MARINE SCIENCE TECHNOLOGY PROGRAM

AT

SOUTHERN MAINE VOCATIONAL TECHNICAL INSTITUTE

Prepared by
Tapan Banerjee
Coordinator

SOUTHERN MAINE VOCATIONAL TECHNICAL INSTITUTE

FORT ROAD, SOUTH PORTLAND, MAINE 04106

NATIONAL SCIENCE FOUNDATION
SEA GRANT PROJECT GH-35

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INTRODUCTION

Modern-day technology does not function by the scientist alone. Today's heart surgeons are assisted by the nurse, laboratory technician, X-Ray technician, etc. Likewise, the space program involves a number of technicians assisting the scientists in man's race to the moon. Many other professional fields have in recent years welcomed assistance from the technician.

In view of this widespread trend it comes as no surprise that those who devote their professional lives to the development and usage of marine resources will now be assisted by the marine science technicians. Commenting on the President's proposal for an "International Decade of Ocean Exploration," the council states:

> "We have only begun to realize the promise of the ocean. As the world's population grows rapidly, the sea can provide new sources of nutritious food. Untapped mineral and energy resources of the sea can help meet growing demands of the world's expanding economy....While very little is known of the composition and distribution of non-living seabed resources, these resources are being sought on the Continental Shelf to meet a growing demand for energy and minerals."

With regard to shortage of technicians, the National Council, in its reports, continues:

> "Skilled manpower is essential for any nation to enhance its capabilities for exploring the oceans. The size, scope and quality of national programs and programs initiated in the next several years for training oceanographers, marine engineers and technicians, and specialists in related fields will be a significant factor in determining the rate at which ocean exploration is intensified during the 1970's."

To get the needed marine science technicians we must set up formalized procedures for training them. Implementing these procedures calls for trained teachers, proper course curriculum, laboratory facilities, vessel availability and the proper location of the institute. While there are several junior colleges and technical institutes offering training programs (marine science) of various types, each school's objectives, as well as curricula vary greatly. There seem to be many concepts of the definition, role and scope of technicians to support ocean research and production.

This report is intended to serve as a source book and to provide information, guide lines, and recommendations to students, educators, government agencies, and industries regarding our involvement in the field of Marine Science Technology. Towards this objective, this report focuses on the existing and future program at Southern Maine Vocational Technical Institute.

The Institute

The Southern Maine Vocational Technical Institute is conducted under the authority of the Maine State Board of Education for persons who desire preparation for profitable employment in mechanical, technical, and other skilled occupations. It is operated under the direction of the State Department of Education and is an integral part of the State's educational system. It is a non-profit institution supported by student tuition fees and an annual appropriation by the State Legislature. The Institute seeks to provide youth with salable skills and the industries of Maine with trained personnel.

The programs offered at this school range from vocational-technical level to highly technical courses. Intensive courses help prepare S.M.V.T.I. graduates to compete in an ever-increasing technological society. Students also pursue academic subjects designed to give them a broader understanding of their chosen fields and provide them with a fundamental knowledge necessary for further educational development. The informed individual lives a fuller life and normally finds promotions in pay and job responsibility more favorable to him. S.M.V.T.I. graduates are in demand by industry and service companies throughout the state. Graduates likewise are sought by companies from other states, particularly for engineering and industrial technician types of work.

Marine Technology Program

The first two-year program in the country in Marine Technology was conceived at this institution in 1958 and has continued to grow and develop through the years, and is presently training and supplying graduates for many ocean-oriented activities.

This program is designed to produce marine technicians who are conversant with practical ship operations and related technical skills. A percentage of the school year is spent at sea on the training vessel, Aqualab. Many instrumental methods and shipboard laboratory techniques relating to oceanography are included as part of the course.

Several weeks each year are spent in the practical maintenance of the vessel, and all students are required to participate in sea trips. Such participation includes deck, engine room and oceanographic station watch. When the vessel is in a port other than her home port, students are also required to stand in-port security watches. Discipline aboard the vessel meets the rigid demands of maritime requirements.

Second year students specialize in either the deck and oceanography or engineering and oceanography phase of the course. This two year program is available as an associate degree or a non-degree program. The enrollment of students in a degree or non-degree program depends on academic background and ability to carry on related subjects. A student in a non-degree program could ultimately receive his degree by acquiring additional Humanities and Natural Sciences.

