OCEAN FACILITIES ENGINEERING CAPABILITY REQUIREMENTS

31 OCTOBER 1975

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OCEAN FACILITIES ENGINEERING CAPABILITY REQUIREMENTS

31 OCTOBER 1975

Chesapeake Division
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This report describes, defines and interrelates a series of Capability Requirements for the design of bottom mounted surface structure and suspended able structure types of Fixed Ocean Facilities. The Capability Requirements are categorized and their interrelationship defined by a generic breakdown structure.

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FOREWORD

This report was prepared under Contract No. N62477-73-C-0359, Modification P00008 by Lockheed Missiles & Space Company, Inc., Sunnyvale, California.

This report describes, defines and interrelates a series of Capability Requirements for the design of bottom mounted surface structure and suspended cable structure types of Fixed Ocean Facilities. The Capability Requirements are categorized and their interrelationship defined by a generic breakdown structure.

This report was prepared for the Department of the Navy, Chesapeake Division, Naval Facilities Engineering Command.

CONTENTS

INTRODUCTION

This report presents a series of capability requirements which describe areas of specialized knowledge or activity necessary to the process of designing bottom mounted surface structure (BMSS) and suspended cable structure (SCS) types of Fixed Ocean Facility. Each capability requirement identifies and briefly describes an Ocean Facilities Engineering (OFE) capability required to design a Fixed Ocean Facility (FOF).

SCOPE

The capability requirements presented in this report relate only to the OFE capabilities required for design of a FOF.

CONTENT AND ORGANIZATION

This report contains a series of capability requirement descriptions organized in two main categories and seven subcategories in accordance with a breakdown structure. The breakdown structure is shown in Fig. 1.

The two main categories are: interpretation of environmental parameters, and interpretation of operational requirements. Under the first of these, the four subcategories contain capability requirements which lead to a determination of the effect on FOF design of, respectively; the atmospheric environment, the oceanic environment, the seafloor environment and the environment due to the air/sea/land interface. Under the second main category (associated with operational requirements) the three subcategories contain capability requirements which lead to a determination of the effect on FOF design of, respectively; deployment operations, installation operations and location operations. Each capability requirement is listed and described under its particular subcategory and each has unique identification.

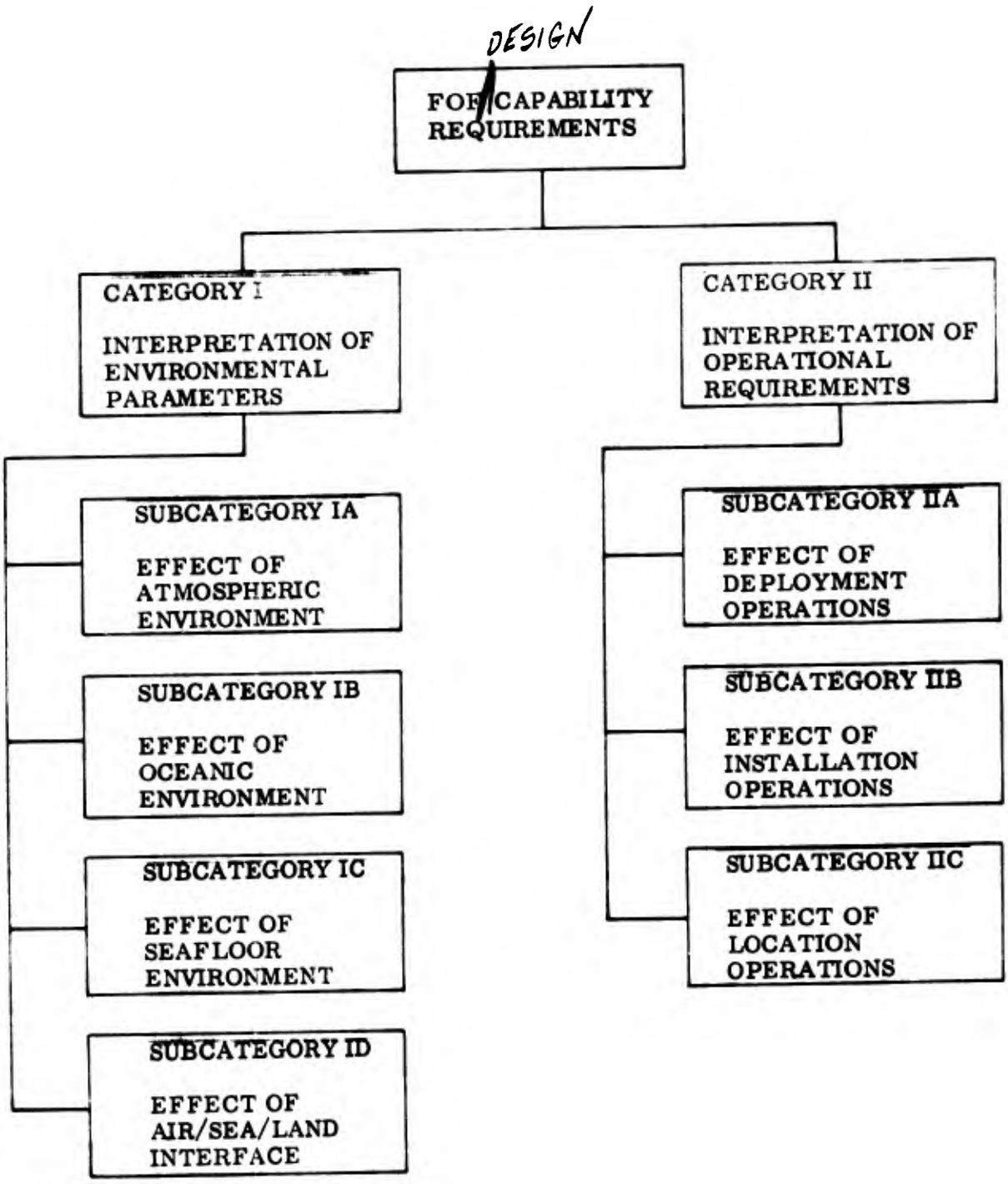


Fig. 1 Breakdown Structure – Capability Requirements

The partial matrices presented as Appendix A provide direct correlation between Ocean Facilities Engineering and Environmental Factors for each segment of the FOFs. Their abscissa and ordinates were taken from the overall matrices prepared as a part of Work Package 1, Task 2. The partial matrices were used as bases for the narratives for capability requirements.

The common element in the partial matrices is the environment, whereas the common element in the overall matrices was the type of FOF. Therefore, while the imformation presented is the same, the composition of the matrices is different.

CATEGORY I, SUBCATEGORY A

BREAKDOWN STRUCTURE ELEMENTS: OFE-200, OFE-210, BMSS-200, SCS-300, EV-102

REQUIREMENT I.A.1 – EXAMINE AND INTERPRET GENERAL ATMOSPHERIC ENVIRONMENTAL DATA TO OBTAIN AN INITIAL DEFINITION OF THE ATMOSPHERIC PROPERTIES

The geographical location of the FOF will be determined by mission requirements. With this known, a general description of the atmospheric characteristics of the area should be sought, which, together with data concerning other aspects of the environment, would be used in making an initial concept of the FOF. This study will be concerned primarily with average wind velocity, direction and variability and to a lesser extent with salt content and humidity in the general area of the FOF location.

The elements of the FOF chiefly affected by the atmospheric characteristics studied are the primary and secondary structures of bottom mounted surface structures and buoyancy elements of suspended cable structures. Wind velocities are translatable into structural loads which will, in the case of bottom mounted surface structures impinge on the structural design of foundations and supporting structure and, if the structure is manned, will affect human factors considerations. In a suspended cable structure wind velocity will generate loads on surface buoyancy elements. These loads will in turn partially determine structural cable sizes leading to an effect on the buoyancy element size.

CATEGORY I, SUBCATEGORY A

BREAKDOWN STRUCTURE ELEMENTS:			
	OFE-221	BMSS-210	EV-102
	OFE-222	BMSS-400	
		SCS-310	
		SCS-600	
		SCS-700	

REQUIREMENT I.A.2 – DATA FROM ARCHIVES OF ACTUAL ATMOSPHERIC MEASUREMENTS

This capability requirement is concerned with the extraction of data from archives giving a more detailed description of the atmospheric environment than the data sought in requirement A.1. The data should consist of actual measurements made at the geographical location of the proposed FOF and should include anticipated maxima, duration, and recurrence intervals. The information extracted will be examined and interpreted so that it can be presented in a form suitable for use in predicting the effects on the FOF as described in requirements I.A.7, I.A.8, and I.A.9. It will also be used to verify the initial concept chosen from the output of requirement I.A.1 or to redirect that choice if more detailed information indicates that another choice or study should be made.

The FOF elements affected by the output of this Capability Requirement are the structural components of bottom mounted surface structures, and buoyancy elements of suspended cable structures to the extent that concepts are being verified. The information developed by this capability requirement will also be used in the preliminary design, not only of structural elements above but of systems such as Utility Systems and Navigation, Warning and Communication Systems.

CATEGORY I, SUBCATEGORY A

BREAKDOWN STRUCTURE ELEMENTS:	OFE-221	BMSS-210	EV-102
	OFE-222	BMSS-400	EV-103
		SCS-310	EV-104
		SCS-500	EV-105
		SCS-600	
		SCS-700	

REQUIREMENT I.A.3 – ON-SITE MEASUREMENT AND OBSERVATION OF THE ATMOSPHERIC ENVIRONMENT

The archival data search conducted under requirement I.A.2 may reveal a lack of the required data for the particular geographical location selected for the proposed FOF. This may be particularly true where there are local environmental deviations which do not appear in the existing collections of data. In this case it will be necessary to evaluate the existing data to determine what further information is required which is peculiar to the design of the FOF. Operations will then have to be instituted to obtain this data by measurement and observation of the required environmental parameters at the actual site. This is one element of a site survey which will also gather data concerning other aspects of the environment as outlined in requirements I.B.3, I.C.3 and I.D.3.

The environmental characteristics of the atmosphere to be observed and measured will include; wind velocities and directions, temperatures, humidity, precipitation in the form of rain, snow, hail, etc; visibility, and other meteorological phenomena, including lightning.

CATEGORY I, SUBCATEGORY A

BREAKDOWN STRUCTURE ELEMENTS: OFE-222, OFE-223, OFE-230, BMSS-200, SCS-300, EV-100

REQUIREMENT I.A.4 – COMPENDIUM OF TECHNIQUES FOR OBTAINING ATMOSPHERIC ENVIRONMENTAL DATA

This capability requirement is for the preparation of a compendium of atmospheric environmental data gathering techniques. These will include techniques for the gathering of data concerning all aspects of the atmosphere including wind velocity, wind velocity profile, wind direction, and frequency of recurrence. Other environmental characteristics for which techniques may be required are humidity, precipitation, temperature, and visibility. In particular these techniques will apply to obtaining data of the atmosphere above the ocean. General types of equipment required and performance specifications for that equipment will be included, but not descriptions of specific items, which will be included in requirement I.A.5.

The data gathered will be that which is peculiar to the particular FOF being considered, as described in requirement I.A.3. Other data would be classified as archival (requirement I.A.2) and would not involve the use of particular techniques.

CATEGORY I, SUBCATEGORY A

BREAKDOWN STRUCTURE ELEMENTS: OFE-222, OFE-223, OFE-230, BMSS-200, SCS-300, EV-100

REQUIREMENT I.A.5 – CATALOG OF ATMOSPHERIC ENVIRONMENTAL DATA GATHERING EQUIPMENT

This capability requirement is for the preparation of a catalog of actual equipment to be used for observing and measuring atmospheric data. The catalog will include descriptions of and sources for all of the equipment for which performance specifications were generated by requirement I.A.4. Sufficient data should be included to enable a selection of equipment to be made for any specified data gathering task and for availability to be ascertained to match the schedule requirements and cost objectives.

CATEGORY I, SUBCATEGORY A

BREAKDOWN STRUCTURE ELEMENTS: OFE-222, OFE-223, OFE-230, BMSS-200, SCS-300, EV-100

REQUIREMENT I.A.6 – CATALOG OF ATMOSPHERIC ENVIRONMENTAL DATA GATHERING ORGANIZATIONS

This capability requirement is for the preparation of a catalog of organizations who have the capability to perform the data gathering tasks using the techniques described in requirement I.A.4 and the equipment described in requirement I.A.5. It may also include organizations which may have specialized atmospheric data, gathered for other purposes, which may not be available in generally published archives.

CATEGORY I, SUBCATEGORY A

BREAKDOWN STRUCTURE ELEMENTS: OFE-230 BMSS-210 EV-102
SCS-300

REQUIREMENT I.A.7 – WIND LOADING ON FOF STRUCTURES

A capability is required to develop techniques for translating the wind velocities and directions determined by requirements I.A.2 and I.A.3 into loads applied to bottom mounted surface structures or to suspended cable structures. Maximum wind velocities of short duration (gust loading) and also sustained winds of lower velocity will be considered.

The loads applied to the structure by the wind may be predicted by analysis, by computer modeling or by physical modeling, coupled with appropriate factors of safety to make allowance for the degree of precision of the method of prediction.

