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AUTHOR Heinkel, Otto A.; Tepedino, Francis J.
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ABSTRACT

This study was a direct response to a 1970 resolution by the California Community College Board of Governors that all community college districts refrain from implementing any new programs in the area of specialized training for marine technicians until the success of existing programs could be evaluated. A needs assessment survey was conducted to measure the gap between marine technology education and the related market. Present training requirements for marine technology were established, and a needs assessment model resulted. Results of the study showed: (1) marine technology instructors have fallen behind in their perceptions of the skills required by marine technicians and those skills found to be necessary in actual job situations; (2) the term "marine technician" is not understood by industry; (3) existing occupations programs can be augmented to serve marine technology requirements with the specific addition of a unit on marine applications; (4) continuing liaison between educational institutions and industry should be maintained; (5) subject matter, instructional methods, and length of course should be adapted to student/job requirements; (6) students should be told of job scarcity, alternative job choices, and the advantages of acquiring general skills that are applicable to particular marine jobs; and (7) counseling in the colleges should be strengthened to inform students of limited job openings, and to urge marine technology students to consider alternative jobs.
(Author/DB)

SAN DIEGO
COMMUNITY
COLLEGES

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RESEARCH

AN ASSESSMENT OF THE MARINE INDUSTRY AND MARINE TECHNOLOGY PROGRAMS IN COMMUNITY COLLEGES IN SAN DIEGO COUNTY

by

PROJECT DIRECTOR
Otto A. Heinkel

PRINCIPAL INVESTIGATOR
Francis J. Tepedino

Final Project Report

1972

835 TWELFTH AVENUE
SAN DIEGO,
CALIFORNIA 92101
(714) 236-1331

REPORT #73.2

OFFICE

Otto A. Heinkel, Director
Dean G. Klampe, Assistant

ABSTRACT

AN ASSESSMENT OF THE MARINE INDUSTRY AND MARINE TECHNOLOGY PROGRAMS IN COMMUNITY COLLEGES IN SAN DIEGO COUNTY

This study was a direct response to a 1970 resolution by the California Community College Board of Governors that all community college districts refrain from implementing any new programs in the area of specialized training for marine technicians until the success of existing programs could be evaluated.

A Needs Assessment Survey, a systematic method for measuring and prioritizing any and all gaps (needs) that exist between current outcomes and desired accomplishments, was conducted to measure the gap between Marine Technology education and the related job market. Under the direction of Dr. Otto A. Heinkel, Director of Research for the San Diego Community College District, the Needs Assessment survey explored discrepancies between industry's skill requirements for ocean-related jobs and those skills being taught in local community colleges. Present training requirements for Marine Technology programs were established and a Needs Assessment model resulted which may be applied for assessing future Marine Technology programs.

The study supported the premise that, in providing the most meaningful kind of training for students, educators should consider carefully revamping the traditional school semester in favor of a more custom-designed system for the occupational student. That is to say, if a person's specific intent is to obtain a particular employment, then Occupational Education should prepare him for that job in the most efficient manner possible. The study also revealed a decided shortage of ocean-related jobs in contrast to the number of students enrolled in Marine Technology programs. Furthermore, evidence exposed definite discrepancies in the kinds of skills community colleges were teaching and those skills required by ocean-related industries. There was evidence to support the following:

- Marine Technology instructors have fallen behind regarding their perceptions of the skills required by marine technicians and those skills found to be necessary in actual job situations.
- The term marine technician is not understood by industry and a more meaningful term should be employed.
- Existing occupational programs such as electronics, drafting, and welding can be augmented to serve Marine Technology requirements with the specific addition of a unit on marine applications at little or no additional cost.
- Continuing liaison between educational institutions and industry should be maintained. Job market and skill requirements of industry must be kept current to maintain realistic Marine Technology programs.
- Subject matter, instructional methods, (and length of course) should be adapted to student/job requirements rather than to conventional semester arrangements.
- Students should be actively appraised of job scarcity, alternative job choices, and the advantages of acquiring general skills which are applicable to particular marine jobs.
- Counseling in the colleges should be strengthened to inform students of current limited actual job openings in Marine Technology and to urge Marine Technology students to consider alternative job areas in which to apply their skills.

AN ASSESSMENT OF THE MARINE INDUSTRY AND MARINE TECHNOLOGY PROGRAMS IN COMMUNITY COLLEGES IN SAN DIEGO COUNTY

Final Project Report

Submitted by:

Otto A. Heinkel, Ph.D.
Director of Research
San Diego Community Colleges
835 Twelfth Avenue
San Diego, California 92101

1972

This research was conducted by the San Diego Community College District during the 1971-72 year in cooperation with the California Community Colleges' Chancellor's Office, Occupational Education Section. The study was performed under Title I, Part C, Sec. 131(b) of Public Law 90-576 and the CRCU Small Grant Program.

Table of Contents

FORWARD

Vocational educators have often relied on a tool which is currently evolving into a required and formal applied science called needs assessment to guide them in selecting, developing, or improving occupational programs. Through a formal needs assessment, educators discover any gaps that exist between current and desired outcomes. For example, a needs assessment could reveal discrepancies between industries' skill requirements and the skills being taught in the community college.

This volume presents initial guidelines for conducting a needs assessment in the marine technology field. Also presented are results of the application of these guidelines in San Diego County.

To Leland Baldwin, William Anderson, and William Morris of the California Community Colleges Chancellor's Office goes the credit for guiding the study design to ensure that the results would be of practical significance.

Credit for successful implementation of the study goes to the outstanding support and time given by educators, industry and other community agencies. The San Diego Chamber of Commerce and the Bissett Berman Corporation were especially helpful.

William Steinberg
Director, Vocational Education

Otto A. Heinkel
Project Director

SUMMARY

Interpretation of the study findings resulted in the following recommendations for immediate action:

1. The term *marine technician* is not understood by industry. It should be replaced with more meaningful terms.
2. Present occupational programs which were not designed for the marine fields but which are required in the marine industry should be expanded to include a unit on marine applications. This is in place of expanding marine technology programs.
3. A constant liaison between education and industry should be maintained. Job market and skill requirements of industry must be kept current to maintain a realistic marine technology program.
4. The time period should be adapted to student/industry needs, not necessarily to a traditional semester system.
5. Student placement and follow-up should be improved and maintained to strengthen counseling.
6. Counseling should urge marine technology students to consider alternative job areas in which to apply their skills.
7. Counseling in the college must be strengthened to inform the student of current limited actual job openings in marine technology.

MARINE TECHNOLOGY IN COMMUNITY COLLEGES

Bridging the gap between education and industry in marine technology to serve better the community college student has resulted from a recent survey conducted by the San Diego Community College District.

The survey followed a series of events which began in December, 1969, when the Coordinating Council for Higher Education in California adopted a resolution advising a delay of further expansion of specialized training for marine technicians until success of existing programs could be evaluated by the Board of Governors and reviewed by the council.

In February, 1970, the California Community College Board of Governors adopted a resolution that requested all Community College districts to refrain from implementing any new programs in the area of specialized training for marine technicians until success of existing programs could be evaluated. Additionally, the resolution directed the State Chancellor to evaluate existing programs and report his findings to the Board no later than June 30, 1972.

A review of all community colleges in California showed that ten colleges in eight districts offered marine technology programs. The ten colleges are:

College	Program Title	Date Program Initiated
Fullerton Junior College	Oceanographic Technology	67-68
Grossmont College	Oceanographic and Aerospace Instrumentation Technology	67-68
College of Marin	Marine Technology	69-70
Orange Coast College	Marine Technology	68-69

College	Program Title	Date Program Initiated
College of the Redwoods	Commercial Fisheries	69-70
Saddleback College	Marine Science Technology	69-70
San Diego City College	Marine Technology	67-68
San Diego Evening College	Marine Technology	67-68
San Diego Mesa College	Marine Technology	67-68
Santa Barbara City College	Marine Diving Technology	68-69

Four of the ten colleges (Grossmont, San Diego City, San Diego Mesa, and San Diego Evening Colleges) are in San Diego County.

In response to direction by the Board of Governors, the Chancellor requested the San Diego Community College District to develop an evaluation proposal. Integral to the evaluation would be the design, development, and demonstration of an evaluation model containing instrumentation and procedures. The evaluation model would then be used for a statewide evaluation of Marine Technology Programs.

In July, 1971, the San Diego Community Colleges received approval of a PL90-576, VEA68, Part C, Research Project entitled, *Evaluation Model Development for Marine Technology Programs.* The project developed and field tested an evaluation model for assessing Marine Technology Programs.

