UNIVERSITY OF MIAMI SEA GRANT PROGRAM

The Marine Technician—Past, Present and Future

RICHARD C. BENSON

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University of Miami Sea Grant Program
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FOREWARD

The Sea Grant Colleges Program was created in 1966 to stimulate research, instruction and extension of knowledge of marine resources of the United States. In 1969 the Sea Grant Program was established at the University of Miami.

The outstanding success of the Land Grant Colleges Program, which in 100 years has brought the United States to its current superior position in agriculture production, helped initiate the Sea Grant concept. This concept has three primary objectives: to promote excellence in education and training, research and information services in the University's disciplines that relate to the sea. The successful accomplishment of these objectives, it is believed, will result in practical contributions to marine oriented industries and government and will, in addition, protect and preserve the environment for the benefit of all.

With these objectives, this series of Sea Grant Special Bulletins is intended to convey useful information to the marine communities interested in resource development.

While the responsibility for administration of the Sea Grant Program rests with the Department of Commerce, the responsibility for financing the program is shared by federal, industrial and University of Miami contributions. This paper, The Marine Technician--Past, Present and Future, was presented at the Marine Technology Society meeting in Washington, D.C., 1971. Because of continued interest shown through the number of requests for copies of this paper, it is published as a part of the Sea Grant Program.

THE MARINE TECHNICIAN - PAST, PRESENT AND FUTURE

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ABSTRACT - The general origin and role of the technician is discussed. The concept of the Marine Technician evolves from considerations of past practices, community needs, and actions taken to meet these needs. The role of the supporting community is discussed and significant factors for a successful program outlined. Photos are presented to emphasize the need for hands-on training.

THE TECHNICIAN

The technician is a relatively new individual on the engineering team. His role has been created by virtue of changes in technology which in turn have brought about a change in the pattern of engineering education. (I use the word engineering to cover both the engineering and scientific fields.) Figure 1.

Some time ago the gap between the craftsman and the engineer was not very great. The engineer studied drafting, shop practices, etc. He was in a position to work closely with the craftsman in the shop to execute his designs. With an ever increasing complexity in technology the emphasis on engineering training has shifted. Today many engineers are not exposed to drafting techniques and shop practices. Their training tends to include more mathematics, theory, and computer techniques. Hence, less emphasis is placed upon the practical aspects. Figure 2.

This educational trend has created an ever increasing gap between the engineers and the craftsman. This is a skill and knowledge gap which separates the man in the shop from the man at the desk.

In addition to the engineer's shift of position, the craftsman may have shifted in an opposite direction as a result of numerous influencing factors: Apprenticeships, Pride in Workmanship, Union Specialization, Lack of Interest, etc. Figure 3.

This skill and knowledge gap is filled by the technician. He is a hybrid character who in fact must be part craftsman and part engineer. Today he performs many of the basic engineering tasks performed by yesterday's engineers.

Let's take a look at the role of these individuals in greater depth. Figure 4.

Note that our block diagram is divided diagonally into "How and Why" or "Hands and Head." Notice the arrows at the top which indicate the type of activities, production or engineering and research. Also notice the placement of job categories on the block diagram. This clearly indicates the general role of the different job classifications with respect to activities and relation to a team effort.

Present ratios of technicians to engineers commonly range from 1:3 to 1:6. This means we have a larger number of engineers and a smaller number of technicians. Since there tends to be a large number of fairly straightforward engineering tasks and considerably less numbers of sophisticated engineering tasks the result is improper utilization of manpower; the engineer doing many tasks that could be accomplished by a person with less training. This results in:

Improper utilization of technical and engineering talent,
Insufficient challenge for both technicians and engineers which leads to a shortage of engineers.

The net result is an economic loss for the employer both from a productivity and moral point of view.

If, however, we reverse the ratios of technicians to engineers, we create a challenging work situation. We free the engineers who were tied up with simple engineering problems, or non-engineering activities to concentrate their efforts on serious problems; hence, easing the so called "Engineering Shortage." The net result to the employer and personnel is positive.

So far we have not mentioned specifically what a technician does. If we continue to think of engineering type technicians we focus our attention on a few prime areas: electronic skills, mechanical skills, and operations activities. I propose that a technician in the aerospace field is not at all different in his basic abilities than an ocean technician. He does, however, focus attention in a truly different direction.

The engineering technician may possess a combination of the following characteristics: craft ability, knowledge of engineering fundamentals, detailed knowledge of certain specific subjects or equipment, ability to work as a team member, ability to communicate, flexibility, and interest in his field. These characteristics will allow him to perform or direct craft functions, provide a communications link between engineering and craft operations, communicate with engineers or technical literature, perform certain engineering tasks to relieve the engineers, work in many areas rather than a specific one, assume a degree of responsibility for a total program, and get things done.

The ocean technician may simply be an electronics technician who has knowledge and ability to apply his skills to the ocean, or a mechanical technician who is acquainted with the oceans and can create hardware which will survive in this specific environment. We may have sea-going technicians, or laboratory technicians who never venture to sea.

The ocean engineering technician may in general provide any or all of the following functions: 1. Design, 2. Fabrication, 3. Installations, 4. Maintenance, 5. Operation of equipment used in the ocean. This, then, I believe describes the general role of the technician.

THE MARINE TECHNICIAN - PAST

Other industries have utilized technicians effectively for many years. Consider the electronics, aerospace, and computer industries as examples.

The classic oceanographic community has generally been reluctant to utilize technicians. Some scientists have said that they must have someone with a Bachelor's degree to work for them. Others utilize graduate students, and some use whoever is available. Sometimes there are certain job write-up classification barriers to be overcome. In those cases where we have placed technicians, the scientist and managers have shown a major change in philosophy.