In a bottom mounted surface structure the wind loads, coupled with wave and current loading (see requirements I.B.5) will influence design of the primary structure. In the case of the suspended cable structure, wind load on a surface buoyancy element will influence the load on its mooring cable and hence its size. This in turn will influence the size of the buoyancy element.

CATEGORY I, SUBCATEGORY A

BREAKDOWN STRUCTURE ELEMENTS: OFE-230 BMSS-210 BMSS-220 BMSS-700 SCS-310 SCS-500 EV-101

REQUIREMENT I.A.8 – CORROSION AND BIOFOULING EFFECTS AND COUNTERMEASURES

This capability is for developing techniques for evaluating the effects of the corrosive qualities of the marine atmospheric environment in all elements of the FOF. This includes an analysis of the effects of biofouling, which, in the case of the atmospheric environment, is caused primarily by birds.

Corrosion is the result, in the main, of the salt laden, humid marine atmosphere. Where the FOF is located close to centers of human activity (as might be the case near a harbor) other corrosive elements may be present in concentrations sufficient to require consideration. The data obtained as a part of requirements I.A.2 and I.A.3 will be examined and evaluated as they will affect the materials proposed for use in the FOF.

This requirement includes identification of measures to counter the effects of the anticipated corrosion. While in many cases the counter-measures will be in the form of applied coatings (paint) other techniques to be considered will include cathodic, impressed current and choice and thickness of material. Service, life, maintenance facility and cost will be factors to be weighed in making a recommendation.

All elements of any FOF may be affected wherever they may be exposed to the atmosphere either during service, emplantment or construction.

CATEGORY I, SUBCATEGORY A

BREAKDOWN STRUCTURE ELEMENTS: OFE-230 BMSS-210 EV-103
SCS-300

REQUIREMENT I.A.9 – LOADING OF FOF STRUCTURES DUE TO PRECIPITATED ICE

A capability is required for establishing the loads imposed on the FOF structures and exposed system elements by the accumulation of ice resulting from precipitation. The observations and measurements of the environment which are the output of requirements I.A.2 and I.A.3 are examined to select data relating to temperature, precipitation and other factors leading to ice accumulation on exposed surfaces. An estimate will be formed of the amount and location of this ice and hence of the loading of the structure due to the weight of ice. In some cases the thickness of ice will be considered where this will cause a significant increase in projected area and hence of wind loading. An estimate will be made of the effect of ice on mechanisms, particularly where hatches or other human safety factors are affected. All elements of any FOF directly exposed to the atmosphere will need to be considered.

CATEGORY I, SUBCATEGORY B

BREAKDOWN STRUCTURE ELEMENTS:	OFE-200	BMSS-100	EV-200
	OFE-210	BMSS-210	
		SCS-110	
		SCS-200	
		SCS-300	

REQUIREMENT I.B.1 – EXAMINE AND INTERPRET GENERAL OCEANIC ENVIRONMENTAL DATA TO OBTAIN AN INITIAL DEFINITION OF OCEAN PROPERTIES

The geographic location of the FOF will have been established by its mission requirements. With this identification of the area of interest, a search can be initiated for general descriptive information of the ocean environments in this area, which is part of the requirement necessary to formulate an initial concept of the FOF. Of primary interest in this search will be information on sea state and subsurface currents and how they vary with time and season. These data can be used to calculate the structural loads for the FOF. Other information, such as water temperature, salinity, and marine life in the area will also be of interest. In the case of bottom mounted surface structures this will affect the structural design of the foundations and support components, the structure, and configuration of the surface components. For suspended cable structures it will affect anchors, cables, and buoyancy elements.

CATEGORY I, SUBCATEGORY B

BREAKDOWN STRUCTURE ELEMENTS:	OFE-221	BMSS-100	EV-202
	OFE-222	BMSS-210	EV-204
		SCS-100	
		SCS-300	

REQUIREMENT I.B.2 – DATA FROM ARCHIVES OF ACTUAL OCEAN MEASUREMENTS

This capability requirement will supplement requirement I.B.1 by extraction of data from archives giving a more detailed description of the ocean environment. These data should provide an actual measurement of the parameters of interest, made at the proposed geographic location. They should include mean and maximum sea states and currents and their variation with time and season. Consideration should be given to contaminants in the water resulting from proximity to centers of population, such as being near a harbor. The data thus extracted will be analyzed and evaluated for use to revise, verify or refine the initial FOF concept chosen during the analysis of requirement I.B.1.

The FOF elements affected by the results of the capability requirement are the structural components of the bottom mounted surface structure and the buoyancy elements of suspended cable structures.

The information developed by this capability requirement will also be used in the preliminary design of these structural elements and of related components such as Utility Systems and Navigation, Warning and Communication Systems.

CATEGORY I, SUBCATEGORY B

BREAKDOWN STRUCTURE ELEMENTS:	OFE-221	BMSS-100	EV-202
	OFE-222	BMSS-210	EV-203
		BMSS-300	EV-204
		SCS-100	
		SCS-200	
		SCS-300	

REQUIREMENT I.B.3 – ON-SITE MEASUREMENT AND OBSERVATION OF THE OCEAN ENVIRONMENT

The summation of data accumulated under requirements I.B.1 and I.B.2 may be insufficient for adequate description of the area ocean environment, leaving gaps that can only be filled by actual measurement. This may be particularly true where there are local environmental deviations which are not identified in the existing data collection system. When this occurs it will be necessary to determine what further information is required that is peculiar to the design of the FOF, and to obtain it by measurement and observation of the appropriate parameters in the selected ocean area. It may be desirable to include parameters concerning other aspects of the environment such as the requirements outlined in I.A.3, I.C.3 and I.D.3.

The parameters to be observed and measured as this requirement will include (to the extent they are not already available); sea state, subsurface currents, water temperature and salinity, and problems related to marine life, such as fishbite. Consideration should also be given to water contaminants resulting from proximity to centers of population, such as a harbor.

CATEGORY I, SUBCATEGORY B

BREAKDOWN STRUCTURE ELEMENTS:	OFE-222	BMSS-100	EV-200
	OFE-223	BMSS-200	
	OFE-230	BMSS-300	

REQUIREMENT I.B.4 – COMPENDIUM OF TECHNIQUES FOR OBTAINING OCEAN ENVIRONMENTAL DATA

This capability requirement is for the preparation of a compendium of techniques for collecting ocean environmental data from all sources, including capability requirements I.B.1, I.B.2, and I.B.3 and any others identified in the course of this activity. This will include the gathering of existing data from all possible sources plus the methods of obtaining further data by measurement at the scene to fill out the necessary data spectrum. The parameters are sea state, subsurface currents, temperature, salinity and effects of marine life such as fishbite. The general types of equipment required and the performance specifications for that equipment will be covered. The detailed descriptions will be included in capability requirement I.B.5.

The data collected by actual measurement will be that portion of the data spectrum peculiar to the specific FOF involved and which is not available from other sources. The remaining portions would be classified as archival (capability requirement I.B.2) and would not require the establishment of data measuring techniques.

CATEGORY I, SUBCATEGORY B

BREAKDOWN STRUCTURE ELEMENTS:	OFE-222	BMSS-100	EV-200
	OFE-223	BMSS-200	
	OFE-230	SCS-100	
		SCS-200	
		SCS-300	

REQUIREMENT I.B.2 – CATALOG OF OCEAN ENVIRONMENTAL DATA GATHERING EQUIPMENT

This capability requirement is for the preparation of a catalog of the actual equipment to be used for observing and measuring the ocean data to be gathered under capability requirement I.B.3. This catalog will include detailed descriptions of and sources for all of the ocean parameter measuring equipment for which performance specifications were generated in capability requirement I.B.4. Sufficient information should be included to permit selection of equipment for any specified tasks for measuring ocean environmental parameters, and to ascertain the availability and cost objectives necessary to match the schedule requirements.

CATEGORY I, SUBCATEGORY B

BREAKDOWN STRUCTURE ELEMENTS:	OFE-222	BMSS-200	EV-200
	OFE-223	SCS-100	
	OFE-230	SCS-200	
		SCS-300	

REQUIREMENT I.B.6 – CATALOG OF OCEAN ENVIRONMENTAL DATA GATHERING ORGANIZATIONS

This capability requirement is for the preparation of a catalog of organizations that have the capability to perform the Ocean Environmental data gathering tasks detailed in capability requirement I.B.3 using the techniques of capability requirement I.B.4 and the equipment described in capability requirement I.B.5. If appropriate it may also include organizations which have specialized ocean environmental data gathered for other purposes, which are representative of the FOF area but may not be available in generally published archives.

CATEGORY I, SUBCATEGORY B

BREAKDOWN STRUCTURE ELEMENTS:	OFE-230	BMSS-210	EV-202
		SCS-100	EV-203
		SCS-200	
		SCS-300	

REQUIREMENT I.B.7 – OCEAN ENVIRONMENTAL EFFECTS ON FOF STRUCTURES

A capability is required to develop techniques for translating the data obtained in requirements I.B.2 and I.B.3 into a form suitable for use in structural design of the facility. The principal consideration is the effect, on the FOF structure, of the loads resulting from sea state and ocean currents.

The loads thus applied to the structure may be predicted by analysis, by computer modeling, or by physical modeling, adding appropriate safety factors to allow for the degree of precision inherent in the data and the method.

In a bottom mounted surface structure the sea state and current loads coupled with wind loading (see requirement I.A.5) will influence design of the primary structure. In the case of suspended cable structures the same factors will influence facilities having surface buoyancy elements; facilities having only subsurface elements will be influenced by currents and internal waves.

CATEGORY I, SUBCATEGORY B

BREAKDOWN STRUCTURE ELEMENTS: OFE-230 BMSS-700 EV-204
SCS-500 EV-205

REQUIREMENT I. B. 8 – CORROSION AND BIO-FOULING EFFECTS AND COUNTERMEASURES

This capability requirement is to develop techniques for evaluating the effects of the corrosive qualities of the ocean environment on all elements of the FOF which are immersed in, or in occasional contact with the water during emplantment, construction, or service. This corrosion is principally the result of the water salinity. When the FOF is located close to centers of human activity (as might be the case near a harbor) other elements or contaminants may be present in the water sufficient to warrant consideration.

The data obtained in requirements I. B. 2 and I. B. 3 will be examined and evaluated for their effect on the materials proposed for use in the FOF components subject to corrosion by the water.

This requirement includes identification of measures to counter the effects of the anticipated corrosion.

The countermeasures will include choice and thickness of material and protective coatings, and cathodic, impressed current protection or any other appropriate measures. The service life and maintenance requirements for the facility will also be considered.

CATEGORY I, SUBCATEGORY B

BREAKDOWN STRUCTURE ELEMENTS: OFE-230 SCS-210 EV-204

REQUIREMENT I.B.9 – EFFECT OF MARINE LIFE AND COUNTERMEASURES

A capability is required for establishing the effects of local marine life on the submerged portions of the FOF. The observations and measurements obtained in requirements I.B.2 and I.B.3 will be examined to determine what problems, if any, must be anticipated. The principal concerns will be fishbite on cables and other organisms, such as barnacles, on other structure. It will be necessary to estimate the magnitude of the problem and to devise preventive measures in the form of material selection or protective coatings. The available data should also be studied to anticipate problems arising from other marine life organisms in the area and to incorporate preventive features in the design.

CATEGORY I, SUBCATEGORY C

BREAKDOWN STRUCTURE ELEMENTS: OFE-210 BMSS-100 EV-303

REQUIREMENT I.C.1 – GEOMORPHOLOGICAL AND SEISMIC DATA TO OBTAIN AN INITIAL CONCEPT OF THE LOAD BEARING CAPABILITY AND STABILITY OF THE SEA FLOOR

To establish requirements specifications for a projected FOF site a capability is required to interpret the extant geomorphological and seismic data to arrive, initially, at the engineering properties and stability of the bottom material. This first estimate will mainly consider the frictional and cohesive components of the shear, and the potential problems arising from seismic activity. Lateral load bearing capability as distinct from the vertical load bearing capability can be estimated for certain sediment types. This initial data may be used to arrive at the conceptual design of those FOF elements interfacing with the sea floor.

CATEGORY I, SUBCATEGORY C

BREAKDOWN STRUCTURE ELEMENTS: OFE-220 BMSS-100 EV-308

REQUIREMENT I.C.2 - DATA FROM ARCHIVES OF ACTUAL SEA-FLOOR CONDITIONS

This capability requirement provides a more refined interpretation of archival data to assess geophysical parameters such as the remolding characteristic (of clay sediments), the frictional and cohesive components of the shear, compressibility due to overburden, metastable potential, and the probability that the data is representative of the FOF site area. More detailed considerations of the bottom material in representative lateral and vertical sections are used to confirm or change the initial FOF foundation type selection. Existing archival data used for this purpose must be from the same or similar bottom areas. The latter alternative requires technical assurance that the areas are indeed similar. Methods should be presented to assure that the load bearing capability of all the subordinate sediment levels in a multiple sediment columnar structure is adequate.

Potential seismic problems, scour, and mass transport problems (see I.D.9, 10, 11 and 12) will be similarly treated.