CURRICULUM LEADING TO ASSOCIATE DEGREE IN MARINE TECHNOLOGY

Description	1st semester	class	hours lab	cr.
Math I		4	0	4
English Composition		3	0	3
Biology		2	2	3
Oceanography I		3	0	3
Engineering I		2	2	3
Deck Technology I		2	2	3
				19
	2nd semester			
Math II		4	0	4
American Literature		3	0	3
Marine Biology I		2	2	3
Oceanography II		3	0	3
Engineering II		2	2	3
Deck Technology II		2	2	3
				19
	3rd semester			
Physics I		3	2	4
Sociology		3	0	3
Marine Biology II		2	2	3
Oceanography III		3	2	4
*Elective:				
Engineering III Deck Technology III		3	2	4
				18
	4th semester			
Physics II		3	2	4
Economics		3	0	3
Political Science		3	0	3
Oceanography IV		3	2	4
Electronic Equipment		2	0	2
*Elective:				
Engineering IV Deck Technology IV		3	2	4
				20

CURRICULUM LEADING TO INDUSTRIAL MARINE TECHNOLOGY

Description	class	hours lab	cr.
1st semester			
Math I	4	0	4
English Composition	3	0	3
Biology	2	2	3
Oceanography I	3	0	3
Engineering I	2	2	3
Deck Technology	2	2	3
			19
2nd semester			
Math II	4	0	4
Marine Biology I	2	2	3
Oceanography II	3	0	3
Engineering II	3	2	4
Deck Technology II	3	2	4
			18
3rd semester			
Physics I	3	2	4
Marine Biology II	2	2	3
Oceanography III	3	2	4
*Electives: (2)			
Engineering III	3	2	4
Deck Technology III	3	2	4
Auxiliaries	2	2	3
Small Boat Handling	2	4	3
			18
4th semester			
Physics II	3	2	4
Oceanography IV	3	2	4
Electronic equipment	2	0	2
Metal Fab	0	4	2
Graphic Arts	1	2	2
*Elective:			
Engineering IV	3	2	4
Deck Technology IV	3	2	*4
			18

CURRICULUM LEADING TO AN ASSOCIATE DEGREE IN APPLIED MARINE BIOLOGY AND OCEANOGRAPHY

First year

1st semester

Description	class	hours lab	cr.
College Eng. Comp.	3	0	3
Algebra and Trig.	3	0	3
College chemistry	3	2	4
General Biology	3	2	4
Element of Oceanography	3	2	4
			18

2nd semester

American Literature	3	0	3
College Physics	2	2	3
Computer Math	3	0	3
Instrumentation and Methods in Oceanography	3	2	4
Biology (Invertebrate Zoology)	3	2	4
			17

Second year

3rd semester

Economics	3	0	3
Physics II	2	2	3
Navigation (Introduction to)	3	0	3
Field Biology Ecology	3	2	4
Chemical Oceanography	3	2	4
Physical Education	1	0	1
			18

4th semester

Political Science	3	0	3
Sociology	3	0	3
Physical Education	1	0	1
Microbiology	3	2	4
Physical and Geological Oceanography	3	2	4
*Electives	3	2	4
			19

*Possible Electives

Planktology	3	2	4
Histology	3	2	4
Marine Botany	3	2	4
Fish Science	3	2	4

Applied Marine Biology and Oceanography Program

A technician in Applied Marine Biology and Oceanography is a semi-professional person with two years of post-high-school training in physical, chemical, marine biological, or general oceanographical studies.

In addition to classroom study, the program consists of field work in the form of collecting basic data, maintaining field stations, sorting, describing, analyzing, graphing, surveying, writing, etc. This exposes the students to the many varied problems and techniques with which they may expect to be confronted in their new position upon graduation.

This two-year associate degree program has been funded by the Sea Grant College Bill of the National Science Foundation, since January 1969.

The ocean industry is not only demanding more technicians, but it is also requiring that these people be better qualified in order to keep abreast of the most recent advances and methods used in the exploration and exploitation of our last earth frontier. S.M.V.T.I. trains applied marine biology and oceanography technicians to fulfill this demand. The student in this program takes all college level courses (Physical, Chemical, and Biological Oceanography) as well as Mathematics and Humanities required for an associate degree. These students may pursue their education in this field beyond the associate degree level.