Only in the last few years has there been extensive effort to organize the training of marine technicians. In March of 1968 the American Association of Junior Colleges investigated the feasibility and need for establishing a program to train Marine Technicians.[1] From this initial effort about twenty[2] programs began in the United States.

These programs represent a wide range of community needs, educational philosophies and personalities. They may be broadly classified into science oriented programs, those which generally follow the pattern of a four year science major, and those which are more technically oriented.

I believe the program at Miami-Dade Junior College is in the latter category.

MARINE TECHNOLOGY - PRESENT

Miami-Dade Junior College offers three two-year curricula in Marine Science Technology, each leading to an Associate in Science Degree. These programs are designed to provide the fundamental training required for technological activities to the various fields of Oceanography and Ocean Engineering.

I. MARINE SURVEY TECHNOLOGY
Marine Survey Technology provides the fundamental training required in the fields of physical, geological, geophysical, biological, and engineering measurements within the ocean. The Technician's prime responsibility is the support of engineering and scientific efforts at sea. He will generally assist in the planning, logistics, and operation of these activities to assure a successful mission.

The student is trained in the use of common salinity, temperature, currents, coring, gravity, magnetic, bottom profiling and mapping. The Technician may also assist in the reduction and interpretation of data. His work may encompass estuary and coastal zreas, as well as the open ocean. In the majority of positions he will be expected to spend considerable time at sea and perform under challenging conditions.

II. MARINE MECHANICAL TECHNOLOGY
Marine Mechanical Technology provides the fundamental training required in the field of mechanical and under the water activities.

The Marine Mechanical Technician will assume responsibility for the support of engineering and scientific efforts in general engineering on-deck or underwater operations. He will assist in the design, fabrication, installation, and maintenance of equipment in the ocean environment. He will be trained in SCUBA diving and underwater work techniques since many of his tasks will be performed underwater.

Work will encompass land based operations, estuary and coastal areas, and off shore activities on the continental shelf.

Some of his time may be spent at sea under challenging conditions.

III. MARINE ELECTRONICS TECHNOLOGY
Marine Electronics Technology provides the fundamental training required in the field of Oceanographic Instrumentation and Electronics.

Training will encompass the basic electronics program at Miami-Dade Junior College with applications to oceanographic problems. He will support engineering and scientific efforts to provide electronic-mechanical instrumentation for use at sea.

He will assist in design, fabrication, operation, and maintenance of these instruments. This work may be entirely land based, or as an electronics specialist aboard an oceanographic vessel. In some positions, he will be expected to spend some time at sea and perform under challenging conditions.

The Marine Technology Courses at Miami-Dade Junior College consist of five (5) basic blocks. These blocks are supplemented by courses in technical math, physics, writing and social science. The basic skill and information blocks are:

A. Oceanographic Science and Related Techniques (3 courses).

GEL 110 - Introduction to Oceanography. A general education broad spectrum course in oceanography.

MST 111 - Introduction to Oceanography Laboratory. An introduction to the classic techniques of oceanography. The three (3) common parameters salinity, temperature, and depth are dealt with and followed up by a one day trip into the Gulf Stream to demonstrate the techniques of a BT cast, a 6 bottle Hydro Cast, reading of reversing thermometers, drawing salinity samples, a plankton tow, and the use of the Precision Depth Recorder.

MST 112 - Applied Oceanography. This course is devoted to extend topics of GEL 110 and MST 111 and to develop proficiency with data acquisition and handling. Station sheets, winch sheets, corrections of reversing thermometers, and the oceanographic slide rule are taught.

B. Seamanship and Ship Operations (2 courses).

MST 115 - Seamanship. This course provides the student with the knowledge and skills necessary for small boat handling and related topics.

MST 201 - Surface Operations. This course develops the students' appreciation and proficiency with electronic navigation, weather, cruise planning, wire rope, winches, A frames and related equipment, common with at sea operations.

C. Electricity/Instrumentation (3 courses).

MST 118 - Marine Electricity. A course in basic DC/AC for non-electronics majors. Topics are slanted to applications in Oceanography.

MST 210 - Ocean Measurements I. This second year course provides the development of the students' proficiency in standard ocean measurements such as Knudsen Titration, Winkler Method, and the Inductive Salinometer. He will make sea trips in which he will be directly involved with responsibilities of the cruise and execution of Hydro Casts, STD Operations and numerous other tasks. He will also receive classroom instruction in the philosophy of measurements, systems concepts, transducers, etc.

MST 211 - Ocean Measurements II. A continuation of MST 210 with emphasis on advanced and specialized techniques such as Geophysical Methods, Pollution Measurements, Survey Work, etc. Continued cruise participation allows the further development of hands-on experience and responsibility. A group of two or three students will be responsible for each cruise plan, preparation, etc.

D. Mechanical Technology (3 courses).

MST 121 - Engineering Practices I. This provides an introduction to basic hand and machine tools. The student develops proficiency with typical machine operations and an introduction to welding.

MST 122 - Engineering Practices II. Lectures cover basic statics, methods of design, and the use of hand books. A term project related to ocean activities is assigned. Here the student applies his knowledge and skills to accomplish the project.

MST 123 - Materials and the Marine Environment. This course will be introduced for the first time this Fall Term. It will cover basic strength of materials, common materials and their properties, deterioration of materials, and proper design and protective measures. This will enable the student to make intelligent use of materials within the marine environment.