CATEGORY I, SUBCATEGORY C

BREAKDOWN STRUCTURE ELEMENTS:	OFE-231	BMSS-100	EV-305
	OFE-220	BMSS-100	EV-305

REQUIREMENT I.C.3 – IN-SITU CORE SAMPLE ACQUISITION, COEFFICIENT OF LATERAL REACTION, AND SEISMIC AND SCOUR DATA

A capability requirement is required for defining bottom coring techniques to define the sediment column at the projected FOF site and for the engineering parameter interpretation of the cores. Since final design is the application of these data it is necessary to assure that the bottom samples are in fact good samples of the bottom material.

Cyclical lateral loading of the FOF, deriving from wind, current, and principally, wave impact, requires refinement of interpretation of the geophysical data to define the lateral reaction forces in each layer of the sedimentary column. The coefficient of lateral reaction, which relates the lateral displacement with its causal pressure, is load and time dependent in certain types of workable sediments. The capability includes accurate and reliable interpretation of lateral reaction potential.

Similarly, as feasible, observation and measurement of seismic and scour information should be obtained and evaluated. (See I.D.9, 10, 11 and 12.)

CATEGORY I, SUBCATEGORY C

BREAKDOWN STRUCTURE ELEMENTS: OFE-233 BMSS-100 EV-309

REQUIREMENT I.C.4 – TEST METHODS AND CRITERIA FOR EVALUATING BOTTOM SAMPLING TECHNIQUES

Much of the archival bottom sample data dates back many years and is presented in a way more useful to the geologist than the ocean engineer. However, with suitable interpretive techniques, the data can be applied usefully. This capability requirement includes test methods by which the archival data can be validated, criteria for determining the accuracy and resolution of that data, and test methods and criteria for evaluating the sampling techniques to be employed in the on site measurements.

Techniques for the use of these data must also be presented since the technique can often limit the validity and interpretation of the data, and the actual acquisition of that data.

CATEGORY I, SUBCATEGORY C

BREAKDOWN STRUCTURE ELEMENTS: OFE-233 BMSS-100 EV-300

REQUIREMENT I.C.5 – CATALOG OF DEVICES FOR DIRECT MEASUREMENT AND OBSERVATION OF ENGINEERING DATA ON BOTTOM SEDIMENTS, SCOUR, AND SEISMIC EVIDENCE

The available instruments for the direct measurement of the engineering parameters of ocean sediments are developmental and limited in scope. Nevertheless, the rapid advance of ocean engineering will require such instruments to be available in a reliable and practical form within the next few years. This capability requirement presents the features, application and limitations of the developmental instruments already tried by the laboratories and industry, and in consequence, presents the needs for further development of such instruments.

The final FOF design stage requires actual on site bottom sample data. Identification of the many available bottom samplers such as corers, dredges, and grabs which can be employed in obtaining the samples is required.

For requirements for seismic and scour data see capability requirements I.C.9, 10, 11 and 12.

CATEGORY I, SUBCATEGORY C

BREAKDOWN STRUCTURE ELEMENTS: OFE-222 BMSS-100 EV-301

REQUIREMENT I.C.6 - CATALOG OF SEA FLOOR DATA SOURCES

The preliminary FOF design stage requires extensive access to archival geophysical data. Although these data are well documented for source research, its documentation and location is not well known outside the geophysics field. This capability requirement is for the preparation of a catalog of the major data resources with their criteria for demarcation. Owing to the special nature of the ships and equipment required to take bottom samples, a significant saving in cost and effort can be achieved by using existing ship services. The catalogue will include a listing of the available commercial, university, and Navy organizations associated with bottom sampling and will also indicate the techniques and limitations of the services.

(See capability requirements I.D.9, 10, 11 and 12.)

CATEGORY I, SUBCATEGORY C

BREAKDOWN STRUCTURE ELEMENTS: OFE-222 BMSS-100 EV-302
SCS-100

REQUIREMENT I.C.7 - EFFECT OF BOTTOM MATERIAL ON FOUNDATION PLACEMENT

A capability is required to develop techniques for using the data acquired in requirements I.C.2 and I.C.3 to select the optimum location for foundation placement in the FOF area and to reject locations which would not provide acceptable support. This applies equally to bottom mounted surface structures and to suspended cable structures.

Selection of the location will lead to consideration of the type of foundation, i.e. a pile foundation, or a spread footing foundation with the latter further divided into skirted, nonskirted or individual foot types.

CATEGORY I, SUBCATEGORY C

BREAKDOWN STRUCTURE ELEMENTS: OFE-221 BMSS-100 EV-302
SCS-100

REQUIREMENT I.C.8 – EFFECT OF BOTTOM MATERIAL ON FOUNDATION STRUCTURE

Having selected a specific location and type of foundation, a capability is required to use the available information from capability requirement I.C.2 and capability requirement I.C.3 to identify any effect it may have on the foundation structure and to translate it into load factors supplementing the loads emerging from subcategories A, B and D. For a given location the results of this activity should be identical for either bottom mounted surface structures or suspended cable structures regardless of their proximity to shore and the added problems thus encountered.

CATEGORY I, SUBCATEGORY C

BREAKDOWN STRUCTURE ELEMENTS: OFE-220 BMSS-100 EV-306

REQUIREMENT I.C.9 – POTENTIAL EFFECT OF SEISMIC ACTIVITY ON FOF FOUNDATION DESIGN

As noted in I.D.2, 3, 5 and 6, data relating to seismic activity will be obtained coincident with acquisition of other data required for this category. The universities, government agencies, and petroleum companies, have been taking seismic reflection or refraction profiles in certain geographic areas. Owing to the complexity of instrumentation, the high investment cost, and the advanced level of technical talent required, seismic profiling is best accomplished by specialists. These specialists frequently limit their activity, for example, to deep ocean areas, continental shelves, marginal seas, or particular localities. Consequently, it is a service to the ocean engineer to have a catalog of seismic profiling services available.

Faults are shown in these profiles. This capability requirement should include the history of seismic disturbance in the area and techniques for the interpretation and prediction of the data to determine its effect on the FOF structure. Furthermore, the same evaluative techniques permit the specification of the accuracy, resolution and perhaps, the specific seismic profiling technique to be used in the final design phase.

CATEGORY I, SUBCATEGORY C

BREAKDOWN STRUCTURE ELEMENTS: OFE-220 BMSS-100 EV-305

REQUIREMENT I.C.10 – POTENTIAL EFFECT OF FAULTS ON FOF FOUNDATIONS

Requirement I.C.9 deals with the possibility of seismic activity and its potential effect on the FOF foundations and their design. Even in the absence of a seismic disturbance, the presence of a fault beneath the FOF foundation can be detrimental to the potential support of the structure. This capability requirement includes identification of the means of determining the potential loss of support in the sedimentary structure due to the presence of faults assuming no seismic activity, and the effect this may have on the design or location of the FOF foundation.

This can be accomplished using the data acquired for capability requirement I.C.9.

CATEGORY I, SUBCATEGORY C

BREAKDOWN STRUCTURE ELEMENTS: OFE-223 BMSS-100 EV-309

REQUIREMENT I.C.11 – EFFECTS OF SCOUR ON FOUNDATION DESIGN

Scour is the re-distribution of surface sediments by alteration of the water motion from the presence of the FOF foundation. It can be detrimental to the FOF support by changing the load bearing capability of the surface sediments. Scour incurs a load on the FOF foundation due to the pressure of the diverted water current and perhaps, the pressure of the transported sediment. The magnitude of the scour in a two-dimensional profile section can be estimated from the available water current profile, bottom sediment composition, and the FOF conceptual foundation shape.

When this two-dimensional section indicates that there may be scour on a projected FOF site, a full three-dimensional modeling technique must be employed to arrive at a detailed evaluation of the scour and an indication of how to relieve its effects. The three-dimensional model can be either a computer model or an actual water tank model.

This capability requirement presents the means of determining the magnitude of the scour from the mathematics of hydrodynamic flow and the criteria for determining if scour is a problem to the FOF foundation stability. It also presents the criteria for determining the modeling approach, the requirements for accuracy and resolution of the water current profile and the sediment structure to achieve a reliable estimate of scour.

CATEGORY I, SUBCATEGORY C

BREAKDOWN STRUCTURE ELEMENTS: OFE-220 BMSS-100 EV-309

REQUIREMENT I.C.12 – COUNTERMEASURES TO THE MASS TRANSPORT OF SEDIMENTS CAUSED BY FOF FOUNDATIONS

This capability requirement identifies the areas and nature of the experience with scour so that the ocean engineer can select a suitable approach to avoid scour. It also presents the techniques to counteract the transport of sediments resulting from emplacement of the FOF foundation.

The lack of a practically useful mathematical technique for evaluating the scour problem in detail and the complexity and cost of the modeling techniques, make minimization of scour a desirable alternative. Minimization, nevertheless, requires an estimate of scour, for which there are certain areas of experience, such as the Netherlands Government Laboratories and the University at Delft. These have extensive empirical data and interpretations of the causes and magnitude of scour.

The techniques to counteract re-transport of sediments due to the presence of the FOF foundations are applicable regardless of whether the scour problem has been resolved by virtue of a model analysis, or if scour is being minimized on the basis of existing experience. The various techniques will be presented for the various types of sediment re-transport conditions, with particular attention given to the manner in which the individual techniques withstand storms, excessive currents, etc. Some examples of the scour prevention techniques are fascine mats (fascina placed over the sediment to act as a holding force), gravel (placed over the sediment to effectively increase the density overall), baffles and breakwaters to divert the water flow, and special design of the FOF foundation shape to eliminate the scour type water flow.

CATEGORY I, SUBCATEGORY D

BREAKDOWN STRUCTURE ELEMENTS:	OFE-200	BMSS-100	EV-400
	OFE-210	BMSS-200	
		SCS-100	
		SCS-200	

REQUIREMENT I.D.1 – EXAMINE AND INTERPRET GENERAL AIR/SEA/LAND INTERFACE DATA TO OBTAIN AN INITIAL DEFINITION OF THE INTERFACE CHARACTERISTICS

This capability requirement is for an initial broad study of phenomena associated with waves, sea-ice, sea level variation and near-shore characteristics. The study will consist of the assembling of data concerning the above mentioned subjects in sufficient depth for an initial concept of the FOF to be established. For this purpose the type of information required will be in extant, readily available publications.

The FOF elements affected by the air/sea/land interface at this state of design are the primary structural elements of both bottom mounted surface structures and suspended cable structure. Waves, sea-ice and sea level variations all generate loading conditions which will bear on design of bottom mounted structures and on the surface buoyancy and cable elements of suspended cable structures. Knowledge of near shore characteristics, including littoral transport, erosion, river discharge and shore topography and geology will be necessary mainly for the design of bottom mounted structures.

CATEGORY I, SUBCATEGORY D

BREAKDOWN STRUCTURE ELEMENTS:	OFE-221	BMSS-100	EV-400
	OFE-222	BMSS-290	
		SCS-100	
		SCS-200	

REQUIREMENT I.D.2 – ARCHIVAL DATA ON AIR/SEA/LAND INTERFACES

This capability requirement will supplement requirement I.D.1 by extraction of data from archives to obtain more detailed information concerning waves, sea ice, sea level variation and near shore characteristics. These data should provide actual measurement of the parameters of interest, made in, or covering, the geographical area where the FOF is to be located. The data thus extracted will be analyzed and evaluated for use to revise, verify, or refine the initial FOF concept chosen during the analysis of requirement I.D.1.

The principal effect of this capability requirement will be to provide more detailed information on the loads and thus the structural requirements of the FOF resulting from sea ice and wave action. The information will also provide more detailed inputs for evaluation of near shore characteristics such as littoral transport, erosion and river discharge for FOF's, where these factors are involved.

CATEGORY I, SUBCATEGORY D

BREAKDOWN STRUCTURE ELEMENTS:	OFE-221	BMSS-100	EV-400
	OFE-222	BMSS-200	
		SCS-100	
		SCS-200	

REQUIREMENT I.D.3 – ON SITE MEASUREMENT AND OBSERVATION OF THE AIR/SEA/LAND INTERFACES

The data summary accumulated under requirements I.B.1 and I.B.2 may be insufficient for adequate description of these interfaces, leaving data gaps that must be filled before finalization of the initial FOF definition and establishment of design factors. The additional information must be filled by actual measurement of the air/sea/land parameters in the FOF area. This may be especially important where there are local interface deviations not identified in the existing data collection system. For such cases it will be necessary to determine what further information is required for the FOF, and to obtain it by measurement and observation of the appropriate parameters in the selected ocean area. It may be desirable to include parameters concerning other aspects of the environment as outlined in requirements I.A, I.B, and I.C.

The parameters to be observed and measured for this requirement will include waves, sea ice, and any near-shore characteristics appropriate to the area, such as littoral transport, erosion and river discharge. It may also be appropriate to consider contaminants, debris or other interference resulting from proximity to centers of population such as a harbor, a beach, or a marina.