Marine Biology and Oceanography Laboratory Facilities

Applied techniques and methods in the above disciplines are taught with the aid of the following facilities: built-in aquaria; Cryostat microtome; paraffin embedding apparatus; dry heat sterilizer; compound microscopes; research binocular compound microscope with dark field and photomicrograph attachments; research binocular dissecting microscopes; stereozoom research compound monocular microscope; microprojector; carbon light source; microscope illuminators; dredges, nets, and grabs; reversing water bottles - Nansen bottle water sampler; oceanographic slide rules; bathythermographs and accessories; EKman current meters; coring devices; anemometers; inductively coupled salinometers; desk top computer; ripple tank; wave generator rheostat; marine hydrographic thermometer; Van Dorn water sampler; rock dredge; protected and unprotected thermometers; Ewing deep sea camera; Dietz-LaFond sampler; Petersen dredge; Phleger corer; J-Z bacteriological water sampler; Clark-Bumpus automatic plankton sampler; plankton net #2 mesh; plankton net #10 mesh; plankton net #20 mesh; turbidity meter with 100 ft. cable; botanical specimen presses.

Seamanship Laboratory Facilities

The seamanship lab of the Marine Technology Course is located in an 80' x 40' wooden building.

Equipment included in this building are rigger vises, sewing machines, magnetic compasses, sextants, nets, rope, blocks and tools used in the maintenance

of the school's small boats and larger vessels. The student is trained in knot tying, wire and rope splicing, block and fall rigging, canvas mending, net mending, and small boat repairs. He also receives training in compass correction and the proper use of a sextant.

Marine Engineering Facilities

A. Engineering Lab: Used for instruction in practical applications, projects, and maintenance of diesel engines, shipboard auxiliary equipment such as piping, pumps, compressors, electricity, clutches, marine gear, etc. The engineering lab has 20 teaching stations.

   Equipment: Tool crib equipped with necessary hand tools, engine rebuilding tools, precision tools, welding equipment, and electrical equipment.

B. Fuel Injection Lab: Used for instruction in servicing and adjustments to fuel injection components.

C. Electrical Lab: Used for instruction on electrical equipment such as electrical motors, generators, starter boxes, relays, etc. The electrical lab has 10 teaching stations.

   Equipment: Various motors, generators, distribution panels, switches, etc.

D. Engineering Classroom: Used for theory classes in engineering

E. Training Ships: Used for instruction in practical applications in shipboard procedures, operation and maintenance of engine room equipment.

Vessels

M/V Aqualab (Training Ship)

Overall length - 136 ft.
Draft - 11 ft.
Beam - 24.8 ft.
Power - 1000 H.P.
Cruising speed - 3 to 10 kts.
Cruising range - 2000 nautical miles
Fuel capacity - 6000 gallons
Fuel consumption - 30 G.P.H.
Electric power - 120 volt system produced by one KW DC generator and one 60 KW DC generator; 60 cycle AC 120 volt upto 8 KW
Deck Equipment - Electric anchor windlass, two (2) 5,000 lb. capacity booms, one (1) 4-drum hydraulic winch.
Electronic and navigational equipment - Gyro compass, three (3) Loran receivers, recording fathometer with fish scope, radar, magnetic and navy-type standard compass, radio-telephone

Laboratory space - various enclosed spaces
Number of berths - 32 persons
Mess facilities - 24 persons at one sitting.

R/V Phykos (Research Vessel)

Overall length - 131.4 ft.
Draft - 7 ft.
Beam - 29.9 ft.
Power - 1000 H.P.
Cruising speed - 3 to 9 kts.
Cruising range - 4,500 nautical miles
Fuel capacity - 10,900 gallons
Fuel consumption - 25 G.P.H.
Electric power - 120 volt system produced by one 30 KW generator and one 60 KW generator; 60 cycle AC 120 volts upto 2 KW
Deck equipment - one (1) Gentry-type 7.5 T boom, one (1) single drum gasoline winch, one (1) davit with hand winch

Electronic and Navigational equipment - radio-telephone, fathometer, radar, navy-type compass
Laboratory space - various enclosed spaces
Number of berths - 6 berths and hammock space for 40 men
Mess facilities - 18 persons at one sitting