E. Underwater Technology (4 courses).

MST 198 - Operational Diving. This is a beginning course in diving for the non-recreational diver. Emphasis will be upon safety, diving equipment, and basic diving skills. Here the student will become comfortable and competent with basic SCUBA gear.

MST 200 - Underwater Operations I. A basic skills course for common underwater activities to include: Underwater Photography (Nikons II System), Basic Rigging and Lift Techniques, Navigation, Use of Hookah Gear, and Night Diving.

MST 202 - Underwater Operations II. A course in advanced or industrial techniques including: Underwater Welding and Cutting, Underwater Tools, Lighting and Television, Communications, Air Lifts, and Underwater Surveys and Inspection.

MST 204 - Advanced Diving. Advanced equipment, physiology and techniques are considered. Students accomplish deep diving certification to 150 feet and chamber runs to 200 feet.

The level of community support given such a new program is critically important to its success. In Miami we have been extremely fortunate in this regard. Our local community provides interest and an excellent advisory committee. The University of Miami's Rosenstiel School of Marine and Atmospheric Science and the National Oceanic and Atmospheric Administration have provided the use of facilities, ship time, guest lecturers and other support. Local marine industries are helpful by providing guest lecturers, tours and internship opportunities.

The major factors in an effective hands-on program are:[3]

- Utilization of instructing staff and guest lecturers who speak from experience.
- Provide the student maximum opportunity for hands-on practice with modern equipment.
- Provide numerous field and at sea trips.
- Provide students with an internship in which he is involved with actual research or commercial operations.

The photographs illustrate some of the many aspects of our hands-on program including activities in labs, field trips, and at sea experience.

MARINE TECHNICIAN - FUTURE

Presently the job market presents a bit of a problem, however, it is not unusual to have one or two jobs waiting for our technicians. Surprisingly, a number of our students become employed as a direct result of our internship program before finishing the program.

The inherent nature of human inertia to new things is being overcome. Marine technicians will be in ever increasing demand as our nation's marine interests grow. We will also see new related programs evolve for specialty areas.

In a recent Marine Science Technology memorandum, Dr. William G. Torpey, Executive Office of the President, Office of Emergency Planning, Manpower Specialist concludes:

> "For the individual, optimum utilization means greater creativity and more productive activity. For the employer, optimum utilization means higher morale and a larger return per dollar spent. For the nation, optimum utilization means conservation of scientific and technical manpower resources, vital to our economic and social health as well as to our national defense and security."

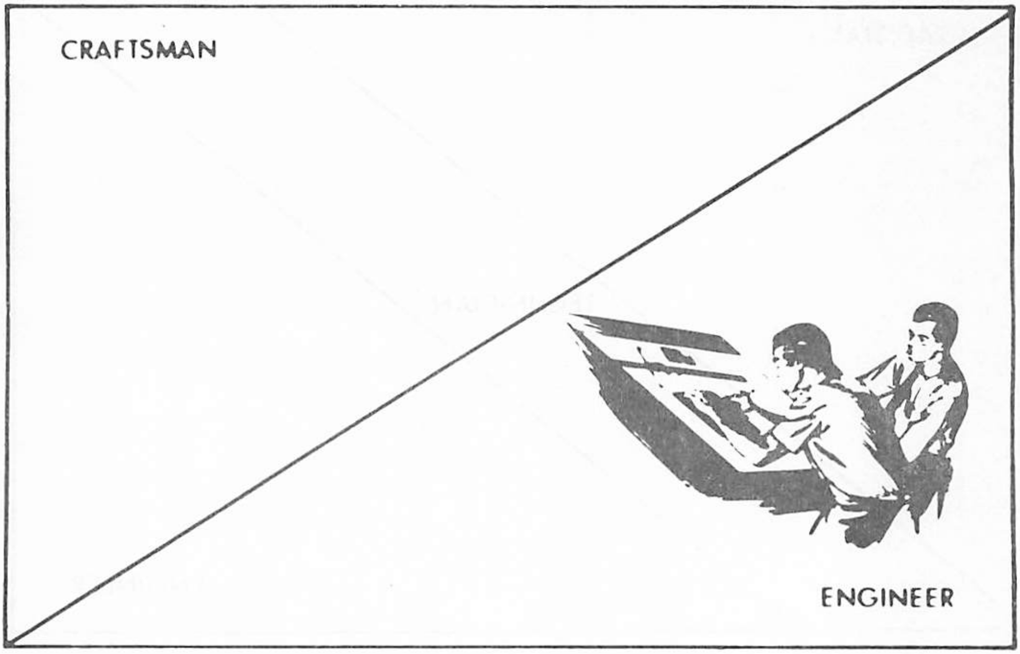
We are by proper training and application of technical, engineering and scientific personnel, achieving optimum utilization of our country's talent.