This report describes the evaluation model and presents results from its application in San Diego County.

Substantiating data for the reported application are presented in Appendix A.

SURVEY OBJECTIVES

The model for evaluating marine technology programs was designed to:

- identify current and projected marine/marine-related job openings.
- identify programs and skills desired by marine and marine-related industries in the local area.
- provide a student evaluation of community college marine technology programs.
- identify discrepancies between industries and community colleges by comparing:
  1. Enrollment of community college marine technology students to current and projected manpower requirements of industry.
  2. Existing community college programs to programs desired by industry.
  3. Community college skill emphasis to skills desired by industry.

Data were gathered from five groups:

- Marine or marine-related industries.
- Community college administrators of marine technology programs.
- Community college instructors of marine technology courses.
- Current students completing a marine technology program in community colleges.
- Former community college students of marine technology programs.

FINDINGS

The survey results have proved highly revealing. They point out required modifications and improvement in curriculum and course planning, instructional emphasis, and counseling to provide better preparation for student employment in marine or marine-related jobs.

For purposes of the study, a marine technologist was defined as a person employed or employable in marine or marine-related industries. This person would possess a specific marine related skill and would have less than a baccalaureate degree. Ironically, the term marine technician itself is not used nor understood within industry. This would indicate that educators should replace the expression with one more meaningful to industry.

Job Availability

For 1972 a total of 126 job opportunities in marine or marine-related industries were identified for the San Diego area. Table 1 presents a breakdown of these jobs.

Industrial spokesmen said that more than half of the job openings will be filled from other than the college pool, e.g., walk-ins, servicemen, transfers from within industry and through on-the-job training. This would leave fewer than 63 job openings that can be expected to be filled from the community college pool.

In addition, industry stated that a substantial number of their openings would be filled by community college students from other than marine technology programs such as drafting, electrical, carpentry, and welding. This would leave a very small number of job opportunities (perhaps less than 25 per cent of the total job openings) that could be filled by marine technology majors.

Table 1

SAN DIEGO EMPLOYMENT MARKET FOR
MARINE AND MARINE-RELATED JOB AREAS

Job Areas	Job Openings 1972
Draftsman	15
Apprentice	10
Commercial Fisherman	10
Engine Room Assistant	10
Marine Welder	10
Mate	10
Navigator	10
Electronic Technician	9
Designer	7
Electrician	6
Carpenter	3
Instrument Technician	3
Loftsman	3
Mech. Gas/D.E.	3
Welder	3
Administrative	2
Marine Instrumentation	2
Clerical	1
Computational Analyst	1
Deck Hand	1
Estimator	1
Lab Assistant	1
Marine Electronic Technician	1
Material Control	1
Pilot/Master	1
Quality Control Technician	1
Shop Technician	1
Total	126

In contrast to the above, San Diego Community College administrators reported the following enrollments in marine technology programs:

Year	1969	1970	1971
Enrollment . . .	238	209	135

Although total enrollments are declining rapidly, the level for 1971 still suggests that there is a surplus of marine technology majors.

These findings are substantiated by statistics from the former students. They point out that less than one-third of the former students of marine technology programs are currently employed in a marine or marine-related industry.

The foregoing data indicated that establishment in the San Diego area of a costly marine institute, such as had been suggested, was not warranted. A more economical approach would be modification of present non-marine curricula to include marine-oriented instruction--a modification that would be adequate in training the number of persons who will likely find job openings in marine-oriented fields.

Industry representatives frequently repeated, *we want welders and carpenters and mechanics who know what particular requirements are necessary to apply those skills in a marine area.* Therefore, the apparent message is that instead of expanding marine technology programs, current occupational programs should be expanded to include a unit on marine application of that particular occupation.

Skill Areas

Additional significant findings of the study resulted from a comparison of skills considered most important for the student to possess.

Employers in marine and marine-related industries were asked to rate the essentialness of 55 skills that had been identified with these industries. Each employer rated each

listed skill on a five-point scale ranging from *essential* to *non-essential*. If an employer evidenced a reaction more positive than neutral relative to the essentialness of a skill, a positive vote was recorded for that skill. Votes were tallied, and skills were ranked in descending order.

The same skills were similarly rated by administrators of marine technology programs in community colleges, by instructors of marine technology courses in community colleges, and by students currently enrolled in marine technology courses. For each target population the votes were tallied and skills were ranked in descending order.

Subsequently, the ranked skill lists for each target population (industry, instructors, students and administrators) were partitioned into five groups. The top fifth of each list comprised the skills identified as those receiving the most emphasis by the specified population and skills were assigned a priority number of one (1). For the next one-fifth of each list a priority number of two (2) was assigned to each skill. The process was continued for the balance of the list for each target population.

The relative emphasis placed on each identified skill for marine or marine-related jobs is summarized in Table 2, according to the foregoing rating procedure. From Table 2, matches and mismatches between industry emphasis and the colleges' perception of what is regarded as *essential* are readily identified. A gap of two priority levels was regarded as a signal of a discrepancy on which educators should focus attention and take action to correct.

Table 2

PRIORITY GROUPING OF SKILLS ACCORDING TO RELATIVE IMPORTANCE AS PERCEIVED BY VARIOUS TARGET POPULATIONS

Priority Scaling: 1 = highest, 5 = lowest

Skill	Target Populations			
	Industry	Instruc.	Admin.	Students
Mathematics	1	5	1	3
Electronics	1	2	5	2
General Science or General Oceanography	1	1	1	1
Office Equipment[a]	1	5	5	5
Machine Shop	1	5	5	5
Physical Instrumentation[b]	1	2	2	1
Electricity	1	5	5	4
Maritime Safety	1	1	1	1
Engineering Drafting Graphics	1	5	5	5
Data Handling[c]	1	5	5	1
Boat Handling	1	2	2	1
Design Engineering	1	5	2	5
Diesel Technology and Repair	1	5	5	4
Welding	2	5	5	5
Publications[d]	2	1	2	2
Sea-Shore Communications[e]	2	2	2	2
Industrial Safety	2	2	2	3
Physics	2	1	2	4
Laboratory Equipment[f]	2	2	5	2
Rigging	2	5	2	3
High Pressure Testing and Environmental Testing	2	5	1	3
Seamanship	2	2	1	2

Table 2 (continued)

Skill	Target Populations			
	Industry	Instruc.	Admin.	Students
Electronic Data Processing and Equipment Operation	3	5	5	4
Hydraulics/Pneumatics	3	5	2	4
Computer Programing	3	5	5	5
Business Management	3	5	5	5
Woodworking	3	5	5	5
Scuba Diving	3	5	5	1
Shipboard Machinery Operation/Repair	3	5	5	2
Fisheries Equipment[g]	3	2	5	1
Marine Geography[h]	3	2	1	1
Navigation (piloting)	3	2	2	1
Acoustics	3	2	5	2
Marine Inspection/ Quality Control	3	5	5	3
Statistics	4	5	5	5
Optical Equipment[i]	4	2	5	1
Photography	4	2	5	4
Air Conditioning and Refrigeration	4	5	5	5
Accounting Practices	4	5	5	5
Shipfitting	4	5	5	4
Underwater Construction	4	5	2	2
Marine Estimating	4	5	5	4
Marketing	4	5	5	5
Basic Boat Building	4	5	2	3
Biology	5	1	1	1
Maritime Trade	5	5	2	4
Chemistry	5	5	5	3
Meteorology	5	1	2	3
Fishing Sciences	5	5	2	2

Table 2 (continued)

Skill	Target Populations			
	Industry	Instruc.	Admin.	Students
Geology	5	1	2	2
Mining and Metallurgy	5	5	5	4
Geophysics	5	5	5	3
Deep Diving Physics and Physiology	5	5	5	3
Hard Hat Diving	5	5	5	3
Business Law	5	5	5	5

[a]Typewriter, calculator, slide rule, copier

[b]Equipment used by the oceanographer, marine scientist, physicist, geologist, meteorologist, biologist

[c]Processing field and laboratory data for computer analysis

[d]Basic references, catalogs, indices

[e]Radio telephone

[f]Glassware, balance, sensors

[g]Nets, winches, processing

[h]Topography, resources, conservation

[i]Transit, sextant, microscope, theodolite

The table indicates that instructors should increase emphasis in the following areas:

Mathematics
Electricity
Office Equipment
Machine Shop
Design Engineering
Engineering Drafting Graphics
Data Handling
Diesel Technology and Repair

Conversely, instructors should reduce emphasis in the following areas:

Biology
Optical Equipment
Photography
Geology
Meteorology

Both industry and educators were in accord relative to the remaining skill areas.

