SEA GRANT PROJECT OFFICE

DIRECTORY OF M.I.T. RESEARCH PROJECTS

RELATED TO MARINE RESOURCES,

OCEAN UTILIZATION AND COASTAL ZONE DEVELOPMENT

Compiled by
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INTRODUCTION

There are many and varied research efforts throughout M.I.T. that are related to the general categories of Marine Resources, Ocean Utilization and Coastal Zone Development. As such, all have a wide interest to the National Sea Grant Program but only a relatively small portion of this related research is Sea Grant sponsored. At present, broad dissemination of research results is given to the Sea Grant sponsored projects but the balance of the related efforts may or may not receive equal coverage.

In keeping with the Institute mandate that M.I.T.'s Sea Grant Project Office serve as a focal point for all Sea Grant related efforts at M.I.T., this Directory of Related Research Projects has been developed. The objectives for the directory are to create a general awareness of and to provide identification and ready reference to the many Sea Grant related research projects at M.I.T.

This directory has been made possible by the cooperation, support and contribution of the Industrial Liaison Office and is largely a specialized extraction and adaptation from their Directory of Current Research.* This Sea Grant related research directory will be maintained current by the M.I.T. Marine Resources Reading and Reference Center and will be re-issued semi-annually or annually as changes demand. Additional information on specific research topics can be obtained through the Marine Resources Reading and Reference Center.

It is recognized that this first Sea Grant Related Research Directory issue may have omitted some related projects and this we regret. This Sea Grant Project Office will welcome any suggestions for improvement of the directory format and data content as well as the identification of any other Marine Resources, Ocean Utilization and Coastal Zone Development research efforts. Pre-addressed tear-out sheets, the last two pages of this Directory, are included to facilitate (1) general comment and (2) data submission for projects to be included.

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Alfred A. H. Keil
Director
M.I.T. Sea Grant Program

Cambridge, Massachusetts
June 1971

* Distribution of the Directory of Current Research is limited to participating members of the Industrial Liaison Program.

Number	Title	Principal Person	Department	Others Involved	Brief Description
SG 70001	Computational Fluid Dynamics	Oliver	Aero and Astro	--------	Methods of using computers in fluid dynamics experiments as numerical and non-numerical computational aids. Emphasis is on interactive capabilities utilizing displays of flow fields and illustrations from internal and external aerodynamics including two-and three-dimensional transonic flow through turbomachine cascades.
70002	Mechanical Behavior of Composite Materials	Mar Pian	Aero and Astro	Orringer	The mechanical behavior of heterogeneous, bonded mixtures of ductile and brittle metals and other materials. Research presently is focused on compressive failure modes in models of ductile and brittle fiber composites. The possibility of using laser techniques for measurement of small deformations is being investigated.
70003	Mechanics of Fibrous Composite Materials	Pian	Aero and Astro	Boland Budde Kotanchik Grossman Cuerdan	Development of methods for analysis and design of laminated fibrous composite structures.

Number	Title	Principal Person	Department	Others Involved	Brief Description
SG 70004	Man-Vehicle Control Simulation	Young	Aero and Astro	Meiry	Laboratory studies of human operator response in vehicle control. Flight simulators and a hybrid computer are used to simulate situations including helicopter hovering, booster rocket control, aircraft blind landings and automobile driving. These studies are performed in conjunction with more basic research on biological subsystems and human operator models.
70005	Life Support Systems	Young	Aero and Astro	Meiry	Studies directed to the problem of providing suitable artificial environments for space flight and other ventures by man into hostile surroundings. The man-environment system is treated as an advanced engineering problem with areas of closed ecological systems, atmospheric mixtures and personnel propulsion units coming under study.
70006	Trace Metals in Sea Water	Hume	Chemistry	Gilbert	Development of high-sensitivity electrochemical methods for the quantitative measurement of trace metal concentrations in the ocean and elucidation of the chemical nature of the species involved.

Number	Title	Principal Person	Department	Others Involved	Brief Description
SG 70007	Water Resources Development in Argentina	Perkins	Civil Engineering	Schaake Marks Major	Mathematical models for use in river basin planning in Argentina. A three-level hierarchy of models is planned as follows: Level I, Models for Economic Planning and Objectives Level II, Screening and Optimization Models; Level III, Models of the Physical System.
70008	Multi-Objective Redesign of the Big Walnut Project	Major	Civil Engineering	--------	Revision of a report on the feasibility of multi-objective planning techniques for water resources projects. Report presents methods for considering alternative project designs in terms of various social objectives.
70009	M.I.T.-Argentina River Basin Planning Project	Major	Civil Engineering	Schaake Marks	A river basin planning manual for multi-objective planning on the basis of a detailed case study of the application of economic, engineering, and mathematical models to the Rio Colorado, Argentina.