REFERENCES

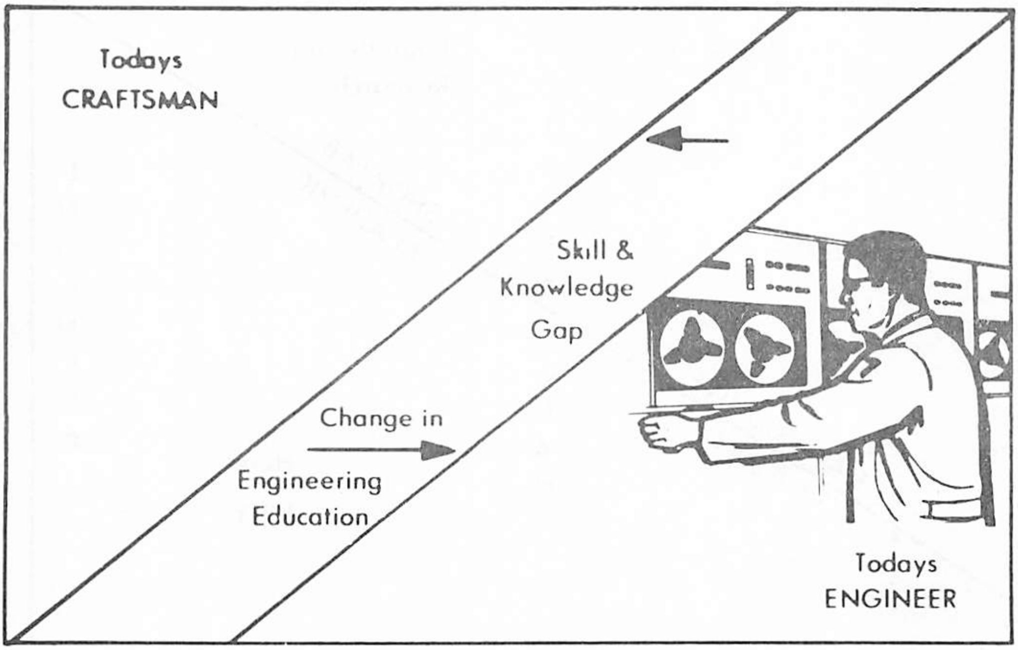
1. Chan, Gordon, "The Education and Training of Marine Technicians." American Association of Junior Colleges.

2. Participating Colleges in "Training of Marine Technicians in the Junior Colleges" Conference.
   Suffolk County Community College, Selden, New York
   Cape Fear Technical Institute, Wilmington, North Carolina
   Clatsop Community College, Astoria, Oregon
   Peninsula College, Port Angeles, Washington
   Del Mar College, Corpus Christi, Texas
   San Diego City College, San Diego, California
   Southern Maine Vocational-Technical Institute, South Portland, Maine
   Fullerton Junior College, Fullerton, California
   University of Rhode Island, Kingston, Rhode Island
   Seattle Central Community College, Seattle, Washington
   Highline Community College, Midway, Washington
   Brevard Junior College, Cocoa, Florida
   Santa Barbara City College, Santa Barbara, California
   College of the Redwoods, Eureka, California
   College of Marin, Kentfield, California
   Orange Coast College, Costa Mesa, California
   Miami-Dade Junior College, Miami, Florida
   Florida Keys Junior College, Key West, Florida
   Shoreline Community College, Seattle, Washington
   Anne Arundel Community College, Arnold, Maryland

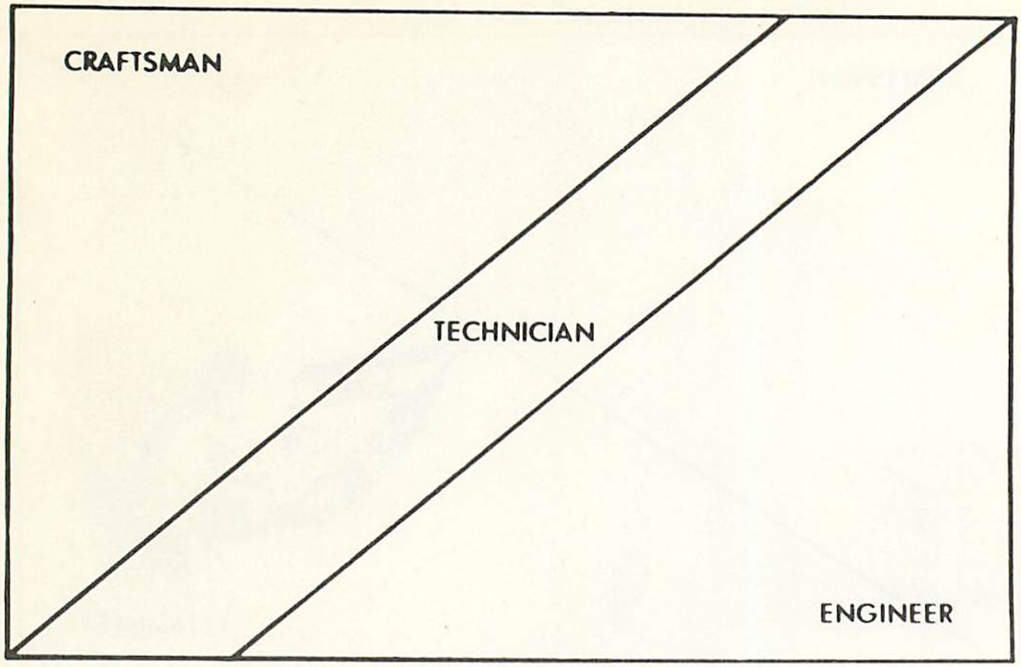
3. "Criteria for Technician Education A Suggested Guide," U. S. Department of Health, Education and Welfare.