CATEGORY I, SUBCATEGORY D

BREAKDOWN STRUCTURE ELEMENTS:	OFE-222	BMSS-100	EV-400
	OFE-223	BMSS-210	
	OFE-230	SCS-100	
		SCS-200	

REQUIREMENT I.D.4 – COMPENDIUM OF TECHNIQUES FOR OBTAINING AIR/SEA/LAND INTERFACE DATA

This capability requirement is for the preparation of a compendium of techniques and processes for acquiring air/sea/land interface data from all sources, including requirements I.D.1, I.D.2 and I.D.3 plus any other sources that may subsequently be identified. This will include the process for gathering the existing data from all sources and the techniques for satisfying additional data requirements by measurement at the scene. The principal parameters of interest will be waves and sea ice, but near-shore characteristics should be considered where appropriate. The general nature of equipment required and the performance specifications for it will be outlined. The detailed description will be included in requirement I.D.5.

The data sought by these actual measurements will be from those parts of the air/sea/land interface data spectrum peculiar to the FOF and its mission, which is not available from other sources. The remaining data would be considered archival (see I.D.2) and would not require the establishment of data measuring techniques.

CATEGORY I, SUBCATEGORY D

BREAKDOWN STRUCTURE ELEMENTS:			
	OFE-222	BMSS-100	EV-400
	OFE-223	BMSS-210	
	OFE-230	SCS-100	
		SCS-200	

REQUIREMENT I.D.5 – CATALOG OF AIR/SEA/LAND INTERFACE DATA GATHERING EQUIPMENT

A capability is required for the preparation of a catalog of the actual equipment to be used for acquiring the air/sea/land interface data to be specified in requirement I.D.3. It will include the sources of supply for the equipment specified in I.D.4 and a detailed description of it sufficient to establish specification conformance. This should be made adequate to permit selection of the necessary equipment for measurement of the required parameters and the cost and availability consistent with schedule requirements.

CATEGORY I, SUBCATEGORY D

BREAKDOWN STRUCTURE ELEMENTS:	OFE-222	BMSS-100	EV-400
	OFE-223	BMSS-210	
	OFE-230	SCS-100	
		SCS-200	

REQUIREMENT I.D.6 – CATALOG OF AIR/SEA/LAND INTERFACE DATA GATHERING ORGANIZATIONS

This capability requirement is for the preparation of a catalog of organizations having the capability to accomplish the air/sea/land interface data gathering tasks detailed in requirement I.D.3 using the techniques of requirement I.D.4 and the equipment of requirement I.D.5. It may also be appropriate to include organizations having specialized air/sea/land interface data which is representative of the FOF area but which may not be available in generally published archives.

CATEGORY I, SUBCATEGORY D

BREAKDOWN STRUCTURE ELEMENTS:	OFE-230	BMSS-100	EV-401
		BMSS-200	EV-403
		SCS-100	EV-407
		SCS-200	

REQUIREMENT I.D.7 – AIR/SEA/LAND INTERFACE EFFECTS ON FOF STRUCTURES

A capability is required for the development of techniques to translate the air/sea/land interface data obtained in requirements I.D.2 and I.D.3 into a format suitable for use in calculating load factors imposed on the FOF by these interface parameters. The major consideration is the effect of waves and sea ice loading on the FOF structure.

The resulting loads on the structure may be predicted by analysis, by computer modeling or by physical modeling, including safety factors appropriate for the degree of precision inherent in the data and the processes.

In a bottom mounted surface structure these loads, coupled with wind loading (I.D.5) and ocean currents (I.B.5) will provide major inputs to the design of the primary structure. In the case of suspended cable structures the same factors will influence the structure of facilities having surface buoyancy elements, or buoyancy elements near enough to the surface to be contacted by sea ice.

CATEGORY I, SUBCATEGORY D

BREAKDOWN STRUCTURE ELEMENTS:	OFE-230	BMSS-100	EV-402
		BMSS-200	EV-404
		SCS-100	EV-405
		SCS-200	EV-406
		SCS-300	EV-408

REQUIREMENT I.D.8 – NEAR-SHORE EFFECTS ON FOF AND COUNTERMEASURES

For FOFs located near the shoreline a capability is required to evaluate any resulting effects that should be considered in the facility design. The principal factors for consideration are littoral transport, erosion, river discharge and sea level variation. Where the FOF is located in the vicinity of population centers it may be appropriate to consider the effects of contaminants or debris in the water or on the ocean floor, and also the possible effects of non military vessels in the area.

All available data, including that collected in requirement I.D.2 and requirement I.D.3 will be studied for effects of these parameters. The countermeasures will include choice of materials and protective coatings, barriers/bumpers or similar devices, audio or visual warning devices or any other appropriate measures.

CATEGORY II, SUBCATEGORY A

BREAKDOWN STRUCTURE ELEMENTS:

OFE-200	BMSS-100
OFE-210	BMSS-200
	SCS-100
	SCS-200
	SCS-300

REQUIREMENT II.A.1 – COMPENDIUM OF OPERATIONAL TECHNIQUES FOR DEPLOYMENT OF FOF

One of the constraints on initial design of a FOF will be the method used to deploy the major structural elements, i.e. to transfer them from the staging area to the operational site. As an example, a bottom mounted surface structure may be towed to the site and there sunk or sections may be towed and assembled at the site. Deployment of a suspended cable structure involves the transportation of great lengths of cable in such a way that they may be readily installed (see requirement II.B.1).

Many of the techniques for these operations have been developed and adaptations may be made for FOF operations. The off-shore oil industry and the ocean cable laying companies are two obvious sources. Other techniques of a less well developed nature include the stowage of long lines to which payload enclosures are pre-attached before installation.

CATEGORY II, SUBCATEGORY A

BREAKDOWN STRUCTURE ELEMENTS: OFE-200 BMSS-100
BMSS-200
SCS-100
SCS-200
SCS-300

REQUIREMENT II.A.2 – CATALOG OF EQUIPMENT FOR FOF DEPLOYMENT

This capability requirement provides for the preparation of a catalog of existing equipment as required for the techniques discussed in requirement II.A.1 for the FOF deployment phase. This phase includes all the operations to transfer the FOF from the staging area to the operational site. The catalog is intended to be used as a source from which candidates may be selected to suit the particular FOF being deployed and will include ships, work-boats and handling equipment. The data presented should include availability of the equipment, its location and, where necessary, costs either for acquisition or lease. In many cases it may not be possible to define this information separately from the operating organization (discussed in requirement II.A.3) particularly where commercial leasing is involved.

CATEGORY II, SUBCATEGORY A

BREAKDOWN STRUCTURE ELEMENTS: OFE-200 BMSS-100
BMSS-200
SCS-100
SCS-200
SCS-300

REQUIREMENT II.A.3 - CATALOG OF ORGANIZATIONS WITH CAPABILITY IN FOF DEPLOYMENT OPERATIONS

This capability requirement provides for the preparation of a catalog or listing of organizations having the operational skill (frequently specialized) to use the equipment defined in requirement II.A.2. Since deployment operations may be of a non-recurring nature, the most efficient method of operation may be to contract with an organization having both the skill and the equipment. This catalog will list such organizations together with their locations and a definition of their particular capabilities. As with the previous requirement II.A.2, the organization possessing the skill may also possess the equipment. The catalog should also include those Navy units which have a capability for any part of the anticipated deployment operations.

CATEGORY II, SUBCATEGORY A

BREAKDOWN STRUCTURE ELEMENTS: OFE-220 BMSS-100
BMSS-200
SCS-100
SCS-200
SCS-300

REQUIREMENT II.A.4 – DEFINITION OF SPECIAL REQUIREMENTS FOR DESIGN OF THE FOF FOR DEPLOYMENT OPERATIONS

Deployment operations may impose constraints on the design of the FOF over and above those for the operation of the FOF after installation. This capability requirement will define these constraints arising from deployment for any particular FOF being proposed, which are over and above basic as-installed requirements. The bottom mounted surface structure, for example, may have to be deployed in several sections because of the maximum transportable (deployable) size. Provision will then have to be made for connection of the parts during installation. In addition sections of the FOF might have to be buoyant and stable when being deployed if they are of such a size as to require towing. Alternatively, if sections of the FOF have to be lifted by crane the loads imposed during handling may be greater, or at least differently applied than those experienced during service. The suspended cable structure will be designed so that the cable lengths involved can be stored and so that the method of stowage is compatible with the method of installation and assembly at sea.

CATEGORY II, SUBCATEGORY A

BREAKDOWN STRUCTURE ELEMENTS: OFE-200 BMSS-100
BMSS-200
SCS-100
SCS-200
SCS-300

REQUIREMENT II.A.5 – SURVEY OF ORGANIZATIONS PERFORMING DEPLOYMENT OPERATIONS

This capability requirement is for the physical inspection of organizations selected as candidates to carry-out the deployment of a proposed FOF. This type of inspection would be made during the later stages of evolution of the FOF to establish that the company or organization selected has uncommitted resources which can be made available at the scheduled time and that the FOF as designed is compatible with the available resources for deployment.

CATEGORY II, SUBCATEGORY B

BREAKDOWN STRUCTURE ELEMENTS:	OFE-200	BMSS-100
	OFE-210	BMSS-200
		SCS-100
		SCS-200
		SCS-300
		SCS-400

REQUIREMENT II. B. 1 – COMPENDIUM OF TECHNIQUES FOR INSTALLATION OF FOF

The requirements for installation of the FOF at its operational site may impose constraints on the structural design of the FOF which are as stringent as constraints due to requirements for operation after installation. This capability requirement is for the identification of installation techniques which may have been used to date for similar structures and the potential application of these techniques to proposed FOF installations. When techniques have been identified, any special equipment required will be catalogued as a part of requirement II. B. 2 and potential effects on FOF design will be predicted in requirement II. B. 4.

In the case of a bottom mounted surface structure the techniques may have to provide for a structure which is positively buoyant and stable while being towed but can then be rendered negatively buoyant at the time of installation. A suspended cable structure may be required to be installed partially or fully covertly or methods may be developed for assembling the structure at the surface and for then taking it down to operational depth. The definition of the specific techniques will lead to performance specifications of the ships and equipment, primarily handling equipment, required.

CATEGORY II, SUBCATEGORY B

BREAKDOWN STRUCTURE ELEMENTS: OFE-200

BMSS-100
BMSS-200
SCS-100
SCS-200
SCS-300
SCS-400

REQUIREMENT II.B.2 – CATALOG OF EQUIPMENT FOR FOF INSTALLATION

This capability requirement provides for the preparation of a catalog of existing equipment required to carry-out the installation techniques discussed in requirement II.B.1. This phase includes all the operations performed at the operational site to set the FOF on the sea-floor or to moor it in place.

The catalog is intended to be used as a source from which candidates may be selected for the particular installation operations being considered. It will include the ships, workboats and specialized handling equipment required for the operation together with their availability, geographical location and costs either for acquisition or lease. In most cases these sources should be closely coordinated with, and may be the same as those defined in requirement II.A.2 for FOF deployment equipment.

The equipment cataloged may range from ships having a suitable configuration for deploying the FOF or which can, with a minimum of effort and cost, be reconfigured to be used during installation, such as special winches arranged to accept cables and payloads for a suspended cable structure. Where structures must be moored at great depths with considerable accuracy special equipment will be required for accurate anchor placement.

CATEGORY II, SUBCATEGORY B

BREAKDOWN STRUCTURE ELEMENTS: OFE-200 BMSS-100
BMSS-200
SCS-100
SCS-200
SCS-300
SCS-400

REQUIREMENT II.B.3 – CATALOG OF ORGANIZATIONS WITH CAPABILITY IN FOF INSTALLATION OPERATIONS

This capability requirement provides for the preparation of a catalog or listing of organizations having operational skill in using the types of equipment catalogued in requirement II.B.2. As with deployment operations, installation will probably be non-recurring and, in addition, may be without precedent. The organizations to be sought, therefore, are those having experience closest to that anticipated for the proposed FOF; for example, bottom mounted surface structure might be installed by people having experience with off-shore oil platforms. Suspended cable structures would require organizations experienced in the deployment of long lengths of cable such as cable layers.

This catalog will list such organizations, with their locations, capabilities and availabilities. It should also include any Navy units having the requisite capability.

The organizations performing installation operations are likely to be the same as those performing deployment which, if so, will be disclosed by this capability requirement. However, there may be installation operations of considerable complication for which deploying organizations may not have capability and for which competent organizations must be sought.

CATEGORY II, SUBCATEGORY B

BREAKDOWN STRUCTURE ELEMENTS: OFE-220 BMSS-100
BMSS-200
SCS-100
SCS-200
SCS-300
SCS-400

REQUIREMENT II.B.4 – DEFINITION OF SPECIAL REQUIREMENTS FOR DESIGN OF THE FOF FOR INSTALLATION OPERATIONS

The techniques for installation as established by requirement II.B.1 will constrain the design of the FOF as much as any other consideration during the design process. This capability requirement will seek to identify design requirements arising from installation procedures so that they may be intergrated with other requirements at the earliest stage and their impact established.

These requirements peculiar to installation may include, in the case of a suspended cable structure for example, increased loads on the cable structure. In this example a mooring line may be used to lower a clump anchor and, in the process, be exposed to higher loads than it will see after emplantment. Other considerations may include the definition of electrical connectors required by the installation procedure and their method of connection, either dry or wet. In the case of a bottom mounted surface where the structure is transferred from the staging area to operational site in sections there may be special requirements for connecting the sections.

These examples illustrate some of many special design requirements established by installation techniques which form the subject of this capability requirement.