Number	Title	Principal Person	Department	Others Involved	Brief Description
SG 70010	Thermal Stratification and Water Quality in Lakes and Reservoirs	Harleman	Civil Engineering	Markofsky	Prediction of seasonal variations of vertical temperature distribution, outflow temperature and concentration of water quality parameters for a lake or reservoir. The mathematical models have been developed and verified by comparison measurements of a laboratory reservoir and field measurements for temperature and dissolved oxygen.
70011	Sediment Suspension in Free Surface Flow	Ippen	Civil Engineering	Montez Petroni	Effect of sediment on the properties of a turbulent free surface flow. The non-uniform distribution of sediments of various properties over the depth of the flow is coupled to changes in the state of turbulence, of boundary resistence, of mean velocity distribution and depth for a given mass-rate of flow of the two-phase system. An instrument to measure relative concentration of sediment by means of laser beams has been developed.

Number	Title	Principal Person	Department	Others Involved	Brief Description
SG 70012	Wave Interaction with Coastal Structures	Cross III	Civil Engineering	Sollitt Wilson	Interaction of water waves with coastal structures. The basic problem under consideration is the transmission of ocean waves past breakwaters, both by overtopping and by penetration through a rubble breakwater.
70013	Operational and Research Uses of Radar in Hydrology	Eagleson	Civil Engineering	Grayman	Value of better rainfall information in flood forecasting, water yield and other hydrologic problems. The advantage of using radar instead of raingages is being examined.
70014	Salinity Intrusion in Estuaries	Harleman	Civil Engineering	Ditmars Thatcher	Analysis of salinity intrusion in tidal estuaries. Finite difference mathematical model of mass transfer equation is used for both one- and two-dimensional conditions of unsteady salinity intrusion due to tidal motion and variation in fresh water discharge.

Number	Title	Principal Person	Department	Others Involved	Brief Description
SG 70015	Thermal Effects Associated with Nuclear Power Plants	Harleman	Civil Engineering	Stolzenbach Jirka Dulskis	Thermal pollution associated with the intake and discharge of heated condenser water from nuclear power plants. Methods of preventing recirculation and of inducing mixing of thermal discharges are under investigation.
70016	Real-Time Model for Estuarine Water Quality Prediction	Harleman	Civil Engineering	Quinlan Dailey	Numerical solution by finite difference techniques of the longitudinal distribution of water quality parameters in an estuary. The mathematical model includes non-linear effects such as variable area, variable dispersion and the instantaneous tidal velocity.
70017	Thermal Generating Facilities	Marks	Civil Engineering	-------	Mathematical models for investigation of the location of thermal generating facilities subject to efficiency requirements. These models are used to show the sensitivity of site selection to various paramters including environmental standards and policy constraints.

Number	Title	Principal Person	Department	Others Involved	Brief Description
SG 70018	Movement and Mixing of Water Injected Into Aquifers	Gelhar	Civil Engineering	Wilson Miller	Analytical and experimental study of the replenishment of ground water aquifers by means of recharge wells. The study considers the effect of dispersion (mixing) between injected water and the native water of the aquifer. The influence of density variations is also being studied.
70019	Interaction of Tides, Freshwater Discharge, and Sedimentation	Ippen	Civil Engineering	Cross Fisher	Transport, deposition, and erosion characteristics of sediments and of salinity intrusion in the Lake Maracaibo Navigation Channel, and the interaction of salinity currents and sediment transport. Extensive field data are being collected and analyzed.
70020	Oil Pollution Control	Cross	Civil Engineering	Hoult Milgram	The behavior of oil slick containment and collection devices in the presence of winds, currents, and waves. More effective methods of control are being developed.

Number	Title	Principal Person	Department	Others Involved	Brief Description
SG 70021	Effects on Topography on Random Water Waves	Mei	Civil Engineering	Unluata Ippen	Scattering of random waves by large submarine irregularities (shelves, islands, etc.) or man-made structures. Force and moment spectra including spectral changes caused by variable bottoms are calculated.
70022	Surface Waves	Mei	Civil Engineering	Chen	Surface wave interaction with large structures. Theoretical aspects of a wave field produced by the scattering of surface or bottom obstacles of various cross-sections. Wave forces and moment on bodies are analyzed.
70023	Mathematical Water Quality Planning Models	Schaake	Civil Engineering	--------	Three mathematical models to determine optimal schemes for investing in facilities to control water quality in Boston Harbor. Feasible facilities include storage space to store combined sewer overflows, treatment facilities for treating municipal and industrial wastes, and diversion facilities for distributing wastes throughout the Harbor. Models include: a mathematical programming model for determining optimal investment schemes, a waste transport model for estimating coefficients for the mathematical pro- (cont.)

