, planning, purchasing, production and EDP. The shipyard representatives were from a broad spectrum of the industry with experience in building ships of all types and sizes. Among the major contributors was the Aker Group - with which my firm is proud to be associated - and which brought the world numerically controlled burning and computer-aided lofting.

During the development phase, ship owners provided input to the working committee and were, in fact, the first to test the system as a maintenance code on board different types of ships - from cargo liners to North Sea trawlers. The experience gained from ship owners was very valuable.

The SFI Group System development was completed and tested in a pilot yard in 1972. The test not only checked the comprehensiveness of the system but provided an

opportunity to analyze routines associated with the use of the system. As might be expected, the routines and procedures in any particular shipyard might not accommodate a given system and it was important to check the system's flexibility.

At the end of the test period, minor changes were made and the SFI Group System was adopted by the Norwegian maritime community. Each user has a contact who stays in touch with the Ship Research Institute concerning changes in ship technology that might affect the system. The Norwegian Ship Research Institute, or NSFI, maintains and revises the system as necessary to accommodate new technology.

The basic criteria for designing the SFI Group System were:

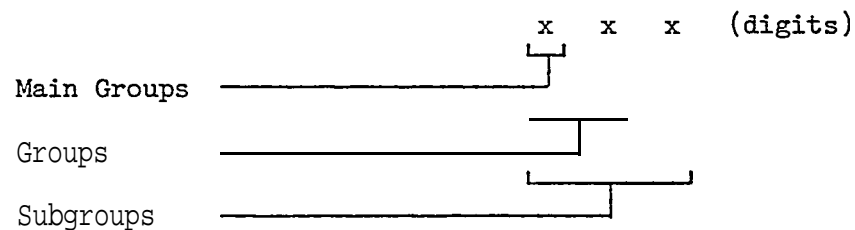
1. that it must be applicable to all users
2. that it must be applicable to all types of ships
3. that it must be simple and easy to understand
4. that it must be capable of future expansion.

As shipbuilders had first crack at designing the system, the immediate argument that had to be resolved was whether the system was to be function oriented or Production oriented. This argument, although interesting, is moot. Production methods change within a shipyard and certainly are different from shipyard to shipyard. Engineering and estimating simply cannot accommodate a production-oriented ship breakdown system whereas production can accommodate a function-oriented ship breakdown.

The SFI Group System is, thus, a function-oriented system. Classification societies, ship owners and naval architects would be lost with a production-oriented system.

In fact, it is rigorously functionally oriented. Components as well as piping are found under the same account number for a given ship's system. Electric motors for pumps are not segregated but are grouped with the driven component. The SFI Group System is designed to conform to a logical ship's specification, to accurately collect direct costs during the design, planning and production phases, and to organize the return costs in a way that they can easily be used as a basis for estimating the cost of similar ships in the future.

The SFI Group System is built up as a three-digit decimal classification system with ten main groups at the highest level. At this time only eight main groups are in use. Each of the main groups (one digit numbers) consist of ten groups (two digit numbers) and each group is further subdivided into ten subgroups (three digit numbers). Hence, the structure of the Group System numbers is as follows:



The main groups are used as follows:

0:

Reserved for a special purpose.

1: Ship General

Includes costs which cannot be charged to any specific function on board, such as launching, trial trips, guarantee work.

2: Hull

Includes hull and superstructure as well as cleaning and painting of the ship.

3: Equipment for Cargo

Includes equipment and systems concerning the ship's cargo, such as hatches, cargo winches, cargo pumps and piping.

4: Ship Equipment

Comprises equipment and systems which normally are peculiar to ships, such as navigation equipment, anchoring equipment. It also includes fishing equipment and weapon systems along with other working equipment for special types of ships.

5: Equipment for Crew and Passengers

Includes equipment and systems which serve crew and passengers, such as furniture, elevators, hotel systems.

6. Machinery Main Components

Comprises the primary components in the engine room, such as main engine, boilers, auxiliary engines.

7: Systems for Machinery Main Components

Includes main propulsion systems, such as fuel and lube oil systems, starting air system, exhaust systems.

8: Ship Systems

Comprises auxiliary systems, such as bilge and ballast systems, fire fighting and wash down systems, electrical distribution systems.

9:

Reserved for a special purpose.

As an example, the freezing system for dry cargo would be derived from:

Main Group 3 : Equipment for Cargo

Group 36 : Freezing, Refrigerating and Heating Systems for Cargo

Subgroup 362: Freezing and Refrigerating Systems for Dry Cargo

Illustrations of how this is presented in the SFI Group System book are:

the main group 3 matrix (see Figure 1)

the subgroup 362 description (see Figure 2)

Note that the description of each subgroup shows what that subgroup does not include as well as what it does include.

