

**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 1985  
NSRP 0226

# **THE NATIONAL SHIPBUILDING RESEARCH PROGRAM**

**1985 Ship Production Symposium  
Volume II  
Paper No. 12:  
North European Craft Training:  
A Trip Report**

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

# Report Documentation Page

*Form Approved*  
*OMB No. 0704-0188*

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1. REPORT DATE <b>SEP 1985</b>	2. REPORT TYPE <b>N/A</b>	3. DATES COVERED <b>-</b>	
4. TITLE AND SUBTITLE <b>The National Shipbuilding Research Program 1985 Ship Production Symposium Volume II Paper No. 12: North European Craft Training: A Trip Report</b>		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) <b>Naval Surface Warfare Center CD Code 2230-Design Integration Tools Building 192 Room 128 9500 MacArthur Bldg Bethesda, MD 20817-5700</b>		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 <b>Approved for public release, distribution unlimited</b>			
13. SUPPLEMENTARY NOTES			
14. ABSTRACT			
15. SUBJECT TERMS			
16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT
a. REPORT <b>unclassified</b>	b. ABSTRACT <b>unclassified</b>	c. THIS PAGE <b>unclassified</b>	<b>SAR</b>
			18. NUMBER OF PAGES <b>18</b>
			19a. NAME OF RESPONSIBLE PERSON

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NORTHERN EUROPEAN CRAFT TRAINING  
A Trip Report

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The Education Panel of the Ship Production Committee is charged with conducting research on training methods and techniques and developing new training methods. As part of this effort, the panel funded a project to provide the means for on-site inspection and evaluation of craft training programs in Europe. In June of 1985, a four-person project team traveled to Northern Europe to meet with shipbuilding trainers and educators. This paper presents highlights of that trip. Discussed here are apprentice training programs of The United Kingdom and the Federal Republic of Germany, and adult training in Scandinavia.

Overview

A four-person team spent two weeks in Europe visiting training centers in England, Sweden, Denmark, and West Germany. The team consisted of James Wallace, Director of Training and Development at Newport News Shipbuilding; Steven Sullivan, Manager of Human Resources at Bethlehem Steel, Sparrows Point; and Howard Bunch and Paul Vickers of the University of Michigan. The project team visited three training centers in England run by British

Shipbuilders (Training, Education Safety) Ltd; two Scandinavian shipyards (Kockums in Sweden and Burmeister & Wain Skipsverft in Denmark); and two shipyards in West Germany (Blohm + Voss AG and Howaldtswerke-Deutsche Werft --Kiel). One engineering organization, Borsig AG, in West Germany was also visited. Table 1 lists the sites visited. Throughout the trip, first-class trainers, educators, and managers were encountered. They patiently answered many questions, and they answered in English. The personnel included shipyard presidents, directors, managers, and trainers, as well as local education officials. The interest of shipyard presidents and directors indicates the importance training has in European countries.

TABLE 1

Organizations Visited by Project Team

United Kingdom	British Shipbuilders (TES)	
	-----Hebburn Training Centre	Newcastle
	-----Barrow Training Centre	Barrow
	-----Birkenhead Centre	Birkenhead
Denmark	Burmeister & Wain	Copenhagen
Sweden	Kockums AB	Malmo
Federal Republic of Germany	Borsig AG	West Berlin
	Blohm + Voss AG	Hamburg
	Howaldtswerke-Deutsche Werft AG	Kiel

## Apprentice Training

The crafts of Europe have been regulated since the Middle Ages. Under the guild system, apprentice training evolved as a method of transferring the knowledge and skills of the older master craftsmen to their student apprentices. Upon completion of the apprenticeship, the student was indentured to the master for several years. The modern age has seen the dissolution of the guilds and the end of indentured apprenticeship, but the apprentice form of structured vocational training continues to be a vital part of the European heritage. Therefore, it is not surprising to discover thriving apprentice programs in Britain and Germany. On the other hand, apprenticeships have been deemphasized in Denmark and eliminated in Sweden. In the following sections, the situation in the four countries visited is briefly described.

British Apprentice Training. In the United Kingdom, an apprenticeship is an in-company, basic training period of four to five years. The length of the apprenticeship is determined by national negotiations between the union and employer associations. A shipbuilding apprenticeship is a four-year training program with one year off-the-job training followed by a three-year on-the-job planned work experience. The responsibility for apprentice training is shared by the sponsoring shipyard and the staff of the training center-who are employees of British Shipbuilders (Training, Education & Safety) Ltd. (BSTES).

BSTES is a non-profit, independent organization responsible for all facets of training and education in the British shipbuilding industry.

The foundation for apprentice training, as well as craft retraining, is the modular training system. The modular training system is a flexible yet well-defined, training scheme designed to ensure that skills are learned and demonstrated by the trainee to a standard skill level. The modular training system consists of modules and elements. A module is the set of skills and standards of workmanship required to work effectively in a given area of the shipyard. To complete the apprenticeship and receive a skilled worker certificate, an apprentice must complete three on-the-job modules. A module cannot be completed without a foundation--a set of skills to build on. The basic skills for various modules are developed at the training center during the first, off-the-job training year. Basic skills needed to successfully complete each module have been meticulously identified, defined, and assigned to elements as element levels.