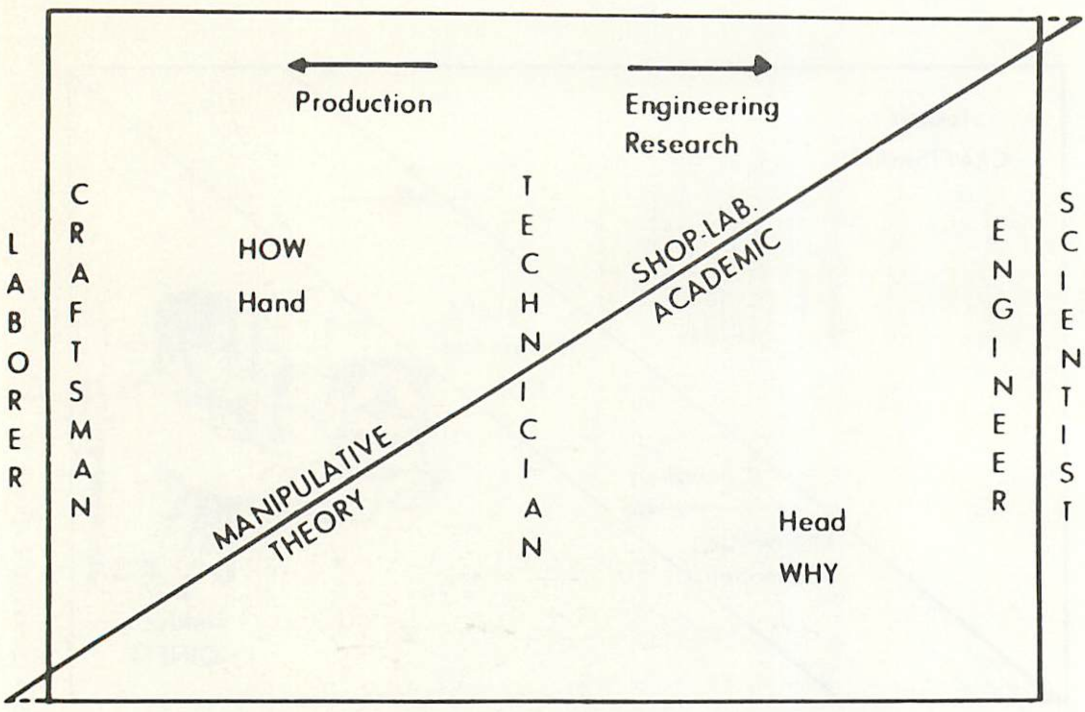
1. Yesterday's engineers were not completely separated from the craftsman.



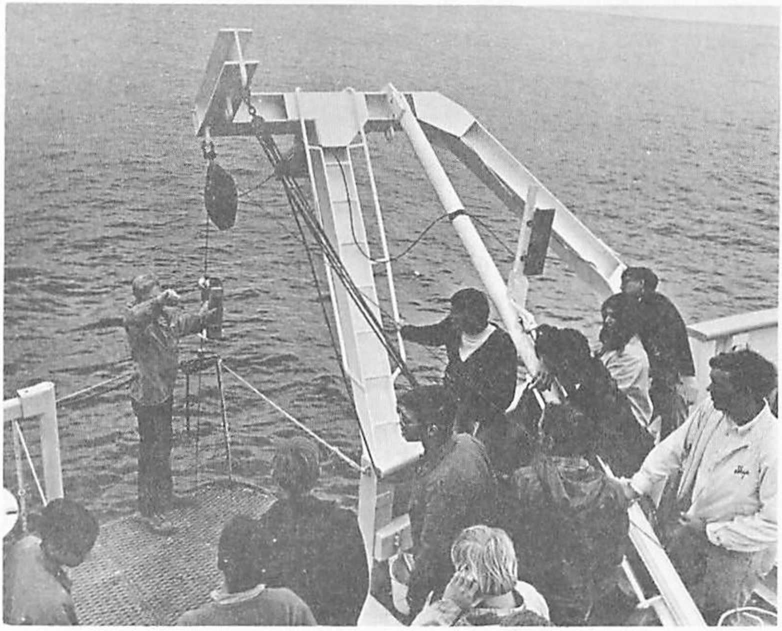
2. Advanced technology has brought about a change in areas of education and training of today's engineer.



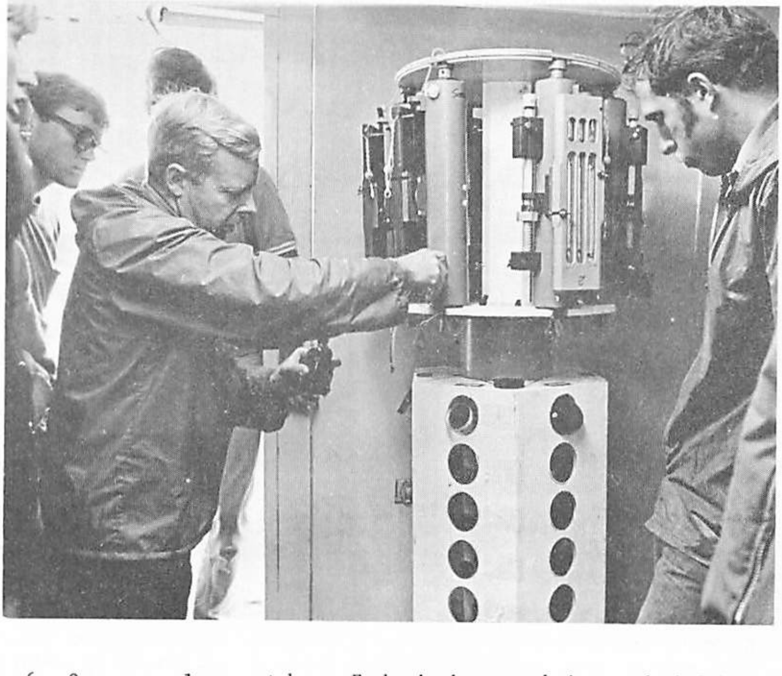
3. The gap between the craftsman and engineer has been filled by the technician.