The SFI Group System book contains several parts. There is a six-page guide to use of the system followed by a matrix showing the 100 possible two-digit groups. This is followed by a chapter for each main group. These chapters begin with a

MAIN GROUP 3 - EQUIPMENT FOR CARGO

	35	36	37	38	39
	LOADING AND DISCHARGING SYSTEMS FOR LIQUID CARGO.	FREEZING, REFRIGERATING AND HEATING SYSTEMS FOR CARGO.	GAS/VENTILATION SYSTEMS FOR CARGO HOLDS/TANKS.	AUXILIARY SYSTEMS AND EQUIPMENT FOR CARGO.	
	350	360	370	380	390
	351 Loading and discharging pumps.	361 Insulation and sheathing of cargo holds and tanks.	371 Ventilation systems for refrigerated cargo holds.	381 Sounding, control and operating equipment for cargo systems.	391
	352 Loading and discharging systems on deck	362 Freezing and refrigerating systems for dry cargo.	372 closed Cycle mechanical ventilation systems for cargo holds.	382 Tank cleaning systems and equipment.	392
	Loading and discharging systems in pump rooms.	363 Direct cooling systems for liquid cargo.	373 Open ventilation systems for cargo holds.	383 Lifting gear for cargo holds.	393
	Loading and discharging systems in cargo tanks.	364 Cascade cooling systems for liquid cargo.	374 Ventilation/gas freeing systems for tanks. Wind sails with equipment.	384 Separate cooling water systems for cargo equipment.	394
	355 Loading and discharging systems for LPG, LNG, etc. in gaseous phase.	365 Indirect cooling/heating systems for cargo (cargo oil heating, etc.).	375 Blow-off systems from safety valves (from pressure/vecuum valves and similar).	385 insulation drying system for cargo holds and tanks.	395
	356 Separate stripping system.	366	376 Inert gas systems with conditioning plant.	386 Equipment for addition/portioning of preservatives, smelting substances, inhibitors, spirits, etc.	396
	357	367	377 Fuel gas system with conditioning plant.	387 Special structures for loading/discharging over sternstem.	397
	358	368	378	388	398
	359	369	379	389	399

SUB-GROUP 3

SFI GROUP SYSTEM - JAN. 13

PARTIAL MAIN GROUP 3 MATRIX

36 Freezing, refrigerating and heating systems for cargo

362 FREEZING AND REFRIGERATING SYSTEMS FOR DRY CARGO

Freezing and refrigerating systems for dry cargo (e.g. fruit, vegetables, meat, etc.) and also for dry cargo and provisions combined, including such as:

- Refrigeration machinery with compressors including drive units, condensers, evaporators, cooling batteries, oil separators, driers, etc.
- Circulation system (for brine, ammonia, Freon or similar) with circulation pumps, valves, insulation, pipes, etc.
- Fans for circulation by/through cooling batteries.
- Drip water trays with drain pipes.

Also included here is the refrigeration machinery (which follows the ship) for containers, with connection hoses and associated machinery as stated above, together with refrigeration machinery for plate freezers, for freezing tunnel, for ice production and for RSW plant (Note! see also Ref.) with associated machinery as stated above.

Ref: Containers with separate refrigeration machinery (which follows the container)	317
Insulation of cargo holds and tanks	361
Ventilation plant with ozone generator, etc. for refrigerated cargo holds	371
Arrangement for remote measurement of temperature, CO₂, humidity, etc.	381
Supply lines from separate cooling water system for cargo equipment, for thawing (de-icing) of refrigeration machinery	384
RSW plant (seawater part)	384
Plate freezers, freezing tunnel (in factory plant for fish, etc.)	468
Refrigeration machinery for provisions	554
Supply lines from the ship's main cooling water system for thawing (de-icing) of refrigeration machinery, see resp. s.gp in gp	72
Drain pipes from sink, including those, in cargo holds	804

363 DIRECT COOLING SYSTEMS FOR LIQUID CARGO

Direct cooling systems (one or more stages) for recondensation of gas cargo, where the boil-off is extracted from the tanks, compressed and condensed directly by cooling water. The system includes such as:

- Suction pipes from tanks or loading/discharging pipes with valves, etc.
- Fluid separators with return pump, piping, etc.
- Compressors with drive units (low and high pressure compressors for multi-stage plant), filters, etc.
- Medium pressure vessels with equipment (for multi-stage plant).
- Fluid collectors.
- Cargo condensers.
- Return pipes for the condensed cargo to tanks or to the loading/discharging system.