Number	Title	Principal Person	Department	Others Involved	Brief Description
SG 70023 (cont)	Mathematical Water Quality Planning Models	Schaake	Civil Engineering	--------	gramming model and a tidal current model for estimating currents for the waste transport model.
70024	Reinforced Plastics	McGarry	Civil Engineering	--------	A study of the ways in which the properties of fiberglass resin composites are influenced by resin glass filament characteristics, surface treatments, wear geometry, and cure conditions. Unique methods of resin modification to prevent microcracking have been devised.
70025	Economic Modeling	Seifert	Commodity Transport Lab	Keminski	A model of the economy of a developing nation that identifies efficient growth. The model allows one to inject changes into the system to determine long term effects which is useful in directing development.
70026	Ocean Movement of Bulk Commodities	Devanney	Commodity Transport Lab	Patell	The relation between constant value of bulk commodities and ocean transportation costs. Particular reference is placed on the trend of bulk ship charter rates and the effects thereof.

Number	Title	Principal Person	Department	Others Involved	Brief Description
SG 70027	Ocean Resource Exploitation and Sea Transportation	Devanney	Commodity Transport Lab	Lassiter	An overall model indicating the effects and potential dislocations of ocean transportation systems and requirements resulting from major ocean resource exploitations such as petroleum and gas.
70028	South American West Coast Ocean Transport Rates	Devanney	Commodity Transport Lab	Livanos	The history and economic factors relating to the determination of conference rates and the potential for influencing such rates to the benefit of the various economies on the West Coast of South America.
70029	Ship to Shore Transport Simulation	Frankel	Commodity Transport Lab	Chryssos-tomidis	A model to represent and analyze the effectiveness and use of ship to shore transfer in developed or non-developed ports.
70030	Coastal Feeders and Port Model	Frankel	Commodity Transprot Lab	Randall	A general model of the effect of foreign trade freight rates on coastal transport and port development.

Number	Title	Principal Person	Department	Others Involved	Brief Description
SG 70031	Ship Systems Model	Frankel	Commodity Transport Lab	Cooper	A methodology for the effective establishment of ship system specifications which integrate design, production, and operational parameters.
70032	Ocean Transportation Systems Study	Frankel	Commodity Transport Lab	Drooker	A technological evaluation of current and future ocean transportation requirements in terms of ships, port, cargo handling, storage, information, and control technology. Technological voids and applications of novel technology are identified.
70033	Future of Atlantic Ports	Frankel	Commodity Transport Lab	Milas	A regional, integrated transportation study of foreign trade movement requirements in the period 1970-1990 and the resulting affects on existing ports and port requirements.
70034	Inertial Sensors	Woodbury	Draper Lab	Denhard Sappupo Hall	Development of inertial sensors to meet the requirements of high quality control, navigation and guidance systems adaptable to marine, aeronautical and astronautical vehicles of all kinds. This effort includes studies to add to knowledge concerning fundamental principles of inertial (cont.)

Number	Title	Principal Person	Department	Others Involved	Brief Description
SG 70034 (cont.)	Inertial Sensors	Woodbury	Draper Lab	Denhard Sappupo Hall	sensing, control theory and spatial reference coordinate systems as they apply to vehicle guidance problems. The engineering realization of inertial sensors which advance the state of the art is a prime concern.
70035	Deep Submergence Control and Navigation	Houston	Draper Lab	-------	Design of control and navigation systems to optimize the man-machine interface of complex undersea vehicles. This includes computer-augumented and computer-aided mission control onboard surface support ships. External sensors are integrated into overall system operation. Synthesis of designs and design verification is accomplished in a six-degree-of-freedom hybrid-computer simulation.
70036	Leak Detection	Toth	Draper Lab	Soikkeli	Leak detection in hermetically sealed packages and components, particularly electronics. New methods of helium leak detection are developed for testing and inspection of equipment for high-humidity corrosive-atmosphere applications.

Number	Title	Principal Person	Department	Others Involved	Brief Description
SG 70037	Buoy Program-Engineering Support	Morey	Draper Lab	-------	Provide engineering support to the Woods Hole Oceanographic Institution effort to develop reliable mooring arrays for oceanographic data acquisition.
70038	Fishery Dynamics Computer Simulation	Suomala	Draper Lab	Gardner	Techniques and appropriate models for forecasting the fisheries market from ocean to consumer as a dynamic process. The simulation is to be used as a resource management tool.
70039	Hydroacoustics Biomass Measurements	Suomala	Draper Lab	Lozow	A systems evaluation study of emanating or backscatter radiation phenomena from acquatic targets (fish). The applicability of various signal processing techniques will be determined with regard to the quality of information relative to target quantity or density. The study is directed at an improved ability to provide resource assesment of acquatic life.