CATEGORY II, SUBCATEGORY B

BREAKDOWN STRUCTURE ELEMENTS: OFE-200

BMSS-100
BMSS-200
SCS-100
SCS-200
SCS-300
SCS-400

REQUIREMENT II. B. 5 – SURVEY OF ORGANIZATIONS PERFORMING INSTALLATION OPERATIONS

As with deployment operations, once candidate installing organizations have been identified, a physical inspection of their facilities and equipment is necessary. This is more true of installation than deployment because of the greater complexity of the operations. This capability requirement will provide for such an inspection after the equipment and procedural requirements have been established.

CATEGORY II, SUBCATEGORY C

BREAKDOWN STRUCTURE ELEMENTS: OFE-200 BMSS-200
SCS-100
SCS-200

REQUIREMENT II.C.1 – COMPENDIUM OF TECHNIQUES FOR LOCATION OF THE FOF

System requirements for the FOF will specify its location and orientation and their tolerances. This capability requirement is for a study of a range of methods which can be used to ensure that the FOF, while it is being installed, is correctly located and oriented. Methods will also be identified for verifying its location after installation and for checking at intervals after installation that the location is being maintained. This last requirement is more appropriate for suspended cable structures which may be more susceptible to the effects of wave and current action.

CATEGORY II, SUBCATEGORY C

BREAKDOWN STRUCTURE ELEMENTS: OFE-200 BMSS-200
SCS-100
SCS-200

REQUIREMENT II.C.2 – CATALOG OF EQUIPMENT FOR LOCATING THE FOF

This capability requirement provides for the preparation of a catalog of equipment required to carry-out the operations defined in requirement II.C.1 for locating the FOF. This includes all the equipment for establishing the location and orientation at intervals after installation. The catalog is intended to be a source, containing descriptions of all relevant equipment, from which candidates can be selected for the particular task being considered.

The equipment will include facilities, such as inertial or satellite navigation equipment for initially establishing the geographical location of the FOF. There will also be equipment for establishing the orientation of the FOF and the relative location of its various elements during and after installation. This will include transponders either on the bottom or on the FOF, perhaps remotely activated and with shipborne sonar gear for interrogating the transponders.

An initial catalog can be compiled based on presently developed installation procedures, which may then be extended and updated as additional or improved installation techniques are developed.

CATEGORY II, SUBCATEGORY C

BREAKDOWN STRUCTURE ELEMENTS: OFE-200 BMSS-200
SCS-100
SCS-200

REQUIREMENT II.C.3 – CATALOG OF ORGANIZATIONS WITH CAPABILITY IN FOF LOCATION OPERATIONS

This capability requirement provides for the preparation of a catalog or listing of organizations having operational skill in using the types of equipment in requirement II.C.2.

Since most of the operations involved in the location operations use state of the art methods and equipment, there are organizations in existence competent in their use. In preparing this catalog the industries now operating the equipment should be sought. The catalog will list the organizations, their locations, capabilities and availability and will also include Navy units having any of the required capabilities.

The organizations may be the same ones that are involved in installing the FOF and this dual capability, where available, will be listed in both catalogs.

CATEGORY II, SUBCATEGORY C

BREAKDOWN STRUCTURE ELEMENTS: OFE-220 BMSS-200
SCS-100
SCS-200

REQUIREMENT II.C.4 – DEFINITION OF SPECIAL DESIGN REQUIREMENTS FOR THE FOF TO PROVIDE FOR LOCATION OPERATIONS

The techniques for location of the FOF as established in requirement II.C.1 will impose requirements on the design of the FOF. This capability requirement will seek to identify those design requirements so that they may be integrated with other requirements as early as possible during design and their impact on the design established.

Typically these requirements might consist in part of provision of transducers either above the surface in the case of bottom mounted surface structures or below the surface for suspended cable structures, either on mooring or buoyancy elements. In either case it will be necessary to have a power supply that may, in turn, lead to access requirements.

CATEGORY II, SUBCATEGORY C

BREAKDOWN STRUCTURE ELEMENTS: OFE-200 BMSS-200
SCS-100
SCS-200

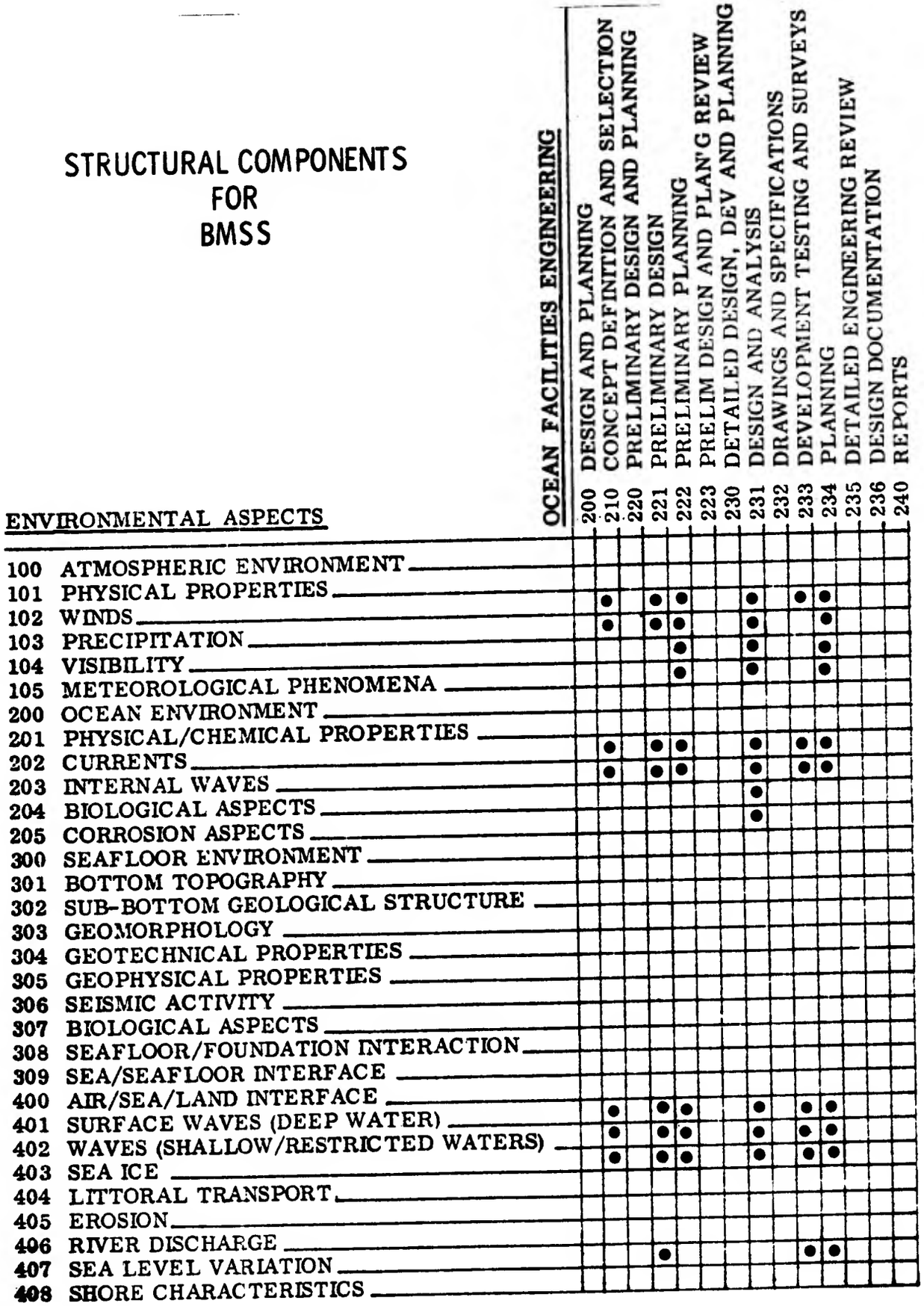
REQUIREMENT II.C.5 – SURVEY OF ORGANIZATIONS PERFORMING FOF LOCATION OPERATIONS

This capability requirement provides for a physical inspection of the facilities and equipment or organizations capable of performing operations to locate the FOF (see requirement II.B.3). This inspection will be made after the equipment and procedural requirements for FOF location have been established and will verify that the suitability of the equipment and capability of the organization. Should this verification not be possible then this capability requirement will provide the basis for such redesign of the FOF as is necessary to use another candidate.

Appendix A

This appendix consists of a series of matrices which indicate areas of interrelationship between ocean facilities engineering operations and environmental parameters for each segment of a fixed ocean facility. Each matrix shows the interrelationships for one FOF segment such as "Structural Components for BMSS." Abbreviations used are BMSS for bottom mounted surface structure and SCS for suspended cable structure.

STRUCTURAL COMPONENTS FOR BMSS



NAVIGATION, WARNING, AND COMMUNICATION SYSTEMS FOR BMSS AND SCS

ENVIRONMENTAL ASPECTS	OCEAN FACILITIES ENGINEERING	200 DESIGN AND PLANNING	210 CONCEPT DEFINITION AND SELECTION	220 PRELIMINARY DESIGN AND PLANNING	221 PRELIMINARY DESIGN	222 PRELIMINARY PLANNING	223 PRELIM DESIGN AND PLAN'G REVIEW	230 DETAILED DESIGN, DEV AND PLANNING	231 DESIGN AND ANALYSIS	232 DRAWINGS AND SPECIFICATIONS	233 DEVELOPMENT TESTING AND SURVEYS	234 PLANNING	235 DETAILED ENGINEERING REVIEW	236 DESIGN DOCUMENTATION	240 REPORTS
100 ATMOSPHERIC ENVIRONMENT															
101 PHYSICAL PROPERTIES															
102 WINDS			●		●	●			●		●				
103 PRECIPITATION			●		●	●			●		●				
104 VISIBILITY			●		●	●			●		●				
105 METEOROLOGICAL PHENOMENA															
200 OCEAN ENVIRONMENT															
201 PHYSICAL/CHEMICAL PROPERTIES															
202 CURRENTS															
203 INTERNAL WAVES															
204 BIOLOGICAL ASPECTS															
205 CORROSION ASPECTS															
300 SEAFLOOR ENVIRONMENT															
301 BOTTOM TOPOGRAPHY															
302 SUB-BOTTOM GEOLOGICAL STRUCTURE															
303 GEOMORPHOLOGY															
304 GEOTECHNICAL PROPERTIES															
305 GEOPHYSICAL PROPERTIES															
306 SEISMIC ACTIVITY															
307 BIOLOGICAL ASPECTS									●						
308 SEAFLOOR/FOUNDATION INTERACTION									●						
309 SEA/SEAFLOOR INTERFACE															
400 AIR/SEA/LAND INTERFACE															
401 SURFACE WAVES (DEEP WATER)			●		●	●			●		●				
402 WAVES (SHALLOW/RESTRICTED WATERS)			●		●	●			●		●				
403 SEA ICE			●		●	●			●		●				
404 LITTORAL TRANSPORT															
405 EROSION															
406 RIVER DISCHARGE															
407 SEA LEVEL VARIATION															
408 SHORE CHARACTERISTICS															

BUOYANCY ELEMENTS FOR SCS

ENVIRONMENTAL ASPECTS	OCEAN FACILITIES ENGINEERING	200 DESIGN AND PLANNING	210 CONCEPT DEFINITION AND SELECTION	220 PRELIMINARY DESIGN AND PLANNING	221 PRELIMINARY DESIGN	222 PRELIMINARY PLANNING	223 PRELIM DESIGN AND PLAN'G REVIEW	230 DETAILED DESIGN, DEV AND PLANNING	231 DESIGN AND ANALYSIS	232 DRAWINGS AND SPECIFICATIONS	233 DEVELOPMENT TESTING AND SURVEYS	234 PLANNING	235 DETAILED ENGINEERING REVIEW	236 DESIGN DOCUMENTATION	240 REPORTS
100 ATMOSPHERIC ENVIRONMENT															
101 PHYSICAL PROPERTIES			●		●				●		●				
102 WINDS			●		●				●						
103 PRECIPITATION			●		●				●						
104 VISIBILITY															
105 METEOROLOGICAL PHENOMENA															
200 OCEAN ENVIRONMENT															
201 PHYSICAL/CHEMICAL PROPERTIES			●		●				●		●				
202 CURRENTS															
203 INTERNAL WAVES									●						
204 BIOLOGICAL ASPECTS									●						
205 CORROSION ASPECTS															
300 SEAFLOOR ENVIRONMENT															
301 BOTTOM TOPOGRAPHY															
302 SUB-BOTTOM GEOLOGICAL STRUCTURE															
303 GEOMORPHOLOGY															
304 GEOTECHNICAL PROPERTIES															
305 GEOPHYSICAL PROPERTIES															
306 SEISMIC ACTIVITY															
307 BIOLOGICAL ASPECTS															
308 SEAFLOOR/FOUNDATION INTERACTION															
309 SEA/SEAFLOOR INTERFACE															
400 AIR/SEA/LAND INTERFACE															
401 SURFACE WAVES (DEEP WATER)			●		●				●		●				
402 WAVES (SHALLOW/RESTRICTED WATERS)			●		●				●		●				
403 SEA ICE			●		●				●		●				
404 LITTORAL TRANSPORT															
405 EROSION															
406 RIVER DISCHARGE															
407 SEA LEVEL VARIATION															
408 SHORE CHARACTERISTICS															