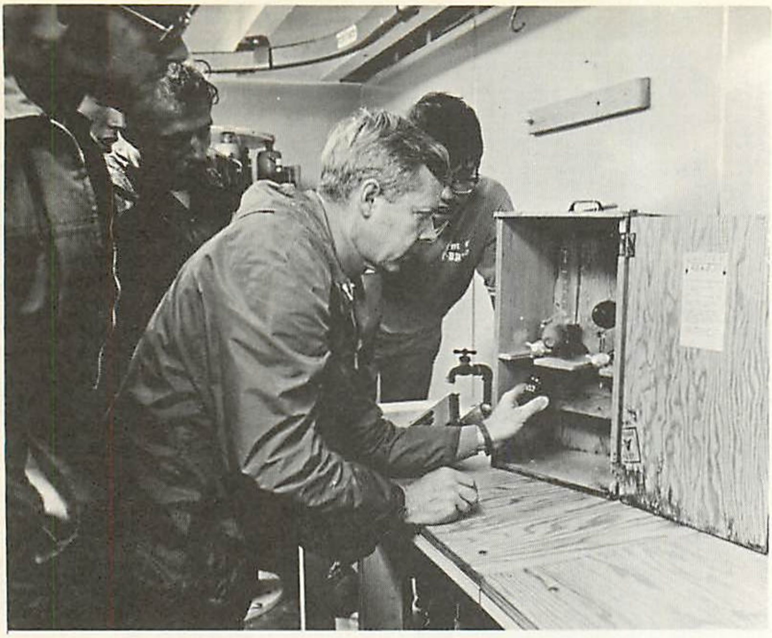
4. The general relationship between job terminology and function.



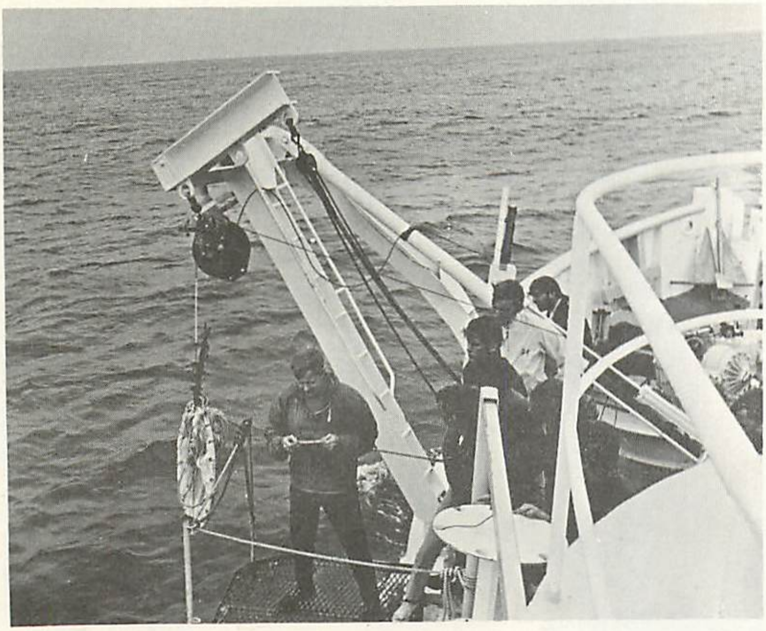
5. In their first term laboratory students are exposed to the classic methods in salinity, temperature and depth measurements. Here they are instructed in Hydro cast technique.



6. Oxygen samples are taken. Emphasis is on technique and pitfalls.

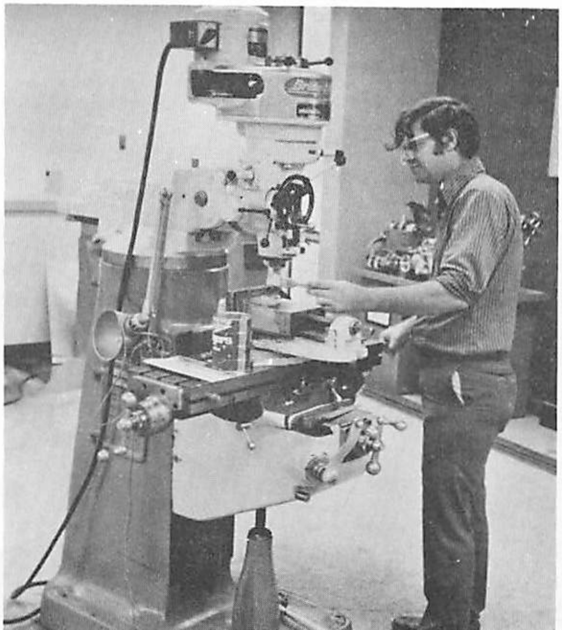


7. The oxygen sample is processed. Again technique and pitfalls are emphasized.

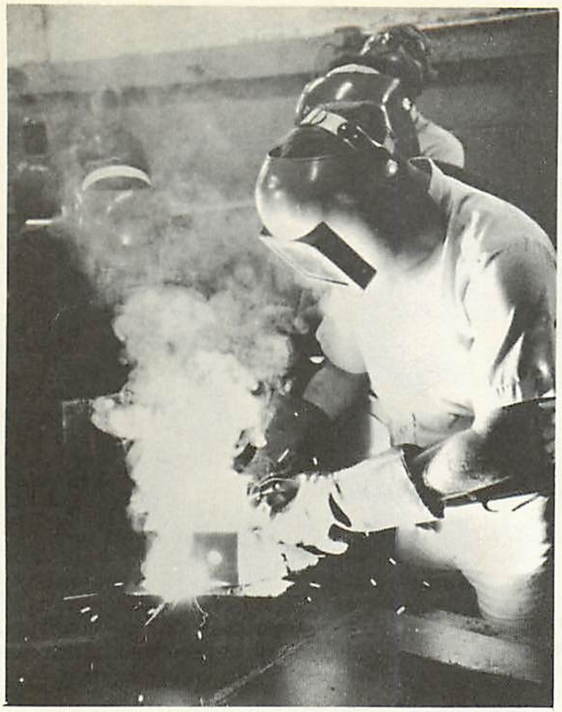


8. Whenever possible experts are used as instructors in specialty areas. A senior marine technician from the University of Miami's Rosenstiel School of Marine and Atmospheric Science demonstrates and explains the technique for using a double trip mechanism for a plankton tow.