Number	Title	Principal Person	Department	Others Involved	Brief Description
SG 70040	Fish Scale Study	Hursh	Draper Lab	Sutro	A study to determine and evaluate methods to accomplish automatic examination and analysis of the fish scale as a step towards computer-aided determination of scale structure and age, and of fish growth patterns.
70041	Trace Elements in Natural and Experimental Geologic Systems	Frey	Earth and Planetary Sciences	-------	Trace element abundances are determined in a variety of geologic systems. Such data are useful in interpreting the geologic history of rocks. Areas under study are New England, Mid-Atlantic Ridge and ultramafic rock areas throughout the world. Laboratory experiments are done to aid in the understanding of trace element distribution among coexisting phases.
70042	Sediment Transportation by Turbulent Flow	Southard	Earth and Planetary Sciences	--------	Measurement of fluid turbulance in the presence of suspended sediment and the tracing of particle trajectories by special techniques in high-concentration flows to study the interaction between turbulent shear flows and transported sediment particle

Number	Title	Principal Person	Department	Others Involved	Brief Description
SG 70043	Erosion of Marine Bottom Sediments	Southard	Earth and Planetary Sciences	Hollister Young	Erosion and deposition of resedimented abyssal marine sediments by flows of sea water in laboratory flumes to determine critical bottom-current velocity for erosion and to study the development of such ocean-bottom features.
70044	Sediment Mechanics	Southard	Earth and Planetary Sciences	--------	Theoretical and experimental study of sediment ripples and dunes developed by unidirectional flows of liquid over loose sediment beds. Emphasis is on understanding the development of ripples from flat sediment beds and on the transition from small-scale ripples to large scale dunes.
70045	Oceanic Effects of Islands and Topography	Wunsch	Earth and Planetary Sciences	Baines Cocchiome Hogg	Strong mixing of temperature and salinity gradients approaching the island of Bermuda. Additional study includes effects of wave trapping around islands, the breaking of internal waves and radiation stress effects of internal waves. A field study of the effects of the Pacific Equatorial Undercurrent on islands is underway.

Number	Title	Principal Person	Department	Others Involved	Brief Description
SG 70046	Planetary Wave Project	Wunsch	Earth and Planetary Sciences	Stommel	Tide gauge array to detect Rossby waves in the ocean. A joint effort with the Environmental Science Services Administration has led to the installation of a tide gauge array in the Caroline and Marshall Islands in the western Pacific Ocean for the detection of Rossby waves.
70047	Internal Waves in the Maine Thermocline	Wunsch	Earth and Planetary Sciences	Baines Dahlen	Field investigation of the properties of open ocean internal waves, with primary emphasis on finding the generation mechanisms and source distributions. The data is used to design a long-term (5 years) antenna for installation in the Sargasso Sea.
70048	Internal Waves and Tides	Wunsch	Earth and Planetary Sciences	Baines	Mathematical model for the reflection and diffraction of internal/inertial waves. Some consequences of this theory will be tested by comparison with laboratory experiments and observations of deep ocean tides and stratification.

Number	Title	Principal Person	Department	Others Involved	Brief Description
SG 70049	Marine Chemistry and Sedimentary Geochemistry	Burns	Earth and Planetary Sciences	--------	Formation of manganese nodules and the marine process leading to the fractionation of transition elements into nodules. Manganese nodules form deep-sea sediments contain appreciable amounts of cobalt, nickel, and copper. The economic importance of these nodules and their formation is being studied.
70050	CO_2 Systems in Sea Water	Edmond	Earth and Planetary Sciences	---------	Factors which control the levels of dissolved CO_2 and carbonate in the deep ocean, and their effect on biological activity, and inorganic precipitation.
70051	Continuous Measurements of Oceanographic Chemical Variables	Edmond	Earth and Planetary Sciences	----------	Measuring techniques employing electrodes and continuous analysers to obtain continuous profiles of oxygen, phosphate, silicate, and CO_2, content of the ocean. Immediate application is to the Massachusetts Bay Project.

Number	Title	Principal Person	Department	Others Involved	Brief Description
SG 70052	Thermal Regime of a Down-going Slab	Toksoz	Earth and Planetary Sciences	--------	Numerical computation of the temperature field of a down-going slab as a result of oceanfloor spreading.
70053	Geothermal Investigations in Ocean Regions	Simmons	Earth and Planetary Sciences	--------	Investigations to improve our understanding of the dynamic processes within the earth as reflected in the geothermal flux. It is planned to investigate (a) the significant regional heat-flow variations in the Atlantic, and their possible relationships with geologic structure, and (b) the sources of local variability in heat-flow values from the ocean floor, with the aim of improving the interpretation of heat-flow data in some regions.
70054	Ocean Transport: U.S.-Puerto Rico	Harris	Economics	---------	U.S. maritime laws and their effect on ocean shipping between the U.S. and Puerto Rico. The costs under alternative technologies are considered with special emphasis on the economics of containerization. A revision of existing regulatory procedures is proposed.