Detailed data from the San Diego survey are presented in Appendix A.

Implications for Counseling

Students should be made aware of the limited actual job openings in the marine technology field. Counseling should be strengthened in this regard.

Marine technology students should be counseled also to choose an alternative area in which to apply their skills in case a job in marine technology is unavailable upon completion of the program. Also, students in other occupational fields should be made aware that their skills could be applied in a marine-oriented job.

Improvement of placement and follow-up practices is required to assure that community college programs reflect the manpower and skill needs of industry.

FUTURE MARINE EDUCATION

In providing the most meaningful kind of training for students, educators should consider carefully revamping the traditional school semester system in favor of a more custom-designed system for the vocational student.

A program should be designed to deemphasize activities that are not necessary toward obtaining a job. If a student can get in six weeks the skills he requires for handling a job, it is unnecessary to prolong the course to fit into a traditional semester.

If a person's intent is to get a job, then education should get him ready to obtain that job. Program skills required by the objective of the student and the requirements of the employer should be the prime considerations. Time and courses should be adapted to these. Naturally there is a danger that a student may be walking into a terminal job so, at the same time, he must be counseled to keep in mind requirements for continued education.

Through counseling, the number of students entering a marine technology program should reflect the actual job market. This requires a close community liaison between industry and education.

Under present job market needs the survey results show that students interested in marine fields should obtain training in an occupational field that is utilized by the marine industry. This field coupled with marine technology orientation would increase the likelihood of successful employment by providing alternative career possibilities.

Those students who plan a career in the marine field should receive exposure to the physical job conditions to determine that no major incompatibilities exist. Individuals with a tendency toward motion sickness, for example, would be a serious liability at sea.

Since marine industry employers prefer community college training for their employees and prefer hiring from the community colleges (see Appendix A), this positive relationship should be maintained. The excellent support of community colleges by industry furnishes an educational partnership that ensures meaningful, effective education for community college students.

Since it is necessary to assure the Community College's continued responsiveness to marine technology requirements, it is strongly recommended that a continuous, formal needs assessment be conducted to show the existing and predicted gaps (needs) between current skills available and required skills and abilities that should be available in marine technology. This study should not be a *one-shot* affair, since it only reflects the current picture--the world can and probably will change.

MODEL FOR EVALUATING MARINE TECHNOLOGY PROGRAMS

The research project in its entirety from the writing of the first question to the evaluation of information offers a pattern which can be followed in the evaluation of marine technology programs whenever desired.

In addition, its basic pattern is easily adaptable to assessments of other college occupational programs and a must if occupational education is to continue to reflect real, documented needs of the community.

The model for evaluating marine technology programs was designed to identify current and projected marine and marine-related job openings as well as the programs and skills desired by marine and marine-related industries in the local area. It was to give the student an opportunity to evaluate the community college marine technology programs. And finally it was to identify discrepancies between industries and community colleges by comparing (1) enrollment of community college marine technology students to current and projected manpower requirements of industry, (2) existing community college programs to programs desired by industry, and (3) community college skill emphasis to skills desired by industry.

The model consisted principally of questionnaires that were individually designed to gather data from each of the five target groups concerned with marine technology education--marine or marine-related industries, community college instructors of marine technology courses, current students completing a marine technology program in community colleges and former community college students of marine technology programs.

Following is a summary of major outcomes from application of the questionnaires:

Industry Questionnaire

1. Type of business or industry.
2. Employment levels including:
   a. Total employment.
   b. Number of marine/marine related technicians.
   c. Past, current, and future employment levels for marine/marine related jobs.
3. Current and predicted specific job openings (indicating skill requirements).
4. Sources of training of current marine personnel, together with desired training sources.
5. Sources of employees, together with desired sources.
6. Desired employee skill and knowledge.

Administrator Questionnaire

1. Descriptive list of marine technology programs including:
   a. Program title.
   b. Program objectives.
   c. First year of operation for each program required units for a certificate or degree.
   d. Enrollment patterns for most recent three year period.
2. Desired student skills and knowledge.
3. List of former students (including address and telephone number) for follow-up questionnaire.

Instructor Questionnaire

1. Descriptive list of marine technology courses including:
   a. Course title.
   b. Course objectives.
   c. First year of operation for each course.
   d. Enrollment patterns for most recent three year period.
2. Desired student skills and knowledge.

Current Student Questionnaire

1. Perceptions of adequacy of marine technology training for obtaining employment.
2. Perceptions relative to employment likelihood.
3. Desired student skills and knowledge.

Former Student Questionnaire

1. Education status including:
   a. Total units completed.
   b. Name of institution if continuing their education.
2. Employment status including (if employed):
   a. Type of employment (marine? marine related?).
   b. Job title.
   c. Weekly hours.
   d. Weekly salary.
   e. Employer's name, address and phone number.
3. Perceptions of adequacy of marine technology training for marine or marine-related job.
4. Suggested program modification.

The questionnaires that were used are presented in Appendix B. They were developed with the assistance of representatives from industry and educators. For replication of the evaluation it is recommended that the evaluator establish working committees with participants from marine industries and with educators dealing with marine technology training. The working committees would review the questionnaires in detail and make suggestions for improvement prior to questionnaire duplication for conducting an evaluation. Involvement of industry and educators at this point in the evaluation process is designed to insure credibility of the questionnaires and to establish preliminary communication links between the evaluator and the groups with whom he will be dealing.

Following, in outline format, are the steps to be followed in conducting the surveys required as part of the evaluation:

Industry Survey

- Identify the companies in the local college or college district area that are engaged in marine or marine-related activities. Sources for this identification would probably include:
  local Chamber of Commerce,
  local office of the Department of Labor,
  local professional societies,
  local labor unions,
  local business federations,
  local telephone directories.
- List the companies together with address, telephone number and president's name.
- Send a letter with a sample Industry Questionnaire to each company president to inform him of the evaluation that is planned and to request his cooperation.
- Follow up the letters with telephone calls for appointments with the president or his designee to conduct interviews toward completion of the questionnaires.
- Conduct interviews with the designated representative of each company and complete the Industry Questionnaires.
- Compile industry data and store for analysis.

Administrator and Instructor Survey

- Send a letter to the college president(s) to announce the evaluation and solicit the college's cooperation.
- Follow up the letter with telephone contacts to arrange a meeting with the president and administrators and instructors who are associated with marine technology education.
- Meet with each college president and his designated administrators and instructors. Explain the questionnaires and leave copies with them. Arrange for completed questionnaires to be returned to evaluator within two weeks.

- Compile administrator and instructor data and store for analysis.

Current Student Survey

- Administer the Current Student Questionnaire to the students enrolled in the last marine technology course as indicated in the catalog sequence. A member of the evaluator's staff should perform this function to minimize possible bias influences that may be otherwise introduced.
- Compile current student data and store for analysis.

Former Student Survey (students who were enrolled within the past 3 year period)

- Train telephone interviewers as to how the Former Student Questionnaire should be completed and how to conduct the interviews.
- Conduct telephone survey.
- Compile former student data and store for analysis.

A suggested time table for conducting the evaluation is given below. Time allowances are based on field test experience and are considered to be realistic for replication of the model.

TIME REQUIREMENTS

The time requirements for this study are minimal for all participants with the exception of the Project Investigator. The estimated time requirements are exclusive of secretarial and clerical assistance.

	Planning	Data Gathering	Data Analysis	*Action Planing
Project Investigator	30 days	50 days	15 days	60 days
College Administrator	3 days	5 days	2 days	6 days
Each College Instructor	1 day	2 hrs.	---	10 days
Each Student (present)	---	15 min.	---	2 days
Each Student (former)	---	5 min.	---	2 days
Each Community Agent	2 hrs.	2 hrs.	---	1 day
Each Employer	2 hrs.	2 hrs.	---	4 hrs.
Each Advisory Committee Member	2 days	---	---	2 days
Each Working Committee Member	5 days	---	---	2 days

*Exclusive of implementing and evaluating "new" program.

Appendix A

STUDY DATA

Application of the survey questionnaires in the San Diego area provided the following data for the various target groups:

Industry

This target group consisted of 110 marine and marine related industries and employers in the San Diego County area. Each was contacted by letter (see Appendix C for sample of letter).