The key to the system is the use of the standards of workmanship as the determining factor in completing an element-or module. The defined standard of workmanship must be met in order for the trainee to receive a certificate which documents the given training.

BSTES has made significant progress in instituting the modular training system and in providing realistic work situations at the training centers.

Table 2 lists crafts and skills for which modules and elements have been developed.

The modular training system is beneficial to shipyard management. The modular training system allows shipbuilding management to specify the skills of their apprentices precisely by specifying the elements and element levels taught during the basic training year. A shipyard can use this system to develop workers with diverse skills in any work area by assigning to that area apprentices and skilled workers who have completed different element levels and modules. The modules and elements can be mixed and matched to meet current or anticipated shop or ship needs. An added benefit of the modular training system is that the same elements and modules are used to retrain experienced workers--imparting new skills or improving old ones--which improves the quality of the work force and can, in fact, lead to a more flexible approach to work assignments. Also, through comprehensive record keeping, the skills and training of all employees are documented, aiding supervisor selection and work assignments.

German Apprentice Training. The German form of apprenticeship-the dual system-is a regulated, in-company, three year, basic training period. Apprenticeships are regulated by national laws concerning worker classification and are administered by the company and the local chamber of commerce. There are roughly 450 occupations or worker classifications,



TABLE 2

## British Shipbuilders (TES) Crafts and Skills

TECHNICAL & DESIGN	COMPUTER & ELECTRONICS	FABRICATION , PIPE & WELDING	ENGINEERING	CLERICAL
Computer-Aided-Design Design Principles Engineering Drawing Freehand Sketching Geometric Drawing Hull Definition Hull Structure Layouts & Ergonomics Piping Systems Plan Reading Structural Steelwork	Network Installation Electronic Office Computer Hardware Bureau Accounts Robotics Basic Electronics Microcomputer Repairs Word Processing	Ox-Gas Cutting Welding to International Standard Plating Sheetmetal Heat Line Bending Heat Treatment Drilling Tack Welding Burning Caulking Shipwrighting Plan Reading Marking Off	Shaping Milling Center Lathe Painting Woodwork Fitting Grinding	Keyboard Typing Telephone Filing Shorthand Accounts Writing

including the shipbuilding trades shown in Table 3. For each worker classification, the federal government sets general training plans and guidelines for apprentice examination. Upon completion of the apprenticeship, the trainee is tested by the local chamber of commerce to determine if the apprentice has reached a level of craftsmanship suitable to be awarded the title of facharbeiter, or skilled worker. Because of the national regulations and local testing, the German apprentice program is geared toward producing individuals who can pass that exam.

Similar to the British system, the first year is conducted off-the-job in a company-run training center. The apprentice receives training ranging from basic hand tool skills to operation of sophisticated, state-of-the-art machinery. All apprentices in a given occupation are required by law to receive similar training--regardless of the companies' needs, facilities, or personnel. Small companies that cannot afford the cost of the training center or the cost of special training equipment contract with German shipyards to provide training for their apprentices.

TABLE 3  
Shipbuilding Apprenticeships in West Germany

Boilermaker/Smith	Joiner	Social Insurance
Boring Machine Operator	Fitter	Shipwright
Carpenter	Material Tester	Technical Draftsmen I
Commercial Employee	Milling Machinist	Technical Draftsman II
Data Processing	Office Worker	Turner
Electrician	Packer	Welder
Engine Fitter	Pipefitter	Woodworker

A key to the German system is the meister or master craftsman responsible for apprentice training. The meister is first and foremost a certified skilled worker-a facharbeiter. Second, the meister has completed a course of study to prepare for his role as an apprentice instructor. This course includes pedagogical training as well as course work in business and social sciences. Third, the meister has successfully completed a licensing examination.

The meister is charged with teaching the apprentices the skills necessary to succeed in a given occupation--or at least pass the facharbeiter examination. The success, or failure, of the meister may be measured by his students' success rate in the facharbeiter examination. The apprentice contract guarantees the student the instruction needed to pass that examination. Failure to pass results in new training and testing for the apprentice and a review of the meisters' credentials by the local chamber of commerce. But, this is a rare event. The success rate for shipbuilding apprentices is very high.

Another key to the success of the German system is the close ties to the public school system. The instruction, particularly for the non-university-bound students, has a definite and intentional industrial bias to prepare students for successful apprentice experiences.

Thus, through classification of skills, meister training, and pre-apprentice vocational training, the German dual system supplies its economy with skilled, highly productive workers.