Number	Title	Principal Person	Department	Others Involved	Brief Description
SG 70055	International Trade Theory	Bhagwati	Economics	--------	Tariffs, exchange control, trade liberalization and related trade theory problems.
70056	Fish Protein Concentrate Plant	Zacharias	Education Research Center	Pariser	Student-directed design and construction of a small-scale plant to process fish into fish protein concentrate for human consumption.
70057	Sonar Device for Mud Penetration	Edgerton	Electrical Engineering	MacRoberts	Development of a mud penetrating sonar device in the power range of 1 watt-second per pulse and 15-30 pps. Emphasis is placed on obtaining desired resolution to give sub-bottom details in sediments.
70058	Elapsed-Time Camera	Edgerton	Electrical Engineering	MacRoberts	Application of elapsed-time motion picture techniques to underwater photography. A camera employing stroboscopic light pulses at intervals of 1/2 to 120 seconds has been developed for operation at depths up to 100 feet. Starfish and urchins are observed to exhibit extraordinary motion when studied by elapsed-time photography at 10 seconds intervals

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SG 70059	Electronic Flash Systems	Edgerton	Electrical Engineering	MacRoberts	Design, development, and study of electronic flash systems capable of short, controllable flashes and the application of these systems to research and engineering.
70060	Rotating Machines with Superconducting Field Windings	Woodson	Electrical Engineering	Smith Thullen Kingsley Kirtley Murphy Lusk Einstein Keim	Superconducting field windings in generators and synchronous condensers in electric power systems. Such machines are projected to be more compact, less costly and have better electrical characteristics than conventional machines. A second generation laboratory scale model is being built.
70061	Fluid Dynamics	Greenspan	Mathematics	Benney	Motion of fluids and gas in rotating coordinate systems with emphasis on problems in oceanography and meterology. Special attention is being directed to the formulation of mathematical descriptions of stratified, viscous, rotating fluids.

Number	Title	Principal Person	Department	Others Involved	Brief Description
SG 70062	Rotating Fluids	Howard	Mathematics	--------	Time dependent rotating fluid motions. The results of this theoretical study are applied to geophysical phenomena.
70063	Thermal Convection	Howard	Mathematics	---------	Theoretical studies of free thermal convection, with emphasis on the turbulent case.
70064	Nonlinear Waves	Benney	Mathematics	---------	Singular perturbation problems related to continuum mechanics. Nonlinear waves and oscillations, the interactions of random waves and their stability are considered.
70065	Oil and Its Spread at Sea	Hoult	Mechanical Engineering	Fay Cross Milgram	The spread of oil on the surface of the ocean. Techniques to control the spread include a bubble curtain.
70066	Oil Pollution in Harbors and Bays	Hoult	Mechanical Engineering	Fay Cross Milgram	Oil pollution problems as they occur in harbors, bays and estuaries.

Number	Title	Principal Person	Department	Others Involved	Brief Description
70067	Oil in the Arctic	Hoult	Mechanical Engineering	Fay Cross Milgram	The spreading of oil spilled over or under arctic ice, associated with operations on the North Slope, appears to require a new technology for oil containment and removal.
70068	Air Cooling Towers for Powerplants	Glicksman	Mechanical Engineering	--------	Direct air-to-fluid cooling towers for conventional power-plants. Emphasis is on novel heat exchanger configurations and materials for inexpensive high performance units.
70069	Stress Corrosion Cracking	Whlig	Metallurgy	--------	A study of the mechanism of stress corrosion cracking in mild and stainless steels.
70070	Corrosion Fatigue (Aluminum)	Pelloux	Metallurgy	Stolte Dawson	Corrosion fatigue behavior of aluminum alloys as a function of aging. The corrosive environment includes sea water and high humidity air. Included are S-N curves and propagation rates determination.

Number	Title	Principal Person	Department	Others Involved	Brief Description
SG 70071	Dynamic Meteorology and Oceanography	Charney	Meteorology	Phillips	Study of the general circulation of the atmosphere and oceans: frontogenesis, tropical and extra-tropical cyclogenesis, formation of the Intertropical Convergence Zone, planetary wave propagation, dynamics of the Equatorial Undercurrent, stability of atmospheric and oceanic motions, dynamic coupling of atmosphere and oceans.
70072	Air-Sea Interaction	Mollo-Christensen	Meteorology	--------	The measurement of wind profile and wind stress below one meter above the water surface. In addition the mechanism of wave generation by wind, air and water turbulence and vertical fluxes of momentum and heat are being investigated.
70073	Ocean Physics	Stommel	Meteorology	Leetma Van Leer Knox	Measurements of vertical velocity in the Mediterranean and eastern Atlantic, detection of rectified currents around islands, microstructure and convection in the subtropical thermocline, (cont.)