A total of 104 firms responded: 64 firms responded substantively by providing the requested detailed information, and 40 firms returned incomplete questionnaires or responded non-substantively with reactions such as:

> *Although we are in the marine business, we don't employ marine technicians or similar technicians; or we no longer are in a marine or marine related business.*

As a consequence, totals of responses on various questions will not always agree.

In response to the question *What is your present total employment level (including staff, secretaries, etc.)* the following results were obtained:

Total Employees	Number of Firms
1-10	9
11-25	20
26-50	12
51-100	7
101-200	6
201-300	2
301-500	4
over 500	7
Total	67

Responses from 104 firms to the request *Please indicate below your past, current, and future employment levels for marine or marine related jobs* are summarized below.

Year	Number of Employees
1969	2162
1970	2806
1971	2313
1972	2254
1973	2363 (Estimate)
1976	2694 (Estimate)

Twenty-seven specific job titles were reported by the San Diego employers representing a total of 126 identified job openings in 1972. They were identified in Table 1. For 1973 an aggregate total of 314 job openings were projected, however, specific jobs were not identified.

Relative to positions requiring skilled marine related personnel, firms were asked *Where should training be acquired.* They were allowed to check up to 3 sources. Following is a summary of responses:

Employee Training Source	Where Training Should Be Acquired (Check up to 3 Sources)
Four-year college/university	14
Junior college (community college)	46
In-house (on-the-job) company training program	30
Military service (schools)	14
High school	2
Labor union schools	1
Others	6

Considering the acquisition of skilled marine related personnel, firms were asked *Where do you feel you should obtain them.* They were allowed to check up to 3 sources. Following is a summary of responses:

Employee Training Source	Where Training Should be Acquired (Check up to 3 Sources)
Four-year college/university	8
Junior college (community college)	32
In-house (on-the-job) company training program	18
Military service (schools)	11
High school	2
Labor union schools	0
Others	23

Administrators

The next target group was community college administrators for marine technology programs. Two were identified in the San Diego area. They reported the following enrollments in marine technology programs:

Year	1969	1970	1971
Enrollment	238	209	135

These administrators also provided the names, addresses and telephone numbers of 31 graduates and former students of marine technology programs.

Instructors

There were 3 instructors of marine technology courses identified in the San Diego area. They reported the following information concerning courses offered and course enrollments:

Marine Technician Training Course Titles and Enrollments

Course Title	Year Course Was Initiated	1969		1970		1971	
		N_1	N_2	N_1	N_2	N_1	N_2
Marine Equipment	1972	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
Introduc. Oceanography	1967	93	109	140	95	92	88
Oceanography Lab	1967	26	23	N.A.	23	33	N.A.
Marine Industrial Operations	1968	N.A.	21	N.A.	27	N.A.	N.A.
Equipment Operations	1969	36	N.A.	N.A.	N.A.	N.A.	N.A.
Marine Resources	1969	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
Marine Communications	1970	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
Seamanship/Engineering	1970	N.A.	14	N.A.	N.A.	N.A.	N.A.

Legend: N_1 = Number of students enrolled in course at beginning of school year (census day, fall semester).

N_2 = Number of students enrolled in course at end of school year (June).

Current Students

This target group consisted of current students enrolled in the last course of the marine technology program and totaled 39.

In response to the question *Do you feel that the Community College Marine Technology Training Program prepared you adequately for a marine or marine related job* the following replies were obtained:

Reply	Number	Per Cent
Yes	13	33
No	23	59

When asked *How do you perceive your chances of employment in a marine or marine related industry upon completion of your marine program*, only 8 (21%) indicated a positive feeling.

Former Students

The thirty-one graduates and former students of the San Diego Community Colleges Marine Technology Program were identified for the final target group. Sixteen (52%) of these were located and offered the following responses to the telephone interviewer:

Question	Response		
	Yes	No	None
Are you continuing education?	7	9	
Are you employed?	10	6	
Is employment in a marine/marine related industry?	4	6	6
Are you actively seeking employment?	5	5	6
Did Community College Marine Technology Training Program prepare you adequately for a marine or marine related job?	13	3	

Essentiality of Skills

Perceptions of essential skills were determined for each of the foregoing target groups with the exception of former students. Questionnaires containe a list of 55 skills that had been identified with marine and marine related industries. Each respondent rated each listed skill on a five-point scale ranging from *essential* to *non-essential*. If a respondent evidenced a reaction more positive than neutral relative to the essentialness of a skill, a positive vote was recorded for that skill. Votes were tallied, and skills were ranked in descending order. Results are presented in Table 3.

Table 3

SKILL PRIORITIES

Essential skills for a marine/marine related job are listed in order of selection by each target population. The number following the skill title is the absolute number of times the skill was selected by that target group.

RANK	Target Group/Number of Respondents			
	Industry/64	Instructors/3	Administrators/2	Current Students/39
1	Mathematics 45	General Science or General Oceanography 3 Maritime Safety 3	General Science or General Oceanography 2 Biology 2 Marine Geography 2 Maritime Safety 2 High Pressure Testing and Environmental Testing 2 Seamanship 2	Physical Instrumentation 38
2	Electronics 43			Marine Geography 35
3	General Science or General Oceanography 38	Physics 2 Biology 2 Geology 2 Meteorology 2 Publications (basic references, catalogs, indices) 2		Fisheries Equipment 34

Table 3 (continued)

SKILL PRIORITIES

RANK	Target Group/Number of Respondents			
	Industry/64	Instructors/3	Administrators/2	Current Students/39
4	Office Equipment 36 Machine Shop 36			Scuba Diving 32 Boat Handling 32
6	Physical Instrumentation 34			General Science or General Oceanography 31 Optical Equipment 31 Biology 31 Data Handling 31 Navigation 31 Maritime Safety 31
7	Electricity 30			

Table 3 (continued)

SKILL PRIORITIES

RANK	Target Group/Number of Respondents			
	Industry/64	Instructors/3	Administrators/2	Current Students/39
8	Maritime Safety 28 Engineering Drafting Graphics 28	Laboratory Equipment 1 Optical Equipment 1 Electronics 1 Photography 1 Physical Instrumentation 1 Fisheries Equipment 1 Boat Handling 1 Marine Geography 1 Navigation (piloting) 1 Sea-Shore Communications 1 Industrial Safety 1 Acoustics 1 Seamanship 1	Physics 1 Geology 1 Meteorology 1 Physical Instrumentation 1 Publications 1 Fishing Sciences 1 Boat Handling 1 Navigation (piloting) 1 Sea-Shore Communications 1 Industrial Safety 1 Rigging 1 Underwater Construction 1 Design Engineering 1 Maritime Trade 1 Basic Boat Handling 1 Hydraulics/Pneumatics 1	
10	Data Handling 26 Boat Handling 26 Design Engineering 26 Diesel Technology and Repair 26			

Table 3 (continued)

SKILL PRIORITIES

RANK	Target Group/Number of Respondents			
	Industry/64	Instructors/3	Administrators/2	Current Students/39
12				Electronics 30 Fishing Sciences 30
14	Welding 25 Publications 25 Sea-Shore Communications 25 Industrial Safety 25			Geology 28 Publications 28 Sea-Shore Communications 28
17				Laboratory Equipment 26 Seamanship 26
18	Physics 24			
19	Laboratory Equipment 22 Rigging 22 High Pressure Testing and Environmental Testing 22 Seamanship 22			Acoustics 24 Shipboard Machinery Operation/Repair 24
21				Underwater Construction 23

Table 3 (continued)

SKILL PRIORITIES

RANK	Target Group/Number of Respondents			
	Industry/64	Instructors/3	Administrators/2	Current Students/39
22				Chemistry 22 Rigging 22 Deep Diving Physics and Physiology 22
23	Electronic Data Processing and Equipment Operation 21 Hydraulics/ Pneumatics 21 Computer Programing 21			
25				Meteorology 21 Mathematics 21 Basic Boat Building 21
26	Business Management 20			
27	Woodworking 19 Scuba Diving 19 Shipboard Machinery Operation/Repair 19			

Table 3 (continued)

SKILL PRIORITIES

RANK	Target Group/Number of Respondents			
	Industry/64	Instructors/3	Administrators/2	Current Students/39
28				Geophysics 20 High Pressure Testing and Environmental Testing 20 Marine Inspection/ Quality Control 20
31	Fisheries Equipment (nets, winches, processing) 18 Marine Geography 18 Navigation (piloting) 18 Acoustics 18 Marine Inspection/ Quality Control 18			Industrial Safety 19 Hard Hat Diving 19
33				Electricity 18 Electronic Data Processing and Equipment Operation 18
35				Maritime Trade 17 Hydraulics/Pneumatics 17