R/V Clarence (Research Vessel)

Overall length - 36.7 ft.
Draft - 2 ft. 7 in.
Beam - 11 ft. 4 in.
Power - 108 H.P.
Cruising speed - 3 to 8 kts.
Cruising range - 200 nautical miles
Fuel capacity - 80 gallons
Fuel consumption - 3 G.P.H.
Electric power - 12 volt system
Deck equipment - small mast, boom, one davit with hand winch, one 2-drum hydraulic winch
Electronic and navigational equipment - depth sounder, navy-type compass
Laboratory space - open after deck space
Number of berths - none
Mess facilities - none

Dutch Shoe (Motor vessel)

Overall length - 26 ft.
Draft - 1 ft.
Beam-- 7 ft. 8 in.
Power - 25 H.P.
Cruising speed - 5 kts.
Cruising range - 40 nautical miles
Fuel capacity - 10 gallons

Fuel consumption - 2 G.P.H.
Electric power - 12 volt battery
Deck equipment - none
Electronic and navigational equipment - Navy-type compass
Laboratory space - small enclosed cabin
Number of berths - two
Mess facilities - none

Small boats

One (1) Race point life boat
Two (2) Surf boats
Three (3) Sixteen ft. dories
Two (2) Twenty ft. dories with outboard wells and 18 H.P. outboard motors
One (1) Nineteen ft. dory
One (1) Small row boat

Working Conditions

As more and more attention is focused on the development of the various phases of Marine Science, we can expect to see the continued introduction of improved accommodations for these technicians. While much of the work is carried on at sea, it cannot be said that the work is especially dangerous. Certainly safety is a primary factor that should receive consideration and much concern is given toward the further recognition of potential hazards.

It can be said that most vessels involved in marine science today are clean and comfortable. This type of vessel offers a more attractive environment for the technician, and companies involved in this work recognize this factor. The technician will be called upon to spend, at certain intervals, much time away from his shore station. (The enterprising technician will recognize these opportunities, however, as experiences which will, in the long run, tend to broaden and educate.)

Opportunities in the field are particularly attractive with regard to salary and involvement with experts in the area of marine science. Since the field is relatively new, the technician has a marvelous opportunity for rapid advancement and personal growth. In a very short time, the technician who is eager and adept will find that he will be able to compare favorably in knowledge and experience with others in the field.

Earnings and Benefits

At a conference held by the American Association of Junior Colleges in Florida on March 17-20, 1968, the following statements were made by James E. Sykes, laboratory director and Evert J. Brakke, regional personnel officer of the Bureau of Commercial Fisheries, St. Petersburg, Florida.

"In days gone by, too few people have taken pride in being technicians and members of a good scientific team. One of the principal causes has been that the technician, often not very well trained, is taken onto the staff at the GS-4 ($5,000) level, works on for years at that level, and knows that if he continues until retirement he will probably achieve the GS-5 level. There has been little incentive for potential technicians to train themselves with the thought of a good livelihood in mind. In government we are living under a system which entitles certain technicians to advance to GS-11 or 12 ($12,500) but the percentage of them doing so is unusually small. We must face the fact that we live with rather strict limitations gradewise and salary-wise for the non-scientist; therefore, we are not recruiting the best people. Only when we raise the technician series in quality will alert people eagerly take the marine technician's course in the junior college.. ...If we train these candidates properly to begin with and establish a good system for them to enter, then we might overcome a great many of the technical and emotional problems which we currently undergo."

From our experience we have found that the marine science technicians can expect from $5,000 to $7,500 as initial earnings, depending on their specific area of employment. There is a 50% sea bonus when operating at sea in some waters. Following employment by the U.S. Navy Oceanographic Office for at least one year, the Navy will pay 75% of the tuition for a technician who is improving his educational position by taking additional courses in his field. The student must maintain a "C" average or better in the course.

Jobs Available for Marine Science Technicians

Oceanographic Laboratory Technicains - Work of the oceanographic laboratory technician would include assisting in a variety of chemical and physical tests and analyses such as tide and current studies, water analysis for dissolved gases and minerals, and wave studies. He would also maintain cleanliness and orderliness in the laboratory ashore and afloat, keep up the inventory in the laboratory stock, calibrate and operate measuring and surveying instruments used in oceanography, assist in data acquisition, keep records, plot graphs and profiles, and reduce processed chemical and physical oceanographic station data to a standard format.