Number	Title	Principal Person	Department	Others Involved	Brief Description
SG 70073 (cont)	Ocean Physics	Stommel	Meteorology	Leetma Van Leer Knox	measurements of equatorial currents in the Indian Ocean near the island of Gan and in the Atlantic Ocean near South America, development of a sea-floor pressure sensor, organization of a multi-institution program to study transient motion in the interior of the Atlantic (Mid-Ocean Dynamics Experiment MODE).
70074	Geophysical Fluid Dynamics	Beardsley	Meteorology	---------	Theoretical and experimental research in geophysical fluid dynamics. Current areas of interest are the "spin-up" of a stratified fluid, laminar convection, internal waves, laboratory and numerical models of the wind-driven ocean circulation, and vortex motion in a rotating fluid.
70075	Dynamical Prediction in the Tropics	Sanders	Meteorology	----------	The dynamics of circulation systems in low latitudes. This includes particularly those processes determining the tracks of tropical cyclones and those determining the character and behavior of circulations of lesser intensity as disclosed by data (cont.)

Number	Title	Principal Person	Department	Others Involved	Brief Description
SG 70075 (cont)	Dynamical Prediction in the Tropics	Sanders	Meteorology	--------	obtained during the Barbados Oceanographic and Meteorological Experiment (BOMEX).
70076	Meteorological and Oceanographic Instrumentation	Keily	Meteorology	--------	Meteorological and oceanographic instrumentation systems, with particular emphasis on sensor design.
70077	Plasma Membranes of Echinoderm and Mammalian Cells	Stanbury	Nutrition and Food Science	---------	Isolation of plasma membranes from static and rapidly dividing cells. Microcavitation with nitrogen is used to remove the membranes from thyroid and sea urchin cells. The purity of the preparation is tested in terms of enzymatic activity. Proteins from these membranes are separated on polyacrylamide gels.
70078	Flavor in Fish Protein Concentrate	Wick	Nutrition and Food Science	Claffey	Chemistry of flavor in fish protein concentrate, of its flavor precursors, and of conditions for, and mechanisms of, its development.

Number	Title	Principal Person	Department	Others Involved	Brief Description
SG 70079	Liquid Chromatography in Biochemical Analysis	Palmer	Nutrition and Food Science	--------	Newer techniques of high-speed, high-resolution liquid chromatography applied to determination of organic acids, sugars, or other organic constituents in foods, waste streams, rivers, etc.
70080	Marine-Life Polypeptides which Inhibit Bacterial Growth	Nickerson	Nutrition and Food Science	---------	Polypeptides in fresh haddock tissues which inhibit the growth of Clostridium botulinum, Type E. Investigation of similar compounds in other species and their effect on other bacteria is being studied.
70081	Solubilization of Fish Protein Concentrate	Tannenbaum	Nutrition and Food Science	Wang	Development of technologically feasible methods for producing soluble protein products from FPC is being accomplished via partial digestion with proteolytic enzymes in a novel system using a selective membrane to simultaneously recover product and recycle the enzyme.

Number SG	Title	Principal Person	Department	Others Involved	Brief Description
70082	Effect of an FPC Diet	Miller	Nutrition and Food Science	--------	The effects of the fluoride count of fish protein concentrate on dental caries reduction. A preliminary experiment with animals showed that supplementing an otherwise cariogenic diet with fish protein concentrate would decrease experimental caries by about 60%.
70083	Sailing Yacht Research	Milgram	Ocean Engineering	---------	Research on yacht hulls and sails directed toward performance prediction. The facilities of the Marine Hydrodynamics Laboratory are used in this work. Digital computers are used for analytical studies of sails.
70084	Maintaining Ship Speed at Sea	Abkowitz	Ocean Engineering	Chryssostomidis	Research on increasing ship speeds in head seas by improving their seakeeping qualities. Techniques are being developed for the comparative evaluation of ship performance using data from theoretical methods and models tests. Computer aided prediction of seakeeping performance for ship design is included.

Number	Title	Principal Person	Department	Others Involved	Brief Description
SG 70085	Hydrodynamics of a Deep Submergence Rescue Vessel	Abkowitz	Ocean Engineering	Mathens	Theoretical and experiemntal studies of maneuvering of a deep submergence rescue vessel at low speeds. Development of hydrodynamic (mathematical) models and investigation into velocity sensors and control effectors is included. Development of techniques for full scale trial plan and data reduction and evaluation.
70086	Dynamic Measurements in Water Tunnels	Kerwin	Ocean Engineering	Cummings Lewis	Development of instrumentation and data analysis techniques for dynamic measurements in water tunnels. Specifically under study are fluctuating propeller forces and associated pressures on adjacent boundaries. Tests are carried out in the M.I.T. Marine Hydrodynamics Laboratory.
70087	Ship Resistance in Irregular Sea States	Abkowitz	Ocean Engineering	Laukakis	Design information on added resistance and motion in a seaway for a systematic series of hull shapes. Computer Programs recently developed at M.I.T. are used as the basis of the project.