Table 3 (continued)

SKILL PRIORITIES

RANK	Target Group/Number of Respondents			
	Industry/64	Instructors/3	Administrators/2	Current Students/39
36	Statistics 17			
37	Optical Equipment 16 Photography 16			Photography 16 Shipfitting 16
39	Air Conditioning and Refrigeration 15 Accounting Practices 15			Physics 15
40				Diesel Technology and Repair 14 Mining and Metallurgy 14 Marine Estimating 14
42	Underwater Construction 14 Marine Estimating 14			
43				Design Engineering 13

Table 3 (continued)

SKILL PRIORITIES

RANK	Target Group/Number of Respondents			
	Industry/64	Instructors/3	Administrators/2	Current Students/39
44	Marketing 13 Basic Boat Building 13			Machine Shop 12 Welding 12 Engineering Drafting Graphics 12 Statistics 12
46	Biology 12			
47	Maritime Trade 11			
48	Chemistry 10 Meteorology 10 Fishing Sciences 10			Office Equipment 9 Business Management 9
50				Air Conditioning and Refrigeration 7 Computer Programing 7
51	Geology 9			
52	Mining and Metallurgy 8			Woodworking 6

Table 3 (continued)

SKILL PRIORITIES

RANK	Target Group/Number of Respondents			
	Industry/64	Instructors/3	Administrators/2	Current Students/39
53	Geophysics 7 Deep Diving Physics and Physiology 7			Accounting Practices 5 Business Law 5 Marketing 5
55	Hard Hat Diving 6 Business Law 6			

INDUSTRY COMMENTS TOWARD
IMPROVEMENT OF COMMUNITY COLLEGE PROGRAMS

When asked to *Please indicate the type(s) of training program(s) you would like to see instituted in the community colleges to create the kind of skilled manpower pool your organization requires,* industries made the following replies:

1. Merchant Marine academies; train different types of individuals--not suited for hard labor on fishing boats.

2. Unless and until the Federal Government releases funds for marine research, there won't be much growth. Grossmont has one of the best community college programs in Electronic Tech. Feel that any Techs needed would come from this source since course is intensive enough.

3. Graduates from a program like the current SDCC program would be welcome. In-house training would be simplified. This company's operations call for contract labor, frequently with spotty excellence.

4. The supply for workers is ample and no knowledge of marine work is needed. Divers are not desired nor needed because of the products that are handled. Owners have requisite experience and need no assistants except in the long run for someone with inventory skill and knowledge of the company's products.

5. Theory from community college is good but industry should have program to rate each student on work/study program--serve as quality control check on both student and education plus quality control check on industry.

6. Company needs have best been met by in-house training primarily in related geophysical survey firms. Good results have been had from a local private technical training firm. Some employees have been with firm for 15 years and have an intimate association that cannot be gained in school. A community college should and could provide the basic foundation in terms of broad exposure to oceanographic equipment -- (a) assembly, and (b) operation of units.

7. Park employees need a broad foundation in coastal environments including local history, resident plants and animals, and mass education practices. A community college program could be an ideal way to provide the kind of applicants needed. Present policy calls for using senior college undergraduates for temporary employment throughout the year.

8. Always a need for diesel mechanics, and good machinists.

9. Staff is principally professional -- B.S./E.E. -- and 3 to 5 years of direct experience.

10. Marine sciences including mechanical and electronic engineering disciplines coupled with ample practical experience.

11. Salesmanship is emphasized and a knowledge of the sea (as gained in college) is secondary. There is no lack of supply of sports-oriented enthusiasts to work in the firm. A knowledge of marketing is the most valuable asset for the retail operation; the owners all are very highly trained in marine matters and need no replacements.

18. Basic boat/ship design --

19. A course related to international commerce, its world-wide importance and need for understanding why trade should be a two-way street.

20. Little or no requirement for marine technology -- lean more toward hardware design and manufacturing.

21. ITT now sending people to Mesa/Southwestern, etc.

22. A 2-year graduate is a preferred type of applicant with as broad an education as possible to have. An applicant should have had as wide a range as possible and have above-the-ordinary adaptability for small engineering firm employment. The college should attempt to create this type of person. The college program at Mesa and City in all programs should have many more lab and shop hours than at present they do have. Community college graduates need to have: (1) command of language, especially in writing; (2) exposure to math; (3) shop practices skills; (4) General Education. Specialization in any field is not preferred.

23. This firm is engaged in selling and, next in importance, fabrication of units and instruments. Marketing and shop training are two important programs.

24. General science background with lab skills. Chemical engineering type. Likes to scuba dive, he's ok.

12. People do the job here who are well-founded in selling procedures as well as diving. Academically-trained people who can sell, those who can design equipment, and who are water-sports minded are the best kind of employees.

13. Marine electrical and electronics, maintenance and repair of electronics test instruments; computer repair and trouble-shooting; instrument repair of digital systems; marketing of Marine instruments; physical oceanography and operations, including at-sea operations.

14. Small companies need technicians with very wide and diversified exposure. This company trains in-house because its needs are for a multitude of assistance-level tasks. A technician lacks judgement that a person with a degree (A.B.) can exercise, so field-type training is important. A startling growth in large environmental companies (20-30 employees) will take place in San Diego within 3 years that will call for increased need for technicians.

15. Indentured apprenticeship -- work/study program would be most useful to all parties for marine electrical/electronics program.

16. Not in marine area but generally could use common skills of technical support training.

17. College program should stress basic education in all sciences (physics, math, geography, chemistry) as well as general education. A great deal of practical shop experience is needed to illustrate fundamentals -- training is to be done by employer. Training by Mesa College with 2 present technicians was very poor primarily because of being out-of-date. Instructors should have current employment, use new equipment, and read current technical journals. Military training is worse than college training.

25. Electronic technician, general marine work using oceanographic instruments. Some work/study exposure would be helpful for student/school.

26. Should have combination work/study type program to make for understanding of trade.

27. Marine data handling with conventional office equipment. Oceanography, science and engineering programs that cover exposure to current and projected programs.

28. Because our facility has a low manpower level and a high technical level of requirements, personnel are expected to possess a considerable level of skill in their specialty. People with this skill level, regardless of where they got their basic training, have several years of active, directly related experience. For this reason, our hiring of 2-year trained technicians would be limited.

29. Community college-trained persons will be ideal but will be selected after temporary positions for 4-year graduates are filled. Special needs will be called for with contracts and these needs should and probably will be built into community college program. A 2-year college program should have instruction, without exception, in: lab equipment; marine instrumentation; geography; maritime safety; drafting; elementary statistics; basic seamanship; boat and ship structure and fittings; office equipment operation; and technical writing.

30. Most people in industry are older. Diver: Certified scuba course; 100 hours/Underwater commercial diving; shallow water mask; 3 years experience, diving/top side; written exam diving physics, etc. Tender: 2 years experience; diving machinery; maintain diving equipment; written exam; small boat handling/maintenance.

31. At San Diego station generally no entry level positions open for community college graduates.

32. Vocational training to equip high school graduates with skills to obtain jobs in the shipbuilding industry without need for post-high school training. Students should reach a reasonable level of competence in one of these fields: Welding, pipefitting, shipfitting, carpentry, marine drafting, electrical wiring and generation, shipboard machinery operation and/or repair. In addition to students with the foregoing skills, some graduates must be trained in clerical and data processing skills. Except for typing, most high school students are now graduated with no occupational skills.

33. A diver who has graduated from a junior college program and who has writing skills in R & D and technical areas would be an ideally trained employee.

34. Arithmetic, measuring, use of hand tools, basic skills needed. Work habits, hours, attitude, dress standards and safety.

35. Office-level assistance can be provided by people who can read and correct abstracting copy and galley proofs. These people should know how to use office equipment and be conversant with the general aspects of marine science, ocean engineering, and marine programs.

36. College students show a woeful lack of practical aspects of selling and business management. Role-playing used extensively in his firm for staff training. College programs need to show over-all picture of marine jobs, engineering, use of resources and typical programs.

37. Training in modern cargo handling facilities, e.g., container crane facilities. Inventory control methods for cargo.

38. Junior college trying to teach too many little things in too short a period of time. For our needs, teach and specialize in electronics. (Electronic technician start at $728/mo., A.S.; Marine Technician start at $644/mo., needs B.S.). Oceanography over-sold some time ago -- we will teach what he needs to know in oceanography -- he needs basics.