Also included here is the arrangement for lubricating the compressors, with equipment for oil regeneration.

The cooling plant, or parts of it, can have subsidiary functions (but comes under this s.gp) and function as:

- Pumps for cargo heating.
- Producer of gas for transfer of cargo for discharging by means of pressure.
- Continues

GROUP AND SUBGROUP DESCRIPTION

matrix showing the 100 possible three-digit subgroups within each main group followed by a detailed description of each group and subgroup. Finally, there is an alphabetical index (Figure 3) with more than 4,000 entries that should lead the searcher to the proper subgroup number. For our "freezing and refrigerating system for "dry cargo" example, the most obvious entry appears on page 32 of the index although it appears elsewhere as well.

The books are loose leaf to facilitate changes and are made of all water resistant materials. A condensed, pocket-sized version containing only the main group matrices and index is also available.

For those requiring even further breakdown than the three-digit system provides, NSFI has developed two sets of supplementary codes. Designed primarily for material, the first set is for direct purchased material and must be used in conjunction with the appropriate subgroup (Figure 4). Using our "freezing and refrigerating systems for dry cargo" example, the number 362 003 would always identify the freezing system compressor or compressors. The second, or section 2 detail code, is a listing of stock materials and does not necessarily need to be identified with the appropriate subgroup (Figure 5). Each of the detail codes contains three digits and is published in a supplementary booklet.

With its flexibility and functional orientation, the SFI Group System can be used for any shipyard classification problem. It can, and should, be used consistently in all of the following areas:

1. indexing of specifications
2. drawing identification
3. purchase requisition and order numbering

FLOWMETERS, see resp. system/component s.gp.

FOAM:

- apparatuses, loose (fire extinguishing) 505
- cannons (monitors) see 816
- extinguishing system with tanks, etc. 816

FOG HORN 427

FOG WINDOW 515

FOILS FOR HYDROFOIL BOATS 639

FOOD LIFT (ELEVATOR) 562

FOOT PLATES (GUARD), refer to resp. door s.gp in gp 51

FOOT WASHBASINS 583

FORE:

- peak see 246
- peak tank see 246
- stem see 246

FORE-AND-AFT GANGWAY 535

FOREBODE, see resp. s.gp in gp 24

FORECASTLE DECK WITH STIFFENING 243

FOREMAN SUPERVISION see 122

FORKLIFT TRUCKS 324

FOUNDATIONS: see 263

- and brackets for spare parts see 447
- bolts, see resp. system/component s.gp.
- (for) loose cargo tanks see 238
- motor-, integrated in inner bottom 223
- (for) spare anchor 431
- (for) spare propeller 636
- (for) spare shaft, see resp. s.gp in gp 63

FOUNTAINS IN:

- sanitary system 581
- separate drinking water system 584

FRAMES FOR WINDOWS/DOORS, see resp. s.gp in gp 51

FREEBOARD MARKS 261

FREEZER TUNNEL see 468

FREEZER PLATE- 468

FREEZER Box 551

FREEZING AND REFRIGERATION SYSTEM FOR:

- cargo, see resp. s.gp in ml 36
- containers see
- plate freezers (factory plant) 362
- provisions 554

FREEZING ROOM:

- doors (provision rooms) 555
- insulation and lining, cargo 361
- insulation and lining, provisions 555

FREIGHT EXPENSES, see transport.

FREON, ETC., see resp. cooling system s.gp.

FRESH Cooling WATER (main cooling water):

- piping 722
- pumps 722
- system 722
- systems which only serve machinery/equipment in one s.gp. see resp. s.gp.

Gr. 36 FRYSE-, KJOLE- OG VARMESYSTEM FOR LAST

U.gr. 361 ISOLASJON OG KLEDNING AV LASTEROM/-TANKER 361
 361060
 361061
 361082
 361083
 361084
 361085
 361086
 361087
 361088
 361089