Number	Title	Principal Person	Department	Others Involved	Brief Description
SG 70088	Vibratory Forces Generated Near Marine Propellers	Lewis	Ocean Engineering	--------	Study of the vibratory interactions between a marine propeller and adjacent ship structures, and between the propeller and the irregular wake stream in which it operates.
70089	Wave Forces on Bodies in the Sea	Milgram	Ocean Engineering	--------	Wave forces on bodies in an ideal fluid. Development of a scattering theory for solution of the integral equations involved. Numerical solutions for engineering structures at sea. Results obtained so far indicate that previously used methods of force determination need the scattering corrections for meaningful results.
70090	Airfoils in Partially Separated Flow	Milgram	Ocean Engineering	---------	Fluid mechanics of airfoils in which the flow is partially separated. Methods of coupling viscous wake flow to potential flow outside the wake are studied.

Number	Title	Principal Person	Department	Others Involved	Brief Description
SG 70091	Application of Shallow-Water Wave Theory to Floating Bodies	Flagg	Ocean Engineering	Oakley Newman McCreight	Hydrodynamic forces on a two-dimensional body in shallow water, near the critical Froude number. Applications to motions and scattering from a circular ice island in shallow water, planning boat forces near the critical Froude number and on two-dimensional bodies in shallow water.
70092	Ship Waves in Homogeneous and Stratified Fluids	Newman	Ocean Engineering	----------	Theoretical and experimental study of wave systems which are generated by ships and other moving bodies. Full-scale aerial photographs are being made and analyzed. The results are compared to theoretical calculations that pay particular attention to effects of nonlinearity.
70093	Hydrodynamic Investigation of Flapped Rudders	Mandel	Ocean Engineering	Kerwin Lewis	A series of rudders embodying variations of flap-cord ratio & balance area. Lift, drag, chordwise and spanwise center of pressure are determined on the whole rudder and/or the flap separately. Extensions include test of rudders behind a propeller operating in uniform flow and in simulated ship wakes. Tests are underway in the M.I.T. Water Tunnels.

Number	Title	Principal Person	Department	Others Involved	Brief Description
SG 70094	Structural Behavior of Pipe Bends	Jones	Ocean Engineering	--------	Investigation of elastic and inelastic behavior of piping geometry. The problem is approached by theoretical and experimental considerations of two normally intersecting cylindrical shells acted on by various external loads.
70095	Creep of Structures with Finite Deflections	Jones	Ocean Engineering	---------	Experimental and theoretical investigation into behavior of a circular plate to develop methods suitable for studying creep in more complex structures. Special consideration is given to geometry changes which might occur during deformation.
70096	Damage to Dynamically Loaded Structures	Jones	Ocean Engineering	Giannotti Walters	Experimental and theoretical response of structures (beams, plates and shells) when subjected to dynamic loads. Intensity of loading considered is sufficient to produce large permanent deformations.

Number	Title	Principal Person	Department	Others Involved	Brief Description
SG 70097	Stresses Around Elliptical Holes in Flat Plates	Jones	Ocean Engineering	--------	Theoretical elastic stress distribution in thin flat plates of finite width which contain an elliptical hole. Influence of adjacent neighboring elliptical holes on stress patterns and effect of various uniaxial and biaxial loads.
70098	Post-Buckling Behavior of Stiffened Plates	Mansour	Ocean Engineering	---------	Behavior of stiffened plates, idealized by equivalent orthotropic plates, in the post buckling range. Deflections, effective breadth, critical loads, bending stresses, and membrane stresses are plotted versus nondimensional parameters that specify the elastic characteristics of the plate and its loading condition.
70099	Bending of Orthotropic Plates-Experiments	Mansour	Ocean Engineering	----------	Rigidity coefficients of stiffened plates treated as orthotropic plates will be determined. Deflections and strain measurements of plates under combined lateral and inplane loads are taken and compared with developed analysis and design curves based on orthotropic plate theory.