39. Broad-base training in marine geography, sales, practical psychology, nursing, equipment use and care. In-house training for details.

40. Applicants do well to have good wood and machine model (pro-type work) experience from engineering or scientific environments. Oddly enough, in-shore piloting, boat handling, and fisheries background is a current requirement that will be continually needed. A broad, general background in all phases of ocean engineering is desired -- they will train their workers in the details.

41. Statistics knowledge is essential.

42. Unfortunately, the civil service requirements for marine technicians cannot be met by the community college system. Our research vessels are crewed by regular coast guard licensed personnel.

43. Program should have heavy emphasis on math, physical and natural sciences, shop skills, (diesel, gasoline, welding, etc.) electronics, and simple computer manipulation.

44. Basic courses in math (then trig.), physics, english, general science, drafting, data handling techniques, and electives in biology or geology/geophysics.

45. A basic requirement is that applicants have a broad and general knowledge of science, math, and writing in academic skills, and a broad exposure to vocational arts of marine instrumentation and gear operation.

46. Great difficulty in communication between need in industry and output of college. Can't use graduates of these marine technology programs.

47. Merchant Marine academies don't supply type of individuals needed -- too sophisticated. Need people -- Class-Mates/ Class-Engineers -- 12 - 15 - 18 Class/Semester.

48. Basic mechanic must know blueprint; call-outs; scales; circuit diagram assembly planning sheets, in addition to basic hand skills. Junior college people seem to be able to handle (even J.C. drop-outs). Don't need many 4-year college graduates; 2 years with skill training is what is required.

49. Basic sciences, engineering, chemistry, etc. Some experience coupled with manual skills. Schools have missed the boat -- can't use "Marine Technician" -- community college program is a loser -- but industrial arts seems to be OK.

50. Four marine technicians from San Diego Community Colleges. Think that program should emphasize care and feeding of electronics and instrumentation of hardware in sea environment, to operate on own to support scientists. Ability to handle data from various sources.

Appendix B

Questionnaires

This Appendix presents the recommended questionnaires that resulted from field-test development in the San Diego area. The titles together with the reference pages are presented below for the reader's convenience.

1. Industry Questionnaire
   (Administered to industrial organizations)

2. Administrators Questionnaire
   (Administered to college administrators)

3. Instructors Questionnaire
   (Administered to college instructors)

4. Program Improvement Guide
   (Administered to current students)

5. Marine Technician Follow-Up Survey
   (Administered to former students)

INDUSTRY QUESTIONNAIRE

February, 1972

PURPOSE

The purposes of this evaluation are to: (1) Obtain information regarding current and future employment opportunities for marine technicians and skilled marine related workers in California; (2) Determine whether the current training programs in California Community Colleges are in consonance with these opportunities, both qualitatively and quantitatively; and (3) Recommend changes in existing community college programs or implementation of new programs to satisfy the identified needs.

1. What is your present total employment level (including staff, secretaries, etc.)?

1-10	11-25	26-50	51-100	101-200	201-300	301-500	over 500

The following questions deal with employees who may be classified as "marine technicians" or "marine-skilled" individuals employed in marine or marine related fields. Such employees would possess a specific marine related skill and would have less than four years of college training. For example, included would be marine-oriented electrical, electronic, mechanical and structural technicians; marine welders; scientific/laboratory aides and assistants; commercial fishermen; divers; and individuals skilled in the business phase of marine transportation and business.

2. Please indicate below your past, current, and future employment levels for marine or marine related jobs.

Year	1969	1970	1971	1972	1973 (Estimate)	1976 (Estimate)
Number of Employees						

3. Please provide in summary form the following information:

What are your present job openings for these skilled individuals?

General Job Title	Type of Skills Required	No. Required 1972

What do you perceive to be your job openings for these skilled individuals for 1973?

(including openings due to attrition and turnover)

General Job Title	Type of Skills Required	No. Required 1973

4. Does your company/organization have written job descriptions for these skilled individuals?

Yes ☐ No ☐

5. Indicate by percent where your skilled marine related personnel acquired their training. Check where you feel personnel in these jobs should acquire their training.

Employee Training Source	Where Training Should Be Acquired (Check up to 3 Sources)
Four-year college/university	_____
Junior college (community college)	_____
In-house (on-the-job) company training program	_____
Military service (schools)	_____
High school	_____
Labor union schools	_____
Others (list)	
_____	_____
_____	_____

6. Indicate by percent where you obtain your skilled marine related personnel. Check where you feel you should obtain them.

Sources of Employees	Where Should be Obtained (Check up to 3 Sources)
Four-year college/university	_____
Junior college (community college)	_____
In-house (on-the-job) company training program	_____
Military service (schools)	_____
High school	_____
Labor union schools	_____
Others (list)	
_____	_____
_____	_____

7. Indicate your opinions as to the relative importance of the following skill areas for securing a job with you as a marine related skilled individual. (A check in the center indicates neutral feelings.)

	Essential					Nonessential
General Science or General Oceanography						
Physics						
Chemistry						
Biology						
Geophysics						
Geology						
Meteorology						
Office Equipment (typewriter, calculator, slide rule, copier)						
Laboratory Equipment (glassware, balance, sensors)						
Optical Equipment (transit, sextant, microscope, theodolite)						
Electronics						
Machine Shop						
Welding						
Woodworking						
Photography						
Air Conditioning and Refrigeration						
Diesel Technology and Repair						
Electricity						
Physical Instrumentation (equipment used by the oceanographer, marine scientist, physicist, geologist, meteorologist, biologist)						
Data Handling (processing field and laboratory data for computer analysis)						
Publications (basic references, catalogs, indices)						
Fishing Sciences						
Fisheries Equipment (nets, winches, processing)						
Boat Handling						
Marine Geography (topography, resources, conservation)						
Navigation (piloting)						
Sea-Shore Communications (radio telephone)						
Industrial Safety						
Maritime Safety						
Acoustics						
Electronic Data Processing and Equipment Operation						
Computer Programing						
Mining and Metallurgy						
Rigging						
Business Management						
Mathematics						

	Essential					Nonessential
High Pressure Testing and Environmental Testing						
Underwater Construction						
Design Engineering						
Engineering Drafting Graphics						
Statistics						
Hard Hat Diving						
Scuba Diving						
Deep Diving Physics and Physiology						
Accounting Practices						
Business Law						
Marketing						
Maritime Trade						
Seamanship						
Basic Boat Building						
Marine Estimating						
Hydraulics/Pneumatics						
Shipfitting						
Shipboard Machinery Operation/Repair						
Marine Inspection/Quality Control						

Others (list) _____

_____

8. Please indicate the type(s) of training program(s) you would like to see instituted in the community colleges to create the kind of skilled manpower pool your organization requires.

_____

_____

_____

_____

_____

_____

_____

_____

ADMINISTRATOR QUESTIONNAIRE

1. Purpose

This instrument will provide data on the Marine Technology Program regarding the on-going program(s) and the identification of former students of the program(s).

2. Target Population

Information for this instrument will be acquired from Marine Technology Program Administrators.

3. Method of Instrument Application

It is planned that the Program Administrators will, together with their office staff, collect the required data using available program and student files.

4. Use of the Data

The data collected will be used for summarization of the existing programs, for match/mismatch among students, instructors, administrators and industry. It will also provide persistance information and identify former students for use with Instrument Number 1.

5. Disposition of Completed Instrument

Should be identified as to college administrator; packaged and sent to the Project Investigator.

ADMINISTRATOR QUESTIONNAIRE

EVALUATION MODEL DEVELOPMENT FOR
MARINE TECHNOLOGY PROGRAMS

To be completed by Administrators in Marine Technology Programs*

Evaluation Emphasis:

A. Identification of Marine Technology Program(s)

B. Statement of Program Objectives

C. Identification of Program Skills

D. Program Enrollment and Student Persistence

E. Identification of Former Marine Technology Students

* For purposes of this instrument, "Program" means a series of courses leading to completion of requirements for job entry in the marine or marine related fields.

A. Identification of marine technology "programs" - The information will be used to develop a description of each Marine Technician Training program currently available in California Community Colleges.

Please give the title of each specific Marine Technician Training program offered by your college. (For purposes of definition, use Ed. Code, Section 200.8: a "program" is "a series of courses leading to a degree or certificate . . .") For each program, please give the following information:

1. For a <u>certificate</u> program, indicate:

   (a) the minimum number of units in courses specifically labeled "Marine Tech." (MT);

   (b) the minimum number of additional units (not MT) required for completion;

   and the total minimum units (a + b) required for completion.