UTILITIES AND ACCESS SYSTEMS FOR BMSS

ENVIRONMENTAL ASPECTS	OCEAN FACILITIES ENGINEERING	200 DESIGN AND PLANNING	210 CONCEPT DEFINITION AND SELECTION	220 PRELIMINARY DESIGN AND PLANNING	221 PRELIMINARY DESIGN	222 PRELIMINARY PLANNING	223 PRELIM DESIGN AND PLAN'G REVIEW	230 DETAILED DESIGN, DEV AND PLANNING	231 DESIGN AND ANALYSIS	232 DRAWINGS AND SPECIFICATIONS	233 DEVELOPMENT TESTING AND SURVEYS	234 PLANNING	235 DETAILED ENGINEERING REVIEW	236 DESIGN DOCUMENTATION	240 REPORTS
100 ATMOSPHERIC ENVIRONMENT															
101 PHYSICAL PROPERTIES			●		●	●			●		●	●			
102 WINDS			●		●	●			●		●	●			
103 PRECIPITATION															
104 VISIBILITY															
105 METEOROLOGICAL PHENOMENA															
200 OCEAN ENVIRONMENT															
201 PHYSICAL/CHEMICAL PROPERTIES															
202 CURRENTS															
203 INTERNAL WAVES															
204 BIOLOGICAL ASPECTS															
205 CORROSION ASPECTS									●						
300 SEAFLOOR ENVIRONMENT															
301 BOTTOM TOPOGRAPHY															
302 SUB-BOTTOM GEOLOGICAL STRUCTURE															
303 GEOMORPHOLOGY															
304 GEOTECHNICAL PROPERTIES															
305 GEOPHYSICAL PROPERTIES															
306 SEISMIC ACTIVITY															
307 BIOLOGICAL ASPECTS															
308 SEAFLOOR/FOUNDATION INTERACTION															
309 SEA/SEAFLOOR INTERFACE															
400 AIR/SEA/LAND INTERFACE															
401 SURFACE WAVES (DEEP WATER)			●		●	●			●		●	●			
402 WAVES (SHALLOW/RESTRICTED WATERS)			●		●	●			●		●	●			
403 SEA ICE			●		●	●			●		●	●			
404 LITTORAL TRANSPORT															
405 EROSION															
406 RIVER DISCHARGE															
407 SEA LEVEL VARIATION															
408 SHORE CHARACTERISTICS															

PRIMARY STRUCTURE FOR SCS

ENVIRONMENTAL ASPECTS	OCEAN FACILITIES ENGINEERING	200 DESIGN AND PLANNING	210 CONCEPT DEFINITION AND SELECTION	220 PRELIMINARY DESIGN AND PLANNING	221 PRELIMINARY DESIGN	222 PRELIMINARY PLANNING	223 PRELIM DESIGN AND PLAN'G REVIEW	230 DETAILED DESIGN, DEV AND PLANNING	231 DESIGN AND ANALYSIS	232 DRAWINGS AND SPECIFICATIONS	233 DEVELOPMENT TESTING AND SURVEYS	234 PLANNING	235 DETAILED ENGINEERING REVIEW	236 DESIGN DOCUMENTATION	240 REPORTS
100 ATMOSPHERIC ENVIRONMENT															
101 PHYSICAL PROPERTIES			●		●				●			●			
102 WINDS			●		●				●			●			
103 PRECIPITATION															
104 VISIBILITY															
105 METEOROLOGICAL PHENOMENA															
200 OCEAN ENVIRONMENT															
201 PHYSICAL/CHEMICAL PROPERTIES			●		●	●					●				
202 CURRENTS			●		●	●			●		●				
203 INTERNAL WAVES									●						
204 BIOLOGICAL ASPECTS									●						
205 CORROSION ASPECTS															
300 SEAFLOOR ENVIRONMENT															
301 BOTTOM TOPOGRAPHY															
302 SUB-BOTTOM GEOLOGICAL STRUCTURE															
303 GEOMORPHOLOGY															
304 GEOTECHNICAL PROPERTIES															
305 GEOPHYSICAL PROPERTIES															
306 SEISMIC ACTIVITY															
307 BIOLOGICAL ASPECTS															
308 SEAFLOOR/FOUNDATION INTERACTION															
309 SEA/SEAFLOOR INTERFACE															
400 AIR/SEA/LAND INTERFACE															
401 SURFACE WAVES (DEEP WATER)			●		●				●			●		●	
402 WAVES (SHALLOW/RESTRICTED WATERS)			●		●				●			●		●	
403 SEA ICE			●		●				●			●		●	
404 LITTORAL TRANSPORT															
405 EROSION															
406 RIVER DISCHARGE															
407 SEA LEVEL VARIATION															
408 SHORE CHARACTERISTICS															

ANCHORING SYSTEMS FOR SCS

ENVIRONMENTAL ASPECTS	OCEAN FACILITIES ENGINEERING	200 DESIGN AND PLANNING	210 CONCEPT DEFINITION AND SELECTION	220 PRELIMINARY DESIGN AND PLANNING	221 PRELIMINARY DESIGN	222 PRELIMINARY PLANNING	223 PRELIM DESIGN AND PLAN'G REVIEW	230 DETAILED DESIGN DEV AND PLANNING	231 DESIGN AND ANALYSIS	232 DRAWINGS AND SPECIFICATIONS	233 DEVELOPMENT TESTING AND SURVEYS	234 PLANNING	235 DETAILED ENGINEERING REVIEW	236 DESIGN DOCUMENTATION	240 REPORTS
100 ATMOSPHERIC ENVIRONMENT															
101 PHYSICAL PROPERTIES															
102 WINDS															
103 PRECIPITATION															
104 VISIBILITY															
105 METEOROLOGICAL PHENOMENA															
200 OCEAN ENVIRONMENT															
201 PHYSICAL/CHEMICAL PROPERTIES															
202 CURRENTS															
203 INTERNAL WAVES															
204 BIOLOGICAL ASPECTS			●	●	●	●	●		●						
205 CORROSION ASPECTS															
300 SEAFLOOR ENVIRONMENT															
301 BOTTOM TOPOGRAPHY			●	●	●	●	●	●	●	●	●	●			
302 SUB-BOTTOM GEOLOGICAL STRUCTURE			●	●	●	●	●	●	●	●	●	●			
303 GEOMORPHOLOGY															
304 GEOTECHNICAL PROPERTIES			●	●	●	●	●	●	●	●	●	●			
305 GEOPHYSICAL PROPERTIES			●	●	●	●	●	●	●	●	●	●			
306 SEISMIC ACTIVITY															
307 BIOLOGICAL ASPECTS			●	●	●	●	●	●	●	●	●	●			
308 SEAFLOOR/FOUNDATION INTERACTION															
309 SEA/SEAFLOOR INTERFACE															
400 AIR/SEA/LAND INTERFACE															
401 SURFACE WAVES (DEEP WATER)															
402 WAVES (SHALLOW/RESTRICTED WATERS)															
403 SEA ICE															
404 LITTORAL TRANSPORT															
405 EROSION															
406 RIVER DISCHARGE															
407 SEA LEVEL VARIATION															
408 SHORE CHARACTERISTICS															

PAYLOAD ACCOMMODATIONS FOR BMSS AND SCS

ENVIRONMENTAL ASPECTS	OCEAN FACILITIES ENGINEERING	200 DESIGN AND PLANNING	210 CONCEPT DEFINITION AND SELECTION	220 PRELIMINARY DESIGN AND PLANNING	221 PRELIMINARY DESIGN	222 PRELIMINARY PLANNING	223 PRELIM DESIGN AND PLAN'G REVIEW	230 DETAILED DESIGN, DEV AND PLANNING	231 DESIGN AND ANALYSIS	232 DRAWINGS AND SPECIFICATIONS	233 DEVELOPMENT TESTING AND SURVEYS	234 PLANNING	235 DETAILED ENGINEERING REVIEW	236 DESIGN DOCUMENTATION	240 REPORTS
100 ATMOSPHERIC ENVIRONMENT															
101 PHYSICAL PROPERTIES			●		●	●			●		●	●			
102 WINDS			●		●	●			●		●	●			
103 PRECIPITATION						●			●			●			
104 VISIBILITY						●			●			●			
105 METEOROLOGICAL PHENOMENA															
200 OCEAN ENVIRONMENT			●		●	●			●		●	●			
201 PHYSICAL/CHEMICAL PROPERTIES			●		●	●			●		●	●			
202 CURRENTS			●		●	●			●		●	●			
203 INTERNAL WAVES					●				●						
204 BIOLOGICAL ASPECTS															
205 CORROSION ASPECTS															
300 SEAFLOOR ENVIRONMENT															
301 BOTTOM TOPOGRAPHY															
302 SUB-BOTTOM GEOLOGICAL STRUCTURE															
303 GEOMORPHOLOGY															
304 GEOTECHNICAL PROPERTIES															
305 GEOPHYSICAL PROPERTIES															
306 SEISMIC ACTIVITY															
307 BIOLOGICAL ASPECTS															
308 SEAFLOOR/FOUNDATION INTERACTION															
309 SEA/SEAFLOOR INTERFACE															
400 AIR/SEA/LAND INTERFACE			●		●	●			●		●	●			
401 SURFACE WAVES (DEEP WATER)			●		●	●			●		●	●			
402 WAVES (SHALLOW/RESTRICTED WATERS)			●		●	●			●		●	●			
403 SEA ICE															
404 LITTORAL TRANSPORT															
405 EROSION															
406 RIVER DISCHARGE															
407 SEA LEVEL VARIATION															
408 SHORE CHARACTERISTICS															

SAFETY SYSTEMS FOR BMSS

OCEAN FACILITIES ENGINEERING

ENVIRONMENTAL ASPECTS	200 DESIGN AND PLANNING	210 CONCEPT DEFINITION AND SELECTION	220 PRELIMINARY DESIGN AND PLANNING	221 PRELIMINARY DESIGN	222 PRELIMINARY PLANNING	223 PRELIM DESIGN AND PLAN'G REVIEW	230 DETAILED DESIGN, DEV AND PLANNING	231 DESIGN AND ANALYSIS	232 DRAWINGS AND SPECIFICATIONS	233 DEVELOPMENT TESTING AND SURVEYS	234 PLANNING	235 DETAILED ENGINEERING REVIEW	236 DESIGN DOCUMENTATION	240 REPORTS
100 ATMOSPHERIC ENVIRONMENT														
101 PHYSICAL PROPERTIES														
102 WINDS		●		●	●			●		●	●			
103 PRECIPITATION		●		●	●			●		●	●			
104 VISIBILITY		●		●	●			●		●	●			
105 METEOROLOGICAL PHENOMENA		●		●	●			●		●	●			
200 OCEAN ENVIRONMENT														
201 PHYSICAL/CHEMICAL PROPERTIES														
202 CURRENTS		●		●	●			●		●	●			
203 INTERNAL WAVES		●		●	●			●		●	●			
204 BIOLOGICAL ASPECTS														
205 CORROSION ASPECTS														
300 SEAFLOOR ENVIRONMENT														
301 BOTTOM TOPOGRAPHY														
302 SUB-BOTTOM GEOLOGICAL STRUCTURE														
303 GEOMORPHOLOGY														
304 GEOTECHNICAL PROPERTIES														
305 GEOPHYSICAL PROPERTIES														
306 SEISMIC ACTIVITY														
307 BIOLOGICAL ASPECTS														
308 SEAFLOOR/FOUNDATION INTERACTION														
309 SEA/SEAFLOOR INTERFACE														
400 AIR/SEA/LAND INTERFACE														
401 SURFACE WAVES (DEEP WATER)		●		●	●			●		●	●			
402 WAVES (SHALLOW/RESTRICTED WATERS)		●		●	●			●		●	●			
403 SEA ICE		●		●	●			●		●	●			
404 LITTORAL TRANSPORT														
405 EROSION														
406 RIVER DISCHARGE														
407 SEA LEVEL VARIATION														
408 SHORE CHARACTERISTICS														