Number	Title	Principal Person	Department	Others Involved	Brief Description
SG 70100	Thermal Stresses and Metal Movement during Welding	Masubuchi	Ocean Engineering	Andrews Arita	Mathematical analyses of thermal and metal movement during welding. Emphasis of the analyses will be placed on gas-tungsten are (GTA) welding of plates in aluminum alloys, especially Types 2014 and 2219. These are used for the fabrication of Saturn V structures including fuel tnaks.
70101	Integration of NASA Sponsored Studies on Aluminum Welding	Masubuchi	Ocean Engineering	---------	Integration of results obtained from studies sponsored by the G.C. Marshall Space Flight Center, NASA. These studies, aimed at solving various problems related to welding of aluminum for space vehicles, were conducted at various types of institutions.
70102	Static and Dynamic Behavior of Rectangular Plates	Jones	Ocean Engineering	----------	Simple, rigid, plastic methods to predict the behavior of rectangular plates subjected to various external loads. In particular the cases (a) uniform static pressure and (b) dynamic pressures due to slamming of a ship are being considered in detail.

Number	Title	Principal Person	Department	Others Involved	Brief Description
SG 70103	Structural Design of Surface Ships	Evans	Ocean Engineering	Vetter	Applied mechanics methods development for a rational, consistent and orderly approach to the design synthesis of the primary structures of surface ships from loadings to detail design. Design optimization considerations and methods are included.
70104	The Analysis of Ocean Structures by the Finite Element Method	Mansour	Ocean Engineering	--------	Three dimensional stress analysis of complex ship and ocean structures is performed using the finite element method. Provision is made for the various types of structural members such as plates, bars and deep girders. Effect of boundary and loading conditions are considered.
70105	Probability of Failure Under Extreme Bending Movement Values	Mansour	Ocean Engineering	---------	Methods for predicting the probability of failure of ships under extreme values of bending moment. The bending moment amplitude is considered to follow Weibull distribution. Therefore, the results could be used for short term as well as long term analysis. Order statistics are (cont.)

Number	Title	Principal Person	Department	Others Involved	Brief Description
SG 70105 (cont)	Probability of Failure Under Extreme Bending Movement Values	Mansour	Ocean Engineering	--------	used to estimate the extreme values. Charts showing the probability of failure are presented.
70106	Underwater Welding and Cutting	Masubuchi	Ocean Engineering	--------	Advance technology of underwater welding and cutting of metals is being considered.
70107	Hydrogen-Oxygen Steam Power System for Deep Submersibles	Carmichael	Ocean Engineering	----------	An open steam cycle utilizing liquid oxygen and liquid hydrogen as the oxidant and fuel in a power system for a deep submersible. The proposed working fluid is a mixture of the steam produced by a combustion plus a proportion of the condensed steam returned to cool the combustion products.
70108	Oil Pollution Control	Milgram	Ocean Engineering	Drake Kern	The containment and collection of oil on the sea are considered. Special attention is given to the forces and motions of floating barriers.

Number	Title	Principal Person	Department	Others Involved	Brief Description
SG 70109	Power Tools for Divers	Carmichael	Ocean Engineering	Curtis	A system involving sea water-hydraulics to provide power to tools for underwater work. A 1/2 kW power tool is being developed.
70110	Technological Development and International Institutions	Skolnikoff	Political Science	--------	An examination of the way in which scientific and technological developments over the next ten to twenty years will generate new requirements for international institutions and an exploration of how these requirements may be met in the light of experience to date.
70111	Public Policy for Seas	Padelford	Political Science	---------	Public policy and the use of the seas in light of new developments in science and technology. Principal emphasis is on United States' interests and policy.
70112	Fiber Connections within the Shark Olfactory System	Heimer	Psychology	---------	Analysis of the morphology of the olfactory pathways in the shark using silver impregnation and electron microscopy.

TO: Executive Officer
M.I.T. Sea Grant Project Office
Room 3-282

SUBJECT: Comments and Recommendations on Directory of M.I.T. Research Projects Related to Marine Resources, Ocean Utilization and Coastal Zone Development.

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Name (Please Print)

_____

Address

_____

Telephone

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Signature

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From:

TO: Executive Officer
M.I.T. Sea Grant Project Office
Room 3-282
Massachusetts Institute of Technology
Cambridge, Massachusetts 02139

TO: Executive Officer, M.I.T. Sea Grant Project Office
Room 3-282

SUBJECT: Research Project for Directory of Work Related to Marine Resources, Ocean Utilization and Coastal Zone Development

The below described Project of current research at M.I.T. is recommended for inclusion in the next issue of the Directory:

Project Title: _____

Sponsor: _____

Principal Person (Faculty Supervisor): _____

Department: _____

Others Involved (Faculty & Key Staff): _____

_____

Scheduled Completion Date: _____

Brief Description (Abstract Statement):

Research Area(s): _____

_____

Remarks:

Date: _____ Signed _____

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M.I.T. Sea Grant Project Office
Room 3-282
Massachusetts Institute of Technology
Cambridge, Massachusetts 02139

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