2. For an Associate <u>Degree</u> program, indicate:

   (c) the minimum number of units required in "Marine Tech." courses;

   (d) the minimum number of additional (not MT) units required for the <u>degree</u>;

   and the total minimum units (e + f) required for graduation.

Program Title	Certificate Programs			Comments	Associate Degree Programs		
	a M.T. Units Required	b Non-M.T. Units Required	a + b Total Units Required		c M.T. Units Required	d Non-M.T. Major Units	e + f Total AA, AS Units
1.							
2.							
3.							
4.							
5.							

B. Program Objectives - This information will make it possible to identify and document objectives among the existing Marine Technician programs in the community colleges.

1. Do you have specific stated objectives for the Marine Technician Training program(s) in your college?

_____Yes _____No

2. If you do have specific stated objectives, please list them below for each of the Marine Technician programs. Include the specific student skills, knowledges and attitudes that are anticipated outcomes of your program(s).

Program Title: _____

Program Objectives:

Program Title: _____

Program Objectives:

(Use additional sheets as necessary)

C. Program Emphasis - This information will show how individual programs vary in emphasis to serve specific training functions.

Place an "X" in the space that best represents your judgment relating to the amount of emphasis that is given in the certificate or Associate Degree Marine Technology Program(s) for each of the following areas of knowledge or skill.

	Essential					Nonessential
General Science or General Oceanography						
Physics						
Chemistry						
Biology						
Geophysics						
Geology						
Meteorology						
Office Equipment (typewriter, calculator, slide rule, copier)						
Laboratory Equipment (glassware, balance, sensors)						
Optical Equipment (transit, sextant, microscope, theodolite)						
Electronics						
Machine Shop						
Welding						
Woodworking						
Photography						
Air Conditioning and Refrigeration						
Diesel Technology and Repair						
Electricity						
Physical Instrumentation (equipment used by the oceanographer, marine scientist, physicist, geologist, meteorologist, biologist)						
Data Handling (processing field and laboratory data for computer analysis)						
Publications (basic references, catalogs, indices)						
Fishing Sciences						
Fisheries Equipment (nets, winches, processing)						
Boat Handling						
Marine Geography (topography, resources, conservation)						
Navigation (piloting)						
Sea-Shore Communications (radio telephone)						
Industrial Safety						
Maritime Safety						
Acoustics						
Electronic Data Processing and Equipment Operation						
Computer Programing						
Mining and Metallurgy						
Rigging						
Business Management						
Mathematics						

	Essential					Nonessential
High Pressure Testing and Environmental Testing						
Underwater Construction						
Design Engineering						
Engineering Drafting Graphics						
Statistics						
Hard Hat Diving						
Scuba Diving						
Deep Diving Physics and Physiology						
Accounting Practices						
Business Law						
Marketing						
Maritime Trade						
Seamanship						
Basic Boat Building						
Marine Estimating						
Hydraulics/Pneumatics						
Shipfitting						
Shipboard Machinery Operation/Repair						
Marine Inspection/Quality Control						

Others (list) _____

_____

D. Please give title of each specific Marine Technician Training Program and provide the following:

(a) The year students were first enrolled in the Marine Technician Program.

(b) The number of students enrolled in the Program as of the census day, at the beginning of each school year (Fall Semester) for the years noted.

(c) The number of students enrolled in the Program at the completion of the school year (June) for the years noted.

Program Title	Year Students First Enrolled in Program (a)	1969 - Students Enrolled in Program		1970 - Students Enrolled in Program		1971 - Students Enrolled in Program	
		Start of Yr. Census Day (Fall Sem.) (b)	End of Yr. (June) (c)	Start of Yr. Census Day (Fall Sem.) (b)	End of Yr. (June) (c)	Start of Yr. Census Day (Fall Sem.) (b)	End of Yr. (June) (c)

E. Provide following information of former students of the Marine Technology Training Program(s) who have graduated from the Marine Technology Program, during the years 1969, 1970, and 1971.

Student Name, Address & Phone No.	Last Semester Completed in Program (e.g., Fall '69)	Did Student Graduate/ Complete Marine Tech. Program?		Comments
		Yes	No	
Name_____ Address_____ Phone No._____				
Name_____ Address_____ Phone No._____				
Name_____ Address_____ Phone No._____				
Name_____ Address_____ Phone No._____				

INSTRUCTOR QUESTIONNAIRE

1. Purpose

This instrument will provide data on on-going Marine Technology courses and student persistance as well as program emphasis.

2. Target Population

Instructors of Marine Technology courses.

3. Method of Instrument Application

Course instructors will individually, and using appropriate files, provide the requested data.

4. Use of the Data

The data will be used for summarizing existing courses and also provide an input for the match/mismatch analysis among instructors, administrators, students, and industry.

5. Disposition of Completed Instrument

Should be identified as to college, instructor, packaged and sent to the San Diego Community College District Research Office.

INSTRUCTOR QUESTIONNAIRE

EVALUATION MODEL DEVELOPMENT FOR
MARINE TECHNOLOGY COURSES

To be completed by Instructors of Marine Technology Courses

Specific anticipated outcomes:

A. Identification of course(s) and student persistence

B. Description, statement of course objectives

C. Program emphasis

A. Please give title of each specific Marine Technician Training Course and provide the following:

(a) The first year each Course was offered.

(b) The number of students enrolled in the Course as of the census day, at the beginning of each school year (Fall Semester) for the years noted.

(c) The number of students enrolled in the Course at the completion of the school year (June) for the years noted.

Course Title	First Year Each Course was Offered (a)	1969 - Students Enrolled in Course		1970 - Students Enrolled in Course		1971 - Students Enrolled in Course	
		Start of Yr. Census Day (Fall Sem.) (b)	End of Yr. (June) (c)	Start of Yr. Census Day (Fall Sem.) (b)	End of Yr. (June) (c)	Start of Yr. Census Day (Fall Sem.) (b)	End of Yr. (June) (c)

B. Course Objectives - This information will make it possible to describe specific differences in emphasis among the existing Marine Technician courses in community colleges.

1. Do you have specific stated objectives for your Marine Technician courses? _____Yes _____No

2. If you do have specific stated objectives, please list them below for each of the Marine Technician courses. Include the specific student skills, knowledges and attitudes that are anticipated outcomes of your course(s).

Course Title: _____

Course Objectives:

Course Title: _____

Course Objectives:

(Use additional sheets as necessary)

C. Program Emphasis - This information will show how individual programs vary in emphasis to serve specific training functions.

Please indicate how much emphasis in the certificate or Associate Degree training programs is given to Marine Tech. students for each of the following areas of knowledge or skill.

	Essential					Nonessential
General Science or General Oceanography						
Physics						
Chemistry						
Biology						
Geophysics						
Geology						
Meteorology						
Office Equipment (typewriter, calculator, slide rule, copier)						
Laboratory Equipment (glassware, balance, sensors)						
Optical Equipment (transit, sextant, microscope, theodolite)						
Electronics						
Machine Shop						
Welding						
Woodworking						
Photography						
Air Conditioning and Refrigeration						
Diesel Technology and Repair						
Electricity						
Physical Instrumentation (equipment used by the oceanographer, marine scientist, physicist, geologist, meteorologist, biologist)						
Data Handling (processing field and laboratory data for computer analysis)						
Publications (basic references, catalogs, indices)						
Fishing Sciences						
Fisheries Equipment (nets, winches, processing)						
Boat Handling						
Marine Geography (topography, resources, conservation)						
Navigation (piloting)						
Sea-Shore Communications (radio telephone)						
Industrial Safety						
Maritime Safety						
Acoustics						
Electronic Data Processing and Equipment Operation						
Computer Programing						
Mining and Metallurgy						
Rigging						
Business Management						
Mathematics						

	Essential					Nonessential
High Pressure Testing and Environmental Testing						
Underwater Construction						
Design Engineering						
Engineering Drafting Graphics						
Statistics						
Hard Hat Diving						
Scuba Diving						
Deep Diving Physics and Physiology						
Accounting Practices						
Business Law						
Marketing						
Maritime Trade						
Seamanship						
Basic Boat Building						
Marine Estimating						
Hydraulics/Pneumatics						
Shipfitting						
Shipboard Machinery Operation/Repair						
Marine Inspection/Quality Control						

Others (list) _____

_____

CURRENT STUDENT QUESTIONNAIRE

MARINE TECHNOLOGY
PROGRAM IMPROVEMENT GUIDE

College _____ Course Title _____ Date _____

Person administering: _____ _____
Name Title

Introduction

Dear Student:

Will you please assist us by filling out the following questionnaire?