Fisheries Technician - The fisheries technician would work with the scientists in investigations carried out on salt water or fresh water fisheries. He would be expected to be familiar with the biological studies of fish habitats, population surveys and environmental surveys, tagging procedures, collecting methods, collecting and reading fish scales and otoliths, organ and tissue removal, stomach analyses for food and feeding habits, assisting in the design and construction of fishing gear and fishways, assisting in the work related to fish farming, and in state and federal hatcheries.

Hydrographic Survey Technicians - Hydrographic survey technicians would assume responsibilities of operating standard surveying instruments including bottom grabs, sextants, theodolites, various type measuring instruments, depth recorders, wire drags and assorted kinds of required navigational equipment. He will be able to read charts and to assist the cartographer in the field. He will assist with data acquisition, processing, and in many instances, the interpretation and analysis of original data. His work would range from tidal and coastal areas involving surveying and engineering to geomagnetic observations and hydrospace seismological observations. Hydrographic surveys may be conducted in either the marine or the freshwater environment.

Limnological Laboratory Technicians - The limnological laboratory technician will be expected to carry out work of a hydrographic nature on our fresh water lakes. This work would include studies on fishery stocks, factors influencing these stocks, and control of unwanted flora and fauna affecting sport and commercial species of fish. He will take water samples, carry out field and laboratory analyses on the water, measure physical parameters, care for and maintain the sampling and measuring equipment used in fresh water hydrography, assist in the laboratory with routine tasks such as weighing and mixing solutions, and will play an active part in quantitative studies of the water itself, and the life in it.

Marine Engineering Technicians - This person would be responsible as an aide in the research and development required in coastal and amphibious engineering including hydro-mechanics, waterfront structures, and amphibious equipment. He would be expected to assist various hydraulic, structural and general research engineers in the set-up of experiments, conducting experiments, and theoretical investigation including data reductions, machine computations, marine engines and motors used in the area of ocean engineering.

Deck Support Technician - He will assist on the deck support party aboard an oceanographic survey vessel. His tasks will require familiarization with a broad range of physical-chemical-meteorological-biological-geological oceanographic sampling and measuring instruments as he will be required to rig these instruments and sampling devices for over-the-side use. He will also know how to operate all types of oceanographic winches and booms during actual operations, and will be responsible for proper stowage and repair of many of these tools of the oceanographer when they are not being used. Another of his duties will be to crate and label all equipment and samples for shipment to shore installations.

Oceanographic Instrumentation Technician - This person would be involved with determining instrument accuracy, modifying equipment and designing new auxiliary apparatus.

Marine Products Salesman - It will be the responsibility of this person to find new uses for the company's products, to suggest new products, to provide technical advice and services, and to keep up-to-date in the developments in the field of oceanographic instrumentation.

Water Pollution Technician - These technicians will work with scientists in their determination of the extent of pollution in bays and estuaries, rivers and lakes and will be involved with research concerning control and abatement of industrial and other pollutants. Work may be carried out under the supervision of a sanitary engineer in field analyses, laboratory testing, and even public relations. They will participate in the surveying of questionable geographical areas, as well as in the design of different sampling systems. They may be expected to assist life scientists in conducting ecological studies in suspected or known polluted waters.

Underwater Technicians - This technician will be, first of all, a trained qualified diver, thoroughly experienced with every type of commercial diving apparatus, mixed gas diving, underwater tools, and safety procedures. His aid will be indispensable in the oil fields, rigging pipelines and wellheads, etc. He will be very useful also in testing underwater communications systems, photographic equipment of assorted makes and models, testing of underwater closed circuit television and other electronic equipment which may be used for observing phenomena under the sea.

Scientific Support Party Chief - This person, with the experience gained as a technician in the field, will assume greater responsibilities of organizing and directing the activities of the deck and associated technicians working aboard scientific research vessels. He will be knowledgeable of all kinds of instrumentation used by all facilities visiting aboard his vessel, will know how to properly and conveniently store such equipment, and will be additionally responsible for all incoming and outgoing shipments, and for making all purchases of inventory as requested by visiting scientists.