PROTECTIVE SYSTEMS FOR BMSS AND SCS

ENVIRONMENTAL ASPECTS	OCEAN FACILITIES ENGINEERING	200 DESIGN AND PLANNING	210 CONCEPT DEFINITION AND SELECTION	220 PRELIMINARY DESIGN AND PLANNING	221 PRELIMINARY DESIGN	222 PRELIMINARY PLANNING	223 PRELIM DESIGN AND PLAN'G REVIEW	230 DETAILED DESIGN, DEV AND PLANNING	231 DESIGN AND ANALYSIS	232 DRAWINGS AND SPECIFICATIONS	233 DEVELOPMENT TESTING AND SURVEYS	234 PLANNING	235 DETAILED ENGINEERING REVIEW	236 DESIGN DOCUMENTATION	240 REPORTS
100 ATMOSPHERIC ENVIRONMENT															
101 PHYSICAL PROPERTIES			●		●	●			●		●	●			
102 WINDS			●		●	●			●		●	●			
103 PRECIPITATION			●		●	●			●		●	●			
104 VISIBILITY															
105 METEOROLOGICAL PHENOMENA															
200 OCEAN ENVIRONMENT															
201 PHYSICAL/CHEMICAL PROPERTIES															
202 CURRENTS															
203 INTERNAL WAVES															
204 BIOLOGICAL ASPECTS			●		●	●			●		●	●			
205 CORROSION ASPECTS			●		●	●			●		●	●			
300 SEAFLOOR ENVIRONMENT															
301 BOTTOM TOPOGRAPHY															
302 SUB-BOTTOM GEOLOGICAL STRUCTURE															
303 GEOMORPHOLOGY															
304 GEOTECHNICAL PROPERTIES															
305 GEOPHYSICAL PROPERTIES															
306 SEISMIC ACTIVITY															
307 BIOLOGICAL ASPECTS															
308 SEAFLOOR/FOUNDATION INTERACTION															
309 SEA/SEAFLOOR INTERFACE															
400 AIR/SEA/LAND INTERFACE															
401 SURFACE WAVES (DEEP WATER)															
402 WAVES (SHALLOW/RESTRICTED WATERS)			●		●	●			●		●	●			
403 SEA ICE															
404 LITTORAL TRANSPORT															
405 EROSION															
406 RIVER DISCHARGE			●		●	●			●		●	●			
407 SEA LEVEL VARIATION															
408 SHORE CHARACTERISTICS															

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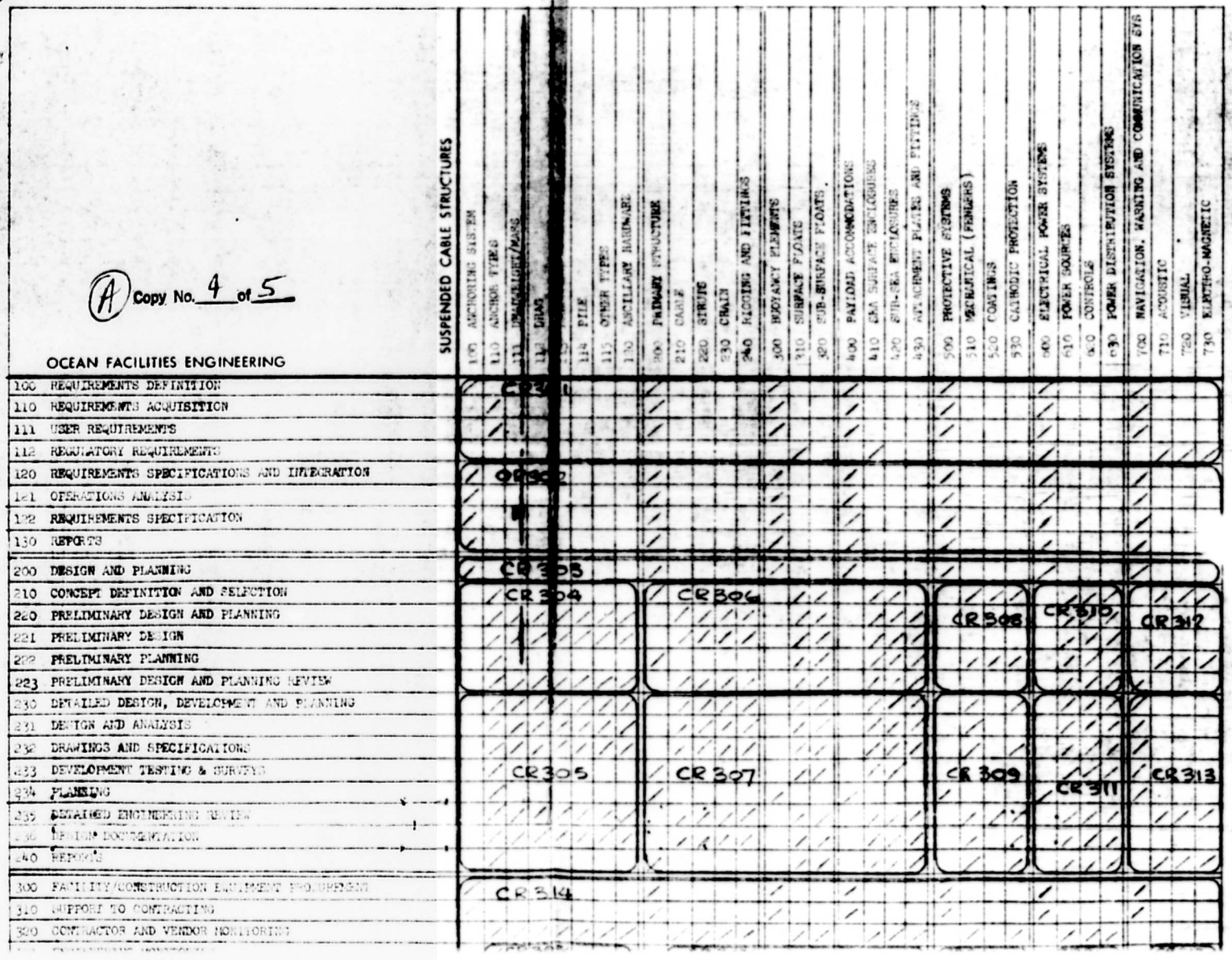
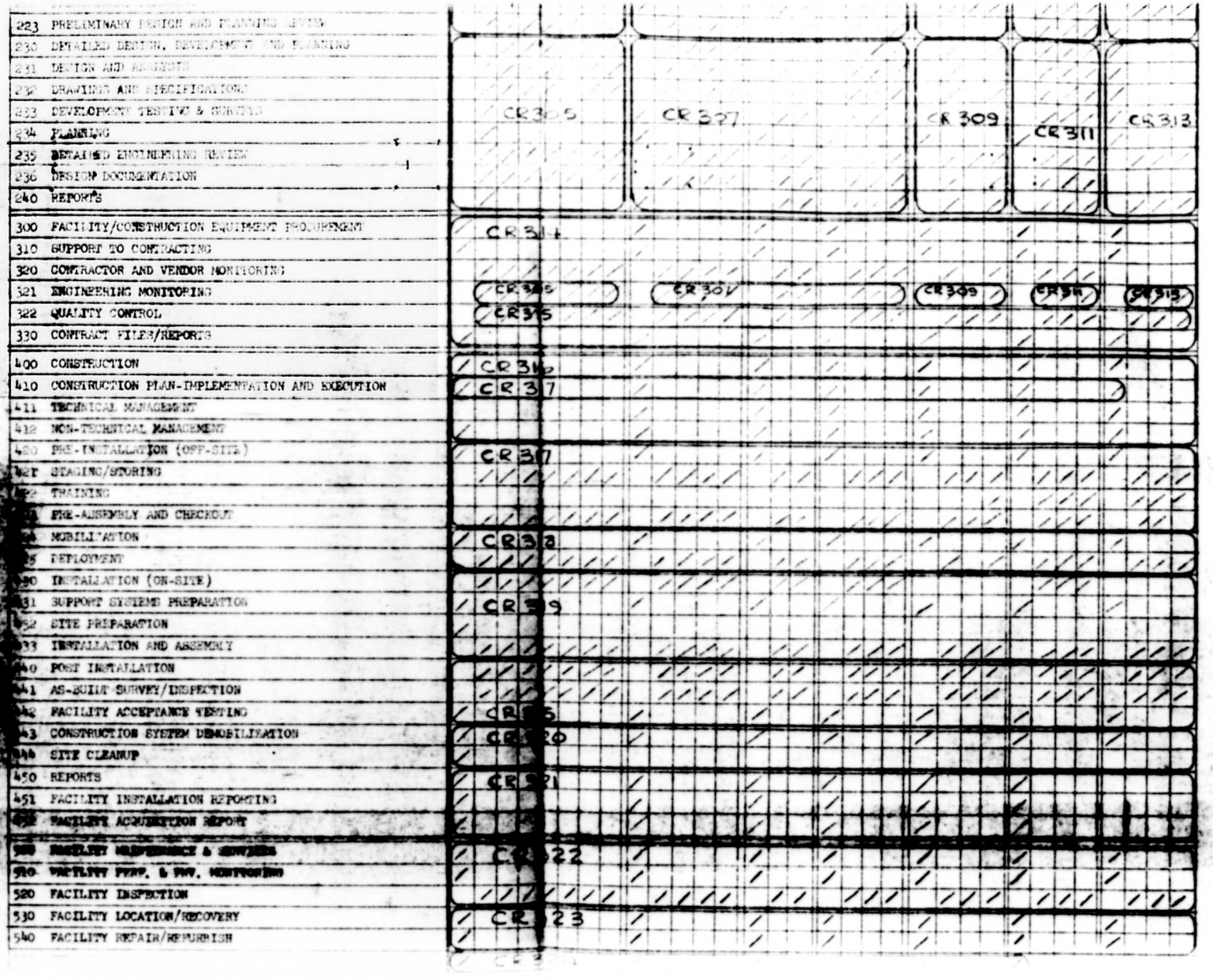
(A) Copy No. 4 of 5





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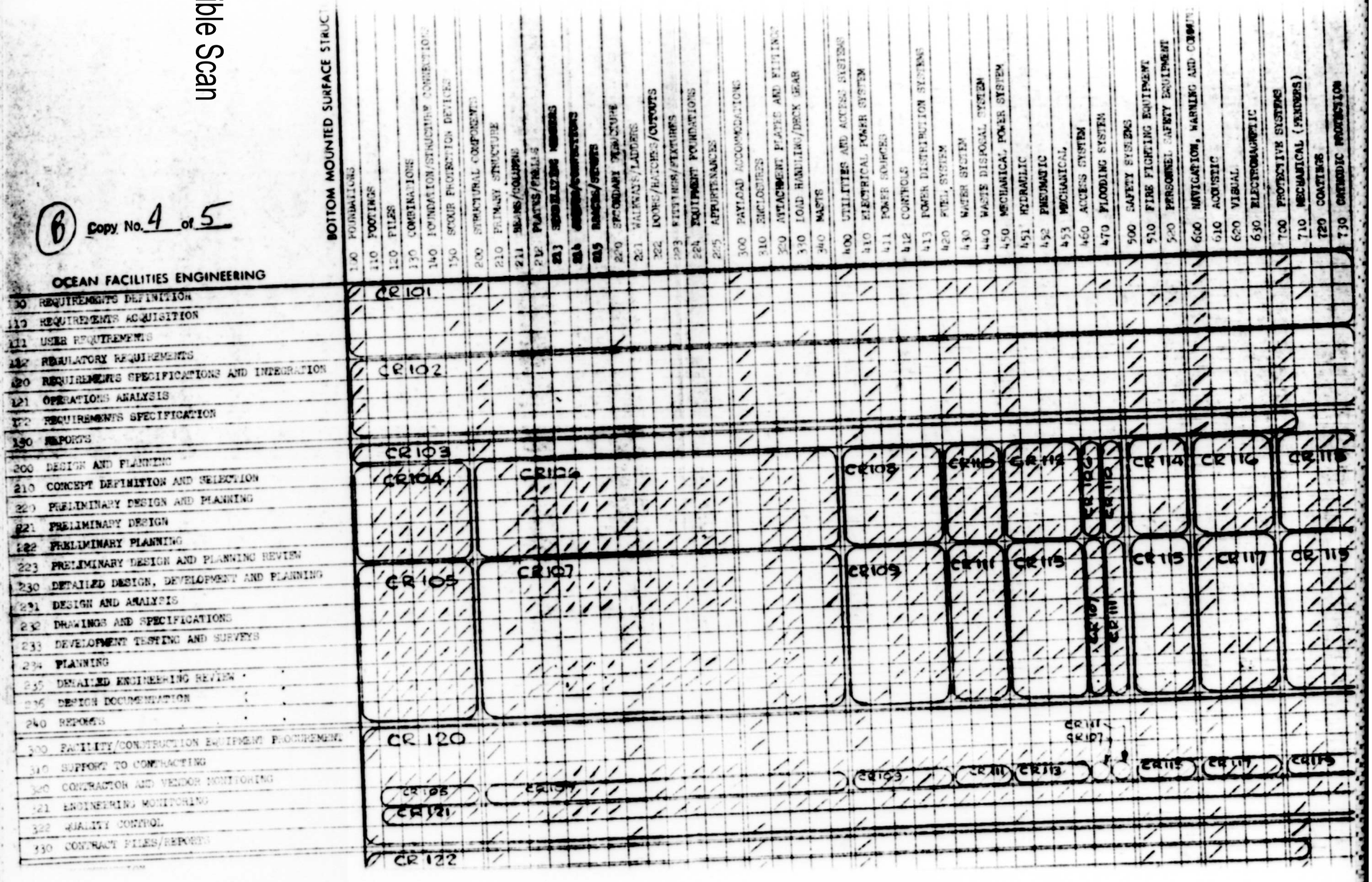