We value your opinions and believe that the information you give will help us do a better job of meeting the needs of future students and of the community.

Your answers will be kept completely confidential and will be used only for statistical purposes.

Employment

Do you feel that the Community College Marine Technology Training Program prepared you adequately for a marine or marine related job? yes ☐ no ☐

How do you perceive your chances of employment in a marine or marine related industry upon completion of your marine program?

High:___:___:___:___:___:___:___:Low

Indicate your opinions as to the relative importance of the following skill areas for securing a job as a marine related skilled individual. (A check in the center indicates neutral feelings.)

	Essential:___:___:___:___:___:Nonessential
General Science or General Oceanography	
Physics	:___:___:___:___:___:
Chemistry	:___:___:___:___:___:
Biology	:___:___:___:___:___:
Geophysics	:___:___:___:___:___:
Geology	:___:___:___:___:___:
Meteorology	:___:___:___:___:___:
Office Equipment (typewriter, calculator, slide rule, copier)	:___:___:___:___:___:
Laboratory Equipment (glassware, balance, sensors)	:___:___:___:___:___:
Optical Equipment (transit, sextant, microscope, theodolite)	:___:___:___:___:___:
Electronics	:___:___:___:___:___:
Machine Shop	:___:___:___:___:___:
Welding	:___:___:___:___:___:
Woodworking	:___:___:___:___:___:
Photography	:___:___:___:___:___:
Air Conditioning and Refrigeration	:___:___:___:___:___:
Diesel Technology and Repair	:___:___:___:___:___:
Electricity	:___:___:___:___:___:

	Essential					Nonessential
Physical Instrumentation (equipment used by the oceanographer, marine scientist, physicist, geologist, meteorologist, biologist)						
Data Handling (processing field and laboratory data for computer analysis)						
Publications (basic references, catalogs, indices)						
Fishing Sciences						
Fisheries Equipment (nets, winches, processing)						
Boat Handling						
Marine Geography (topography, resources, conservation)						
Navigation (piloting)						
Sea-Shore Communications (radio telephone)						
Industrial Safety						
Maritime Safety						
Acoustics						
Electronic Data Processing and Equipment Operation						
Computer Programing						
Mining and Metallurgy						
Rigging						
Business Management						
Mathematics						
High Pressure Testing and Environmental Testing						
Underwater Construction						
Design Engineering						
Engineering Drafting Graphics						
Statistics						
Hard Hat Diving						
Scuba Diving						
Deep Diving Physics and Physiology						
Accounting Practices						
Business Law						
Marketing						
Maritime Trade						
Seamanship						
Basic Boat Building						
Marine Estimating						
Hydraulics/Pneumatics						
Shipfitting						
Shipboard Machinery Operation/Repair						
Marine Inspection/Quality Control						

Others (list) _____

_____

FORMER STUDENT QUESTIONNAIRE

1. Purpose

This instrument is designed to collect data regarding the current status, activity, and opinions of former students of the Marine Technology Program of your college.

2. Target Population

Former students.

3. Method of Instrument Application

The method of application is expected to be via telephone survey. The surveyer need simply follow the form and ask the questions in order. Any general comments may be put at the bottom of the form.

4. Source of Student Name and Telephone Number

The source of student names and telephone numbers will be Instrument Number 3, Section E.

5. Use and Application of Collected Data

The data collected by this instrument will be used to indicate, among other things:

- What use the student is making of his Marine Technology Education.
- Student opinions on Marine Technology Training Program or a possible program improvement guide.

6. Disposition of Completed Instrument

Instruments are to be identified as to interviewer, interviewee, college, packaged and sent to San Diego Community College District, Research Office.

7. General Note

The reverse side of Instrument Number 1 was erroneously printed, is not part of this instrument and is to be disregarded in the application of the instrument.

FORMER STUDENT QUESTIONNAIRE

MARINE TECHNICIAN FOLLOW-UP SURVEY

College/District _____ Interviewer _____ Interview Date _____

Your junior college records show that you were enrolled in a Marine Technician program within the past three years. We are currently evaluating such programs throughout California and would like to have your reactions so that we may improve the program.

NAME _____ ADDRESS _____ PHONE _____

Date of last attendance _____ Total units completed _____

1. Are you continuing your education? yes ☐ no ☐

2. If you are continuing your education, please indicate the name of the institution _____

3. Are you employed? yes ☐ no ☐

4. If yes, is employment in a marine/marine related industry? yes ☐ no ☐

5. If no, are you actively seeking employment? yes ☐ no ☐

6. If not actively seeking employment, why not? _____

7. If you are employed, please provide the following:

   Your job title _____ Approximate Hours per week _____

   Employer's Name _____ Approximate Weekly salary _____

   Address _____

   Phone No. _____

8. How many years of marine/marine related experience do you have? _____

9. Did the Community College Marine Technology Training Program prepare you adequately for a marine or marine related job? yes ☐ no ☐

10. What additional training areas/courses should the marine technology program include?

    _____

    _____

11. What areas/courses should the marine technology program drop or eliminate?

    _____

12. Comments: _____

	Essential					Nonessential
Publications (basic references, catalogs, indices)						
Fishing Sciences						
Fisheries Equipment (nets, winches, processing)						
Boat Handling						
Marine Geography (topography, resources, conservation)						
Navigation (piloting)						
Sea-Shore Communications (radio telephone)						
Industrial Safety						
Maritime Safety						
Acoustics						
Electronic Data Processing and Equipment Operation						
Computer Programing						
Mining and Metallurgy						
Rigging						
Business Management						
Mathematics						
High Pressure Testing and Environmental Testing						
Underwater Construction						
Design Engineering						
Engineering Drafting Graphics						
Statistics						
Hard Hat Diving						
Scuba Diving						
Deep Diving Physics and Physiology						
Accounting Practices						
Business Law						
Marketing						
Maritime Trade						
Seamanship						
Basic Boat Building						
Marine Estimating						
Hydraulics/Pneumatics						
Shipfitting						
Shipboard Machinery Operation/Repair						
Marine Inspection/Quality Control						

Others (list) _____

_____

Appendix C

SAMPLE LETTER FOR INDUSTRY CONTACTS

Following is a sample letter that was sent out to each industry in the San Diego area.

SAN DIEGO COMMUNITY COLLEGES
835 TWELFTH AVENUE
SAN DIEGO, CALIFORNIA 92101

SAN DIEGO CITY COLLEGE
SAN DIEGO MESA COLLEGE
SAN DIEGO EVENING COLLEGE
SAN DIEGO ADULT SCHOOLS

February 10, 1972

Joseph D. Pierce
General Manager
GENERAL DYNAMICS, ELECTRIC BOAT DIV.
P. O. Box 127 (7-94)
San Diego, CA 92112

Dear Mr. Pierce

Several months ago, the Board of Governors of the California Community Colleges directed that an evaluation be made of the marine technical programs in the state's community colleges. The purpose is to provide the Board with information for judging priorities for support of marine technology and marine-oriented training programs.

The thrust of the evaluation is toward identification and measurement of present and potential employment demands, identification of types of skill areas required, and their relation to community college courses and programs. The data collected will be analyzed to provide trend indicators toward immediate application of results. A final report will be published and presented to the Board of Governors, copies of which will be made available to each cooperating industry.

The results of this study will enable the California Community Colleges to provide courses and programs that are responsive to the requirements of local marine and marine related industries. In order to assure this, the study has been designed to elicit your suggestions and direction for the planning of courses and programs to meet your particular needs.

The San Diego portion of this state-wide study is under the program direction of Dr. O. A. Heinkel, Director of Research, and is being conducted for Mr. W. B. Steinberg, Director of Vocational Education.

We would appreciate your authorization for us to contact either yourself or a designee who would be able to provide information regarding your firm that would assist in the formulation of industry characteristics and requirements.

Enclosed for your review is a sample questionnaire which indicates the type of information we are seeking. This questionnaire was developed in close cooperation with a number of industry representatives in San Diego.

Please note that we are not asking you to complete the attached questionnaire at this time. We will contact your office within the next few days to confirm arrangements regarding a response.

If you require further information, do not hesitate to call upon us, either in writing or by telephone (236-1331, ext. 214).

Yours truly,

F. J. Tepedino
Consultant
Marine Technology Project

FJT/mbd

Enclosure: Sample questionnaire