The Future Expansion

This Institute hopes to expand its Marine Science Technology Program into three additional divisions by 1972. The following is a list of these programs.

Fisheries Technology - The world population explosion has substantially increased the demand for fishery products. One way to satisfy this demand is to provide young fishermen with a thorough background in commercial fisheries so that they may be adequately prepared for this occupation. With additional staff and facilities, and in cooperation with local fishing organizations, SMVTI will be able to conduct a two-year program in Fisheries Technology. Students in this program will graduate with a certificate or an associate in science degree in Marine Science Technology.

Marine Electronics Technology - The intent of this program will be to provide a broad foundation for students in marine electronics. Laboratory as well as field training in electronic instrumentation for chemical, physical, biological and geological analysis would be emphasized in this course. Also mechanical calibration and electronic calibration and repair of ocean research equipment would be included. After successful completion of this two-year program, students would receive an associate degree in science.

Underwater Technology - Due to tremendous expansion and growth in the field of Oceanography, there is an increasing need for skilled underwater technicians. The student in this program will learn how to take underwater photographs with modern cameras and T.V. equipment on underwater sorties. He will also learn underwater welding, diving, and submersible vehicle operational navigation. This two-year program will offer an associate degree in science.

COURSE RECOMMENDATIONS FOR PROPOSED NEW FIELDS OF MARINE SCIENCE

Fisheries Technology	Marine Electronics Technology	Underwater Technology
English Composition	Physical and Chemical Oceanography	English Composition
General Physics	Biological and Geological Oceanography	Physics I and II
Algebra and Trigonometry	Technical Math I and II	Technical Math I and II
Social Science	Physics I and II	Physical Education
Physical Education	General Chemistry	SCUBA Diving
Fisheries Science	English Composition	Welding
Introduction to Oceanography	Electronics theory and laboratory	Seamanship and Navigation
Fishery Hydrography	Electrical Machinery	Marine Electronic Equipment
Fishing Methods and fishing gear technology	Electronic Communication	Marine Geology
Commercial Fish Processing	Electrical-Electronic Logic	Physical and Chemical Oceanography
Navigation and Seamanship	Underwater Acoustics	Invertebrate Marine Biology
Basic Marine Engineering	Social Science	Underwater Photography
Net mending and designing	Physical Education	Applied Underwater Engineering
	Industrial Control Circuits	Submersible Vehicle Operation
	Electrical Analysis and measurements	Underwater Physiology
	Marine Electronics	

Necessary Qualities of Students Desiring to be Marine Science Technicians

The technician who would be successful in the field of marine science must have a strong desire to work out-of-doors and aboard ship. He should be prepared both mentally and physically for the sometimes rigorous demands that will face him. He should be one interested in working closely with others as a team member.

The prospective marine science technician should be prepared to entertain new concepts as he should realize that the field is just now beginning to develop at a rapid rate. To be prepared for this predicted evolvement of this technology, the technician should be well versed in seamanship, marine engineering, mathematics, marine laws, navigation, marine electricity, marine electronics, fishing, and marine biology and oceanography.

These technicians should be prepared to fulfill their responsibilities on an irregular time basis and to engage in a variety of activities not wholly expected to be strictly oceanographic at any given time.

Educational Requirements for Admission in Marine Science Program at S.M.V.T.I.

A student expecting to enter the Marine Science Technology program should obtain a high school diploma and should be advised to take one or more of the standard college entrance examinations. Students should take at least one year of algebra, physics, chemistry, and biology to enter the associate degree program.

The Future of Marine Science Technology

The future growth in this field is likely to be explosive, primarily as a result of the federal government's stepped-up interest in the field. It is probable that a major non-military program of oceanographic research will be launched during the coming months. The government-civilian spending in this field may reach six hundred million by 1971, more than a four hundred percent jump over 1967. The newly created Environmental Science Services Administration (ESSA) has already stimulated increased interest in the field. It has recently launched a 3,800 ton, seven million dollar ocean research ship, and will launch a sister ship shortly.