Similarities Between British and German Apprenticeships.- Four points

distinguish German and British apprentices: definition, training centers, instructors, and age. First, both countries have defined the skills needed to qualify as a skilled worker to a degree not normally found in the United States. Through elements and modules in the U.K. or by classification in Germany, the qualifications of a skilled worker are defined and certified. This implies a significant investment in training organization. Second, mandatory off-the-job training has led to the development of training centers--stocked with machinery and workspaces, including state-of-the-art machines. This means a significant investment in facilities and continuing improvements. Third, the importance of the instructors in British and German training centers is unique. In the U.K., instructors are typically older men with a great deal of experience who, in the twilight of their careers, transfer their knowledge to the younger tradesmen. In Germany, the meister is a certified craftsman, businessman, and trainer. The meister holds an esteemed position in German society. The people involved in training apprentices adds a dimension to vocational training worth exploring further. Fourth, and last, is the age of the apprentice. That factor clearly

differentiates European apprenticeships from U.S. apprenticeships. Typically, a European will enter an apprenticeship at age sixteen. In the U.K., the person can be as young as fifteen and no older than seventeen. A U.S. shipyard could not employ a person of that age. Nor does the typical U.S. sixteen year old make a career decision at that age. The high proportion of students who enter college in the U.S. delays that decision for several years. Therefore, European apprenticeships are very youth oriented and apprentice programs are significantly influenced by the age of their charges.

#### Scandinavian Training

Denmark and Sweden emphasize adult training and retraining to a far greater extent than do Germany and Great Britain. Apprentice programs exist in Denmark but not in Sweden. Therefore, the resources of the shipyard training departments are directed toward an older and, in some cases, skilled work force.

Training in Denmark. Danish apprentice programs are jointly managed by labor unions and management. Following a one month training period in the shipyard training school, the apprentice alternates between periods in a state run school and on-the-job experiences. Shop skills are taught at the training school. On-the-job experiences are determined by the apprentice's supervisor

and are determined, in part, by the workload. After four years, the apprentice must pass a final examination to earn the title of skilled worker.

Of much greater importance to the Danish shipbuilding training staff is the development of the current work force. Danish shipbuilding employs significant numbers of unskilled workers who require training. Twenty percent of the Burmeister & Wain Skipsverft's work force is unskilled. The Danish government financially supports the training of unskilled workers in the shipyard training schools. After four years of experience and training, the unskilled worker can become a skilled worker. Therefore, the shipyard must ensure that these employees receive the necessary training to earn that title.

In addition to the shipyard training staff, outside agencies, such as the Danish Welding Institute, provide training in new skills, retraining of old skills, and testing of skills for the shipyards. Reliance on outside firms decreases the need for significant investment in training facilities and trainers.

Training in Sweden. The Swedish shipbuilding industry does not have a formal apprentice program. A small number of young people are hired from vocational schools at age sixteen. They must complete a vigorous program including nine months of basic skill training in welding, plating, and pipe work. Upon completion, they are given further on-the-job training but do not earn a title such as skilled worker.

The world-wide decline in shipbuilding orders has had a significant effect on the number of new hires and, thus, on the training program emphasis. Swedish shipbuilding has been in a recession. Shipyards have been closing. Those that have stayed open have been forced to cut back on the number of employees and change their product line. Thus, the training programs have changed to reflect the need for skills in demand as determined by the order book. For example, welders and platers are being retrained to be joiners and plumbers to build outfit intensive passenger ships instead of steel-work-intensive tankers. The training schools are smaller and oriented toward an older, experienced worker.

Scandinavian shipyards are oriented toward training older and, in some cases, skilled workers, in comparison to the shipyards of Great Britain and Germany. The Scandinavian shipyards have not invested as heavily in training centers or programs. The training schools which are employed are not directed toward training shipbuilders. The training staffs are smaller and are not necessarily licensed as vocational trainers. Yet the Scandinavians do consider education and training to be vitally important to their continued success.

### Conclusions

The European shipyards stress the importance of developing and maintaining a highly skilled work force. Through apprentice training in the

United Kingdom and Germany and the adult training programs in Denmark and Sweden, European shipbuilders learn the skills needed to produce ships at a competitive price. The Europeans have developed new techniques and modified traditional apprenticeships to produce high quality employees. Especially important topics for future consideration are the modular training program in the United Kingdom; the use of licensed meisters as instructors, as practiced in the Federal Republic of Germany; and the use of standard qualifications and examinations for earning the title of skilled worker.

The modular training system allows British Shipbuilders to provide flexible training alternatives to meet the demands of production. Through on-the-job modules and training elements, experienced workers and apprentices can be given training in different skill areas to the needed skill level. This allows production managers to specifically determine the training needs of their workers.

In the Federal Republic of Germany, the meister is a licensed apprentice instructor as well as a skilled worker. The meister must demonstrate a level of competence in his craft and instructional competence not normally required in the United States. The meister is internationally recognized as a key component of the German training system.

The use of standard skill levels, qualification examinations, and certification provides solid documentation of worker skills and training. Documentation and certification allows management to better determine the best



employee for a given job or supervisory position. Standards as well as documentation requires a well-defined training system with training centers, trainers, and training administrators. This means a significant investment of money, men, and facilities. But, as Herr Berg of Blohm + Voss Shipyards says, "I am not telling you any secrets, training is expensive. The only thing which can be more expensive for a company is: Do not train."

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