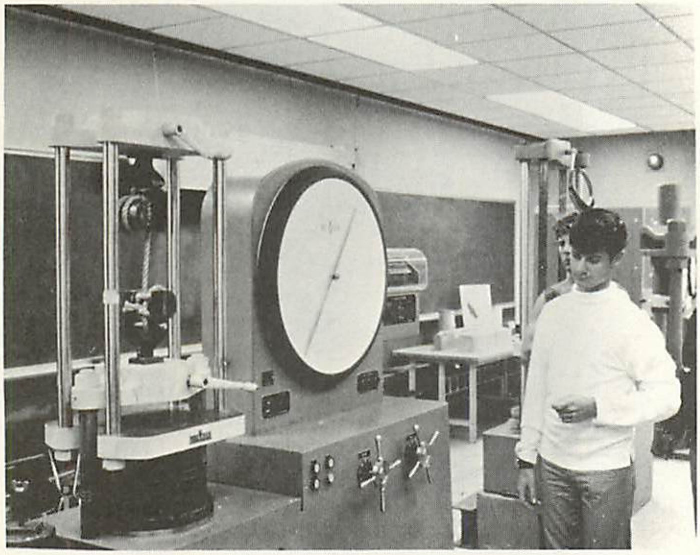
9. The results of the plankton tow are observed. This early exposure to sea operations provides the student with an early understanding of the techniques and associated problems.



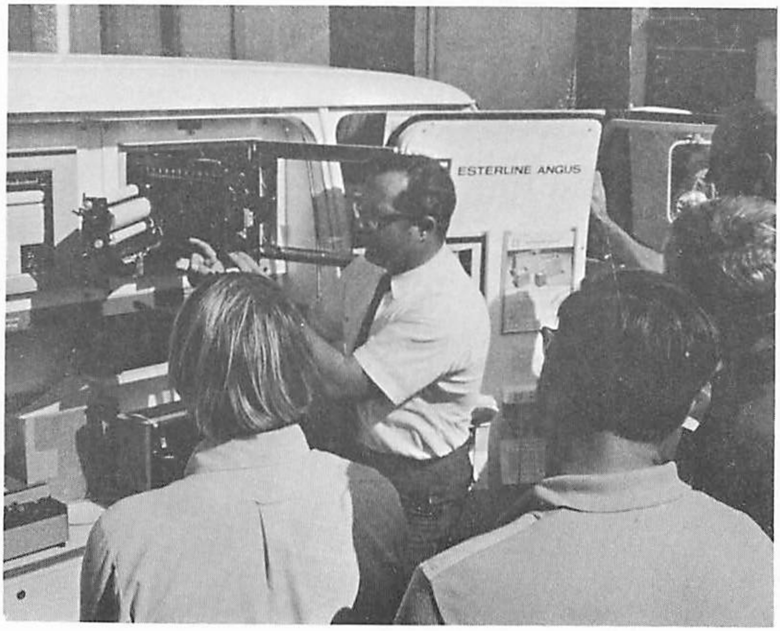
10. Basic mechanical skills and practices are developed. An advanced student is working on a term project he previously designed.



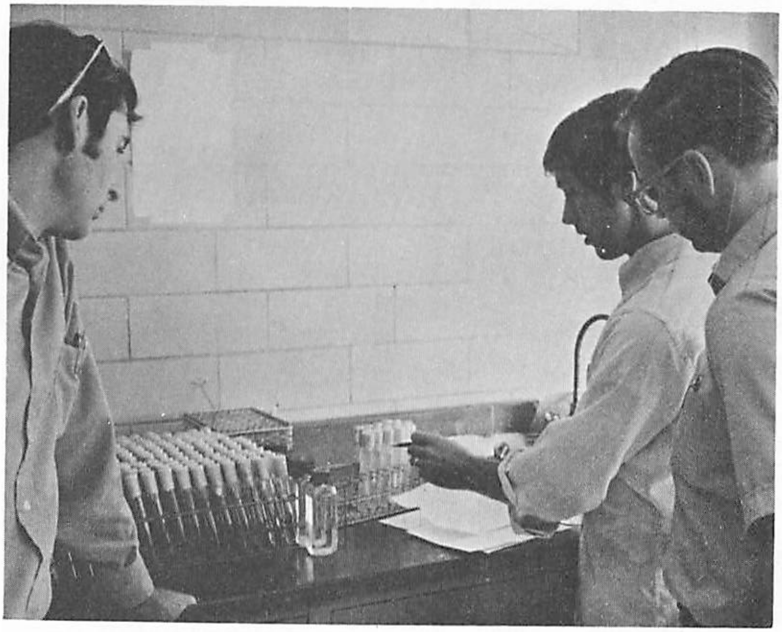
11. Students spend a considerable amount of time in welding practice. Basic theory and practical experience are obtained in gas, arc, heliarc, and underwater welding.