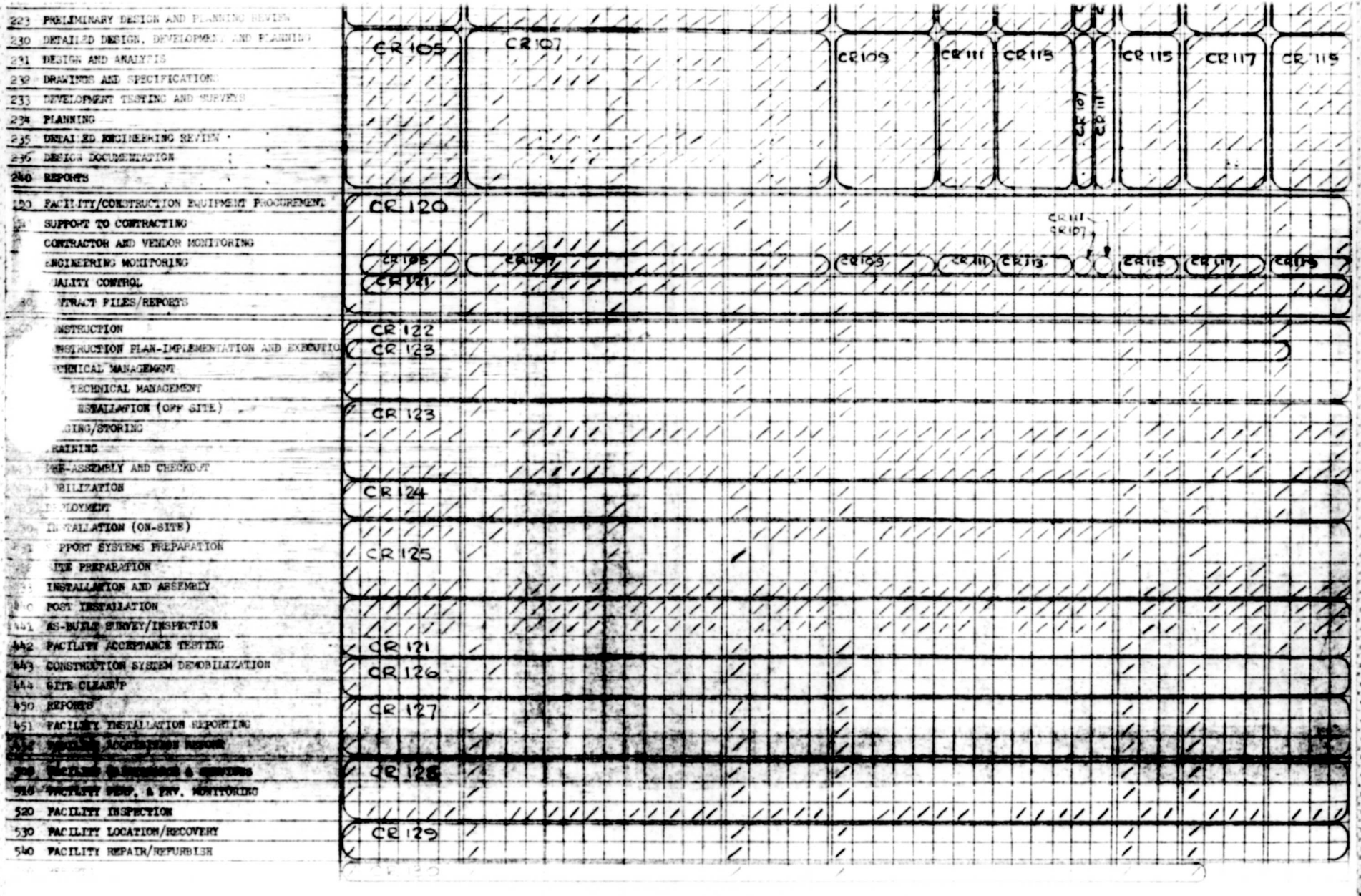

Best Possible Scan

Best Possible Scan

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SUSPENDED CABLE STRUCTURES

- 100 ANCHORING SYSTEM
- 110 ANCHOR TYPES
- 111 DEADWEIGHT/MASS
- 112 DRAG
- 113 EMBEDMENT
- 114 PILE
- 115 OTHER TYPES
- 120 ANCILLARY HARDWARE
- 200 PRIMARY STRUCTURE
- 210 CABLE
- [illegible]
- [illegible] CHAIN
- [illegible] RIGGING AND FITTINGS
- [illegible]
- [illegible]
- [illegible]
- [illegible]
- [illegible]
- [illegible]
- [illegible] ATTACHMENT CLAMPS AND FITTINGS
- [illegible] PROTECTIVE SYSTEMS
- [illegible] MECHANICAL (FAIRINGS)
- [illegible] COATINGS
- [illegible] CATHODIC PROTECTION
- 600 ELECTRICAL POWER SYSTEMS
- [illegible] POWER SOURCES
- [illegible] CONTROLS
- [illegible] POWER DISTRIBUTION SYSTEMS
- 700 NAVIGATION, WARNING AND COMMUNICATION SYSTEMS
- 710 ACOUSTIC
- 720 VISUAL
- 730 ELECTRO-MAGNETIC

ENVIRONMENTAL ASPECTS

- 100 ATMOSPHERIC ENVIRONMENT
- 101 PHYSICAL PROPERTIES
- 102 WINDS
- [illegible] PRECIPITATION
- [illegible] VISIBILITY
- [illegible] METEOROLOGICAL PHENOMENA
- 200 OCEAN ENVIRONMENT
- 201 PHYSICAL/CHEMICAL PROPERTIES
- 202 CURRENTS
- 203 INTERNAL WAVES
- [illegible] BIOLOGICAL ASPECTS
- [illegible] CORROSION ASPECTS
- [illegible] SEAFLOOR ENVIRONMENT
- [illegible] BOTTOM TOPOGRAPHY
- [illegible] SUB-BOTTOM GEOLOGICAL STRUCTURE
- [illegible] GEOMORPHOLOGY
- [illegible]
- [illegible]
- [illegible]
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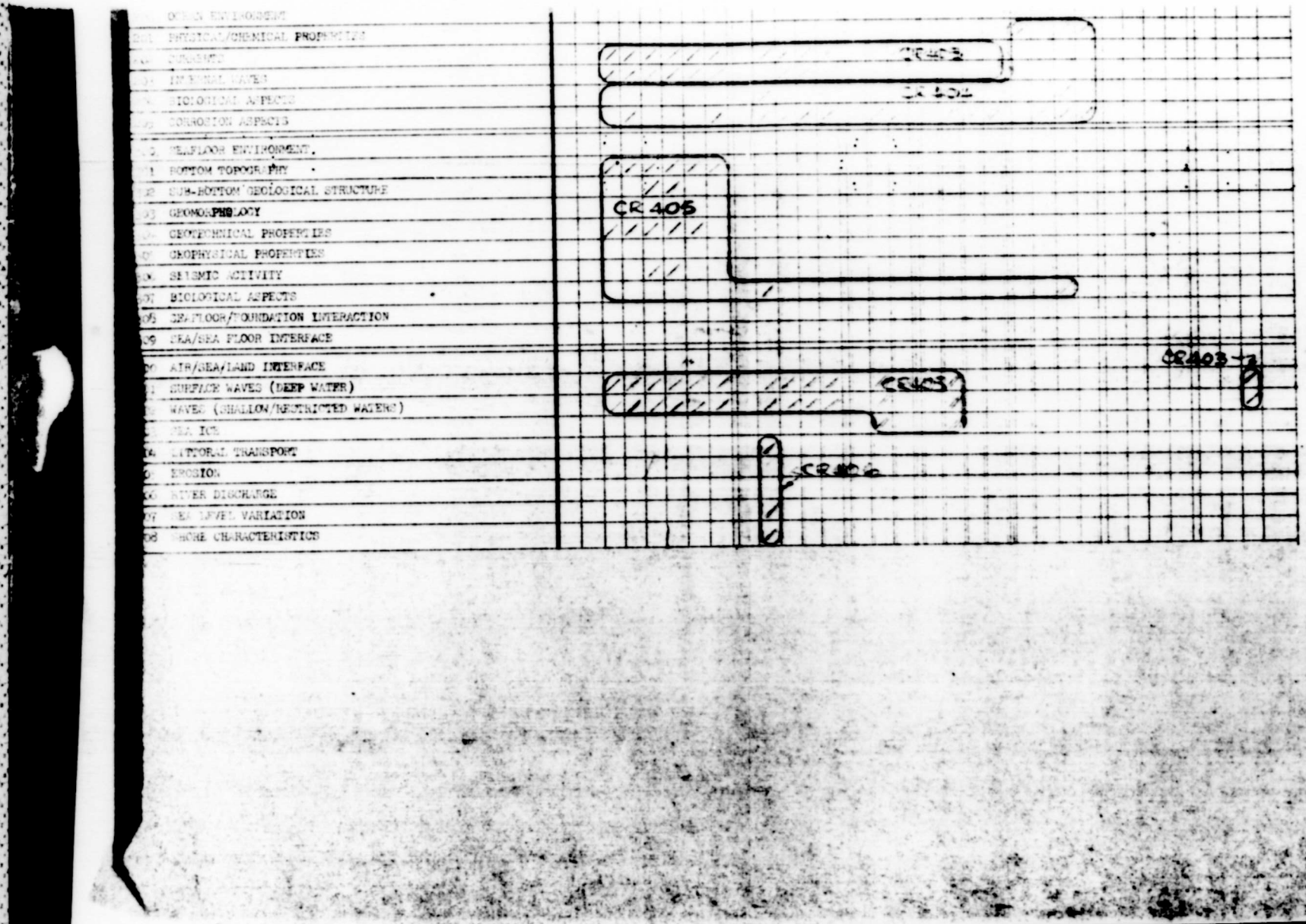
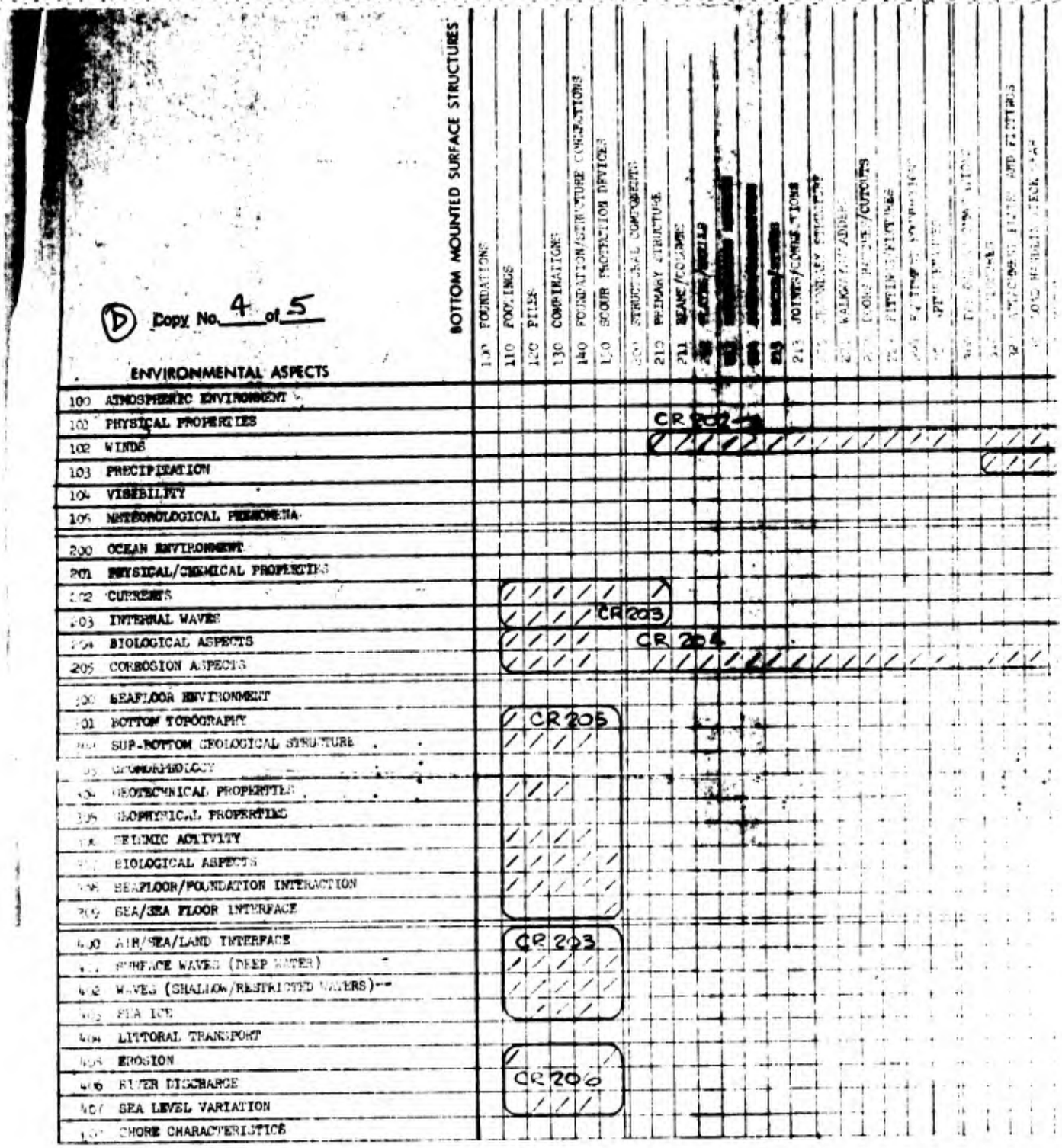
CR 301

CR 402

CR 201





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