Knowledge of the ocean and oceanographic conditions is becoming increasingly important to the nation's interest. The importance of the ocean in food and power production, in weather forecasting, and as a source of fresh water, new drugs, rare earths and other needed materials cannot be underestimated. The day is dawning when all of our programs will be formalized, and this country will be catapulted into the hydro-space age following on the heels of the outer-space age. Knowing the importance of this field, Frederick J. Close, Chairman of the Board of the Aluminum Company of America made the following statement in his keynote address at the Marine Technology Society's fourth annual conference held on July 8, 1968, at Washington, D.C.

> "The exploration of space, at least for many decades to come, will remain something for those chosen few who can fill an astronaut's boots. The admission charge is much too high for the rest of us to see the show up there in person. So we'll have to be content to watch it on our television screens.
>
> Oceanography, on the other hand, offers just the opposite to the young man starting out on a career. If he can't afford an orchestra seat, he can buy a seat in the balcony. The world ocean - all 300 million cubic miles of it -- is there for him to sample. And he doesn't have to dive 10,000 feet beneath the surface of the water to get his feet wet. He can see it, and hear it, and smell it, and touch it, and learn some of its countless secrets without mounting a multi-million dollar spacecraft."

* Two-Year Programs in Other Institutions Offering Training of Marine Science Technicians (Reported by American Association of Junior Colleges 1968)

1. College of Redwoods, Redwood, California
2. The College of Marin, Kentfield, California
3. Santa Barbara City College, Santa Barbara, California
4. Los Angeles Trade-Technical College, Los Angeles, California
5. Fullerton Junior College, Fullerton, California
6. Orange Coast College, Newport Beach, California
7. San Diego City College, San Diego, California
8. Southwestern College, San Diego, California
9. Clatsop Community College, Astoria, Oregon
10. Peninsula College, Port Angeles, Washington
11. Shoreline Community College, Seattle, Washington
12. University of Rhode Island, Kingston, Rhode Island
13. Suffolk Community College, Seldon, Long Island, New York
14. Cape Fear Technical Institute, Wilmington, North Carolina
15. Miami-Dade Junior College, Miami, Florida

Existing Faculty Involved in Marine Science Technology Program at S.M.V.T.I.

Arlander, Richard P. - Instructor B.S., U.S. Coast Guard Academy	Marine Engineering
Banerjee, Tapan - Coordinator B.S., University of Calcutta; M.S., University of the Pacific	Marine Biology and Oceanography
Baillargeon, Roland - Instructor B.S., University of Maine; M.S., Gorham State College	Mathematics and Blueprint reading
Caswell, Mrs. Frances P. - Instructor B.A., University of Maine; M.A., University of Michigan	English and Sociology
Cobb, Elmer W. - Instructor B.S., University of Maine	English and Social Sciences
Cook, William H. - Instructor B.S., Maine Maritime Academy; B.A., University of Maine	Physics
Colpitts, Lawrence H. - Captain B.S., Gorham Teachers College Unlimited Masters license	Captain of the Vessels
Eayrs, Weston - Instructor B.S., University of Massachusetts	Marine Biology and Oceanography
Hall, Charles M. - Instructor B.S., Maine Maritime Academy	Seamanship and Navigation
Hupper, George W. - Instructor U.S. Navy Institute; U.S. Coast Guard Institute	Seamanship and Navigation
Knowles, George B. - Instructor B.S. University of Maine	Mathematics

*There are other institutions offering marine science technicians training, but we have not listed them, as we do not have their addresses.

Lomoriello, Luigi S. - Mate B.S., Maine Maritime Academy	First Mate of the Vessels
Marcotte, Roland G. - Chairman, Science Department; B.S. Bates College	Physics
Morong, Frank S. - Instructor B.S., Gorham State College M.S., Gorham State College	Economics - Political Science
Reckitt, Lois G. - Instructor A.B., Brandeis University; M.A., Boston University	Marine Biology and Oceanography
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Student Activities in Marine Science Technicians Program at S.M.V.T.I.

Figure 1
The Training Vessel Aqualab

Figure 2
Student Navigational Training

Figure 3
Marine Engineering Lab.

Figure 4
Shipboard Engineering Training

Figure 5
Casting Nansen Bottle for Water Sample

Figure 6
Deck Handling Practice

Figure 7
Bottom Sampling with Orange Peel

Figure 8
Dredge Sample

Figure 9
Towing Trawl Net

Figure 10
Casting a Gill Net

Figure 11
Research Vessel Phykos

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