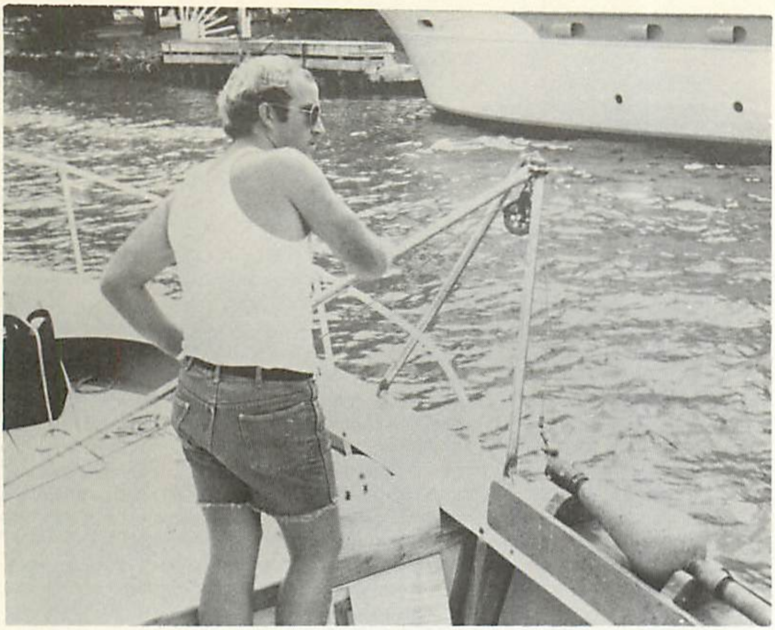
12. Common engineering materials and their properties are examined when tensile tests are run on various lines, wire rope, and fittings.



13. Guest lecturers are used whenever possible to expose students to different points of view as well as contact with other institutions and industries. A factory representative demonstrates a recorder using a functional display.



14. Most students are interested in the topic of pollution. A former student, now working with sewage water measurements, demonstrates the technique of taking coliform counts.



15. Whenever possible field projects are designed to provide support for local agencies. The gravity core samples taken from the Miami River were used by scientists to analyze the nature of pollutants.

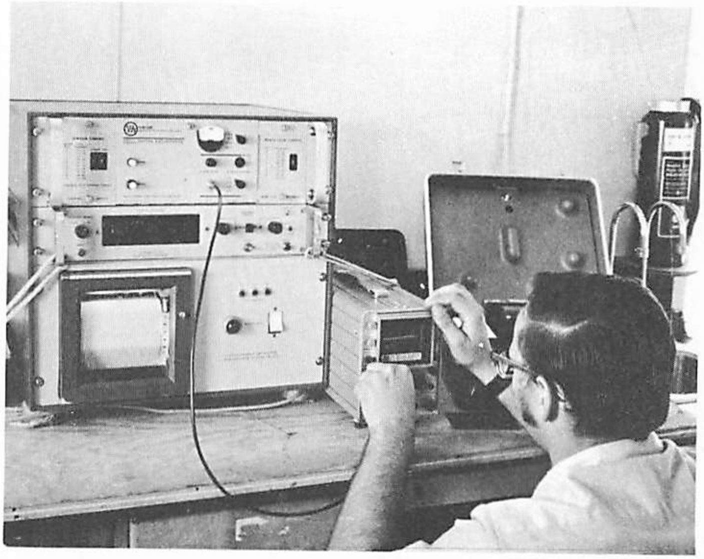
16. Advanced classes are designed to spend as much time in the field and at sea as possible. Here a group of advanced students receive a briefing on the use of the PDR and Pinger previous to taking a piston core in the Florida Straits. Most of these training classes have taken place aboard the R/V GERDA provided by University of Miami Rosenstiel School of Marine and Atmospheric Science.

17. Advanced student cruises provide an opportunity for cruise planning and execution of such skills as running a ten-bottle hydro cast.

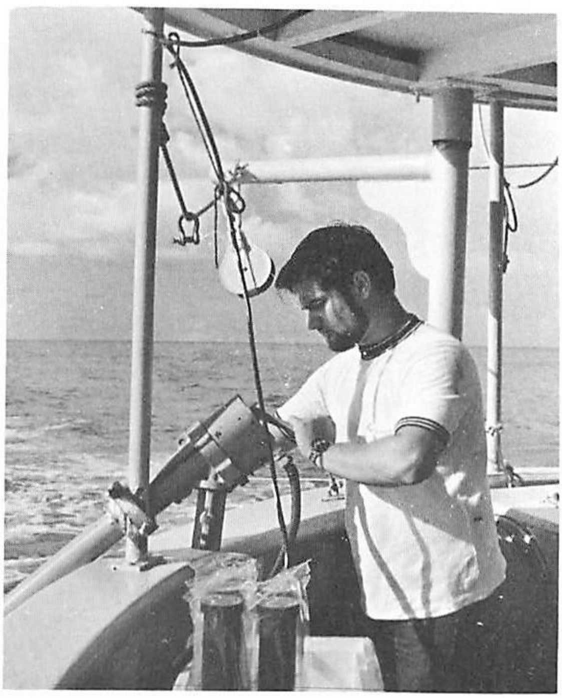
18. All aspects of ships operations are covered. This student is coordinating the activities of the PDR observer and the winch operator, using sound-powered phones.

19. Students are exposed to modern equipment. They are lowering a S.T.D. (Salinity, Temperature and Depth) "fish."

20. Internship programs provide training at sea. This student now calibrates and operates the S.T.D. console with a great deal of proficiency after a few days at sea supporting research projects.



21. Student maintaining a Magnetometer watch as the ship crosses the Florida Straits.



22. An advanced student operates an XBT (Expendable Bathythermograph) during his internship.