U.gr. 362 FRYSE-/KJOLESYSTEM FOR TORRLAST 362

362 001	KJoleaggregat, kuldemedium..	Cooling agg, cooling medium
362 003	Kjolekompressor m/drivenhet	Cooling compressor
362 005	Kondenser	Condenser
362 007	Vaeskesamler	Liquid receiver
362 009	Fordamper	Evaporator
362 011	Vaeskeutskiller	Liquid separator
362 013	Torkefilter	Drying filter
362 015	Sugefilter	Suction filter
362 017	Oljeutskiller	Oilseparator
362 019	Sirk.pumpe, kuldemedium	Circulationpump, cooling med.
362 021	Fyllepumpe, kuldemedium	Supplypump, cooling med.
362 023	Kuldemediumtank	Tank for cooling medium
262025	Lokalt kontrollpanel	Local controlpanel
362 030	Lakekjoler	Brinecooler
362 032	Lakeforvarmer	Brinepreheater
362 034	Blandetank	Mixingtank
362 036	Sirk. pumpe, lake	Circulationpump, brine
362 038	Fyllepumpe, lake	Supplypump, brine
362 040	Laketank	Brinetank
362042	Kjolebatterier	Cooling batteries
362044	Sirkulasjonsvifte	Circulation fan
362070	Smøreoljesystem, compressor	Lub.oil system, compressor
362071	Smøreoljepumpe	Lub.oil pump
352073	Smøreoljefilter	Lub.oil filter
362075	Smøreoljeseparator	Lub.oil separator
362077	Smøreoljekjoler	Lub.oil cooler
362079	Smøreoljetank	Lub.oil tank
362080		
362081		
362082		
362083		
362084		
362 085		
362086		
362097		
362088		
362089		

Kjøple timer, leide timer, kjøpt ass., patentutg. etc. se Brukerorient.

DETAIL CODE, SECTION 1

Figure 4

CL. 21 INSULATION AND PACKING MATERIALS.

- S.cl. 210 General.
 211 **Insulation and fire proof materials (excl. pipe insulating materials.**
 212 Pipe insulation materials.
 213
 214 Plate and box packings, cord and strip packings incl., packing material.
 215 **Flange packing rings, manhole and inspection hatch packing - rings .**
 216 Moulded packings, packings for special applications.
 217 Sealing and O-rings.
 218 Lip packings, U-packings, cup and dome Packings. incl., sealing rings for rotating axles.
 219 Diverse.

CL. 22 PIPES AND HOSES INCL, PARTS FOR PLATE AND CAST IRON PIPES.

- S.cl. 220 General.
 221 Steel pipes.
 222 Non ferreous metal pipes.
 223 plastic pipes and plastic hoses.
 224 Other hoses and flexible pipes.
 225 Plate pipes and associated parts.
 226 Cast iron pipes and associated parts.
 227 Discharge pipes and associated parts (sail pipes).
 228
 229 Diverse.

CL. 23 COMPONENTS FOR PLASTIC PIPES AND HOSES.

- s cl. 230 General.
 231 Polyethylene components.
 232 Styrene components (synthetic rubber).
 233 Nylon based components.
 234 P.V.C. components.
 235
 236
 237 Pipe components for plastic pipes with coupling, decoupling arrangements.
 238 Hose clamps and junctions (not fire fittings/equipment).
 239

CL 24 PIPE COMPONENTS FOR STEEL AND METAL PIPES. (Excl. plate and cast iron pipes).

- s cl. 240 General
 241 Components for steel threaded pipes, Black steel.
 242 Components for steel threaded pipes. Steam.
 243 Components for steel threaded pipes Galvanized.
 244
 245 Components for brass threaded pipes.
 246 Couplings etc., components for smooth (seamless) pipes.
 247 Bends, Hanges. etc., components for smooth (seamless) pipes
 248 Unions. bulkhead flanges, deck penetrations etc.
 249 Diverse

DETAIL CODE, SECTION 2

Figure 5

4. work package identification
5. labor and material cost collection
6. test agenda identification
7. technical manual identification
8. recommended spare parts list identification
9. estimating
10. guarantee work identification
11. general filing index.

After several years of use, the information retrieval capabilities of the shipyard are greatly enhanced.

Now, carry the application of the SFI Group System one step further as the Norwegians have done. Have all shipyards, naval architects, marine suppliers, the ABS, MarAd, the Navy and ship owners use the same system. Communications become easy. Specifications for new construction, repair, material and subcontracting are more consistent in format. Design and testing criteria for each system can readily located. Cost and progress reporting do not need to be translated from one account system to another. Duplicate sets of financial books are eliminated. It is even possible that shipyard qualification to DOD Instruction 7000.2 can become understandable with a common frame of reference.

Is standardization possible? Norway has a far larger merchant fleet and an equivalent number of shipyards as the U.S. The answer, then, probably lies in the willingness of MarAd and the Navy to jointly agree to such a move.

with or without standardization, if your shipyard doesn't have a functionally-oriented classification system similar to the SFI Group System, it should have. And if your system isn't as good as the SFI Group System, it should be. The advantages of a well-designed classification system are too obvious.

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