

## Navy Support for Oceanography at SIO

These historical notes were prepared by Archivist Deborah Day on January 24, 2000 as background for speakers at the ONR/Heinz Center sponsored symposium, "Oceanography: The Making of A Science<sup>3</sup>" which was held at SIO/UCSD February 8-9, 2000.

Navy funding for oceanography was essential to the growth of the discipline. The Scripps Institution would not have become a world leader in oceanographic research without that support; in fact one can question whether the institution would be here today without navy support. The Navy supported research projects at SIO as early as the 1920's. These projects tended to be narrowly focused and applied research. For instance, SIO conducted research on fouling organisms for years. During World War II, the U.S. Navy Bureau of Ships and other naval bureaus supported research at SIO and the University of California Division of War Research (UCDWR) on broad areas including underwater acoustics.

SIO was closely connected with the Navy and specifically with the Office of Naval Research (ONR) through Roger Revelle. Revelle left Scripps for active duty in the Navy during World War II. In 1946, he was named the first head of the Geophysics Branch of ONR, where he administered the first ONR grants for oceanographic research.

After the war, ONR funded scientists and encouraged them to investigate the subjects that interested them; its funding was quick and flexible and enabled scientists to take advantage of research opportunities and new technologies. ONR funded ideas rather than programs in its earliest years; it was always interested in bold research initiatives that addressed fundamental problems particularly in physical oceanography and geochemistry. It supported ships and the development of new tools and instruments. Basic oceanographic work, such as the taking of bathythermographs and the study of cores, was funded by ONR. ONR did not have a formal peer review procedure, but in other respects it became a model for government funded basic science in the United States. Its goals and policies influenced federal scientific organizations such as the National Science Foundation. At its founding, ONR emphasized support for basic rather than applied research, but eventually ONR's applied research program grew in size to match the basic science program. ONR supported research at academic institutions, it placed a high value on maintaining excellent laboratories, and it funded operations of the American research fleet. During its first decade, ONR provided block grants to institutions, in addition to grants to individual investigators. The block grants provided flexible money to support ship operations and empowered institutions through their directors to shape research programs.

Between 1946 and 1965 80-90% of the funding for American research in oceanography was provided by the Navy. A very substantial portion of postwar federal research support was provided to the Scripps Institution of Oceanography in the form of block grants. For instance, in 1959, SIO received \$802,500 under contract Nonr 2216 "to permit investigation of all phases of oceanography."

ONR funding supported what Roger Revelle called the "Golden Age of Oceanography," the decades of the 1950's and 1960's when academic marine scientists began multi-program large-scale reconnaissance and systematic exploration of the oceans. Immediately after the war, ONR funds paid for the conversion of vessels to oceanographic use. Later, the Navy designed and built AGORs, vessels specifically designed and equipped for oceanographic research. including SIO's THOMAS WASHINGTON and R/V MELVILLE ONR was a major contributor to SIO's postwar expeditions to research the deep Pacific, funding a series of deep sea expeditions starting with MIDPAC which yielded important scientific results. For instance, ONR supported Ronald Mason's magnetometer observations on CAPRICORN Expedition, Russell Raitt's seismic refraction studies of crustal structure, and Arthur Maxwell and Revelle's study of heat flow. ONR also supported the work of Victor Vacquier. ONR funds supported research by Walter Munk on long ocean waves. It funded Chip Cox's research on microstructure measurements that contributed to an understanding of ocean mixing and his work on electromagnetic processes in the ocean that contributes geophysical data on the ocean crust and mantle. Studies of large pattern circulation systems by Joe Reid, John Knauss and Warren Wooster were long supported by ONR. It also provided funds for the design of deep-anchored buoys and other innovative instruments by John Isaacs. ONR funds supported collection and interpretation of deep sea soundings, and the intensive expeditionary work of H. William Menard, Robert L. Fisher, and William R. Riedel which vastly expanded knowledge of the geology of the Pacific seafloor and, later, in the Indian Ocean. ONR funds supported Douglas Inman's work and provided seed money for the development of the science of nearshore and coastal processes which ultimately led to the formation of the Center for Coastal Studies at SIO in 1980.

The Navy was a generous supporter of the Marine Physical Laboratory (MPL). MPL developed Deep Tow and FLIP with support from ONR and other agencies. MPL scientist Victor Anderson conducted research on signal processing which improved sonar used by the U.S. Navy. ONR funded research at Visibility Laboratory beginning in 1952, when the lab moved to SIO, although Visibility Laboratory received more funds from BuShips and other federal and from private sources .

ONR supported preliminary Mohole drilling on the drilling vessel CUSS I. ONR and others supported the work of Edward D. Goldberg, Harmon Craig and other pioneers in the field of chemical oceanography and geochemistry. ONR funded significant conferences, such as the 1952 Rancho Sante Fe Symposium on Oceanographic Instrumentation, which brought oceanographers from all institutions in the United States together to discuss new oceanographic instrumentation for the first time.

The Navy supported the development of research diving by scuba. In 1948, Francis Shepard received an aqua lung from his friend Jacques Cousteau and his group used this new equipment to study submarine geology. A number of Scripps divers purchased the Gagnan-Cousteau regulators as soon as these were available in Los Angeles in 1951. It was the Navy's interest in underwater swimmers that inspired Hugh Bradner to invent a wet suit and test it in the swimming pool of the La Jolla Beach and Tennis Club down the street from SIO. SIO diving officers Conrad Limbaugh and James Stewart worked with

ONR to develop diving safety standards and training programs. The research diving program developed at SIO became the model for diving programs developed at other institutions.

The Navy worked closely with civilian scientists to set policies and research priorities. In 1956, ONR and other agencies asked the National Academy of Sciences to appoint a Committee of Oceanography (NASCO) to provide advice on oceanography. Detlev Bronk appointed Harrison Brown chairman, and the membership included Maurice Ewing, Columbus Iselin, Fritz Koczy, Sumner Pike, Roger Revelle, Gordon Riley, Milner B. Schaefer, and Athelstan Spilhaus. NASCO was charged to evaluate the national need for an expanded program in oceanography, which they described in a report entitled, *Oceanography 1960-1970*.

NASCO worked with the Navy, which developed its own ten-year program in oceanography (TENOC). TENOC represented a significant part of the national oceanographic program outlined by NASCO. Admiral Rawson Bennett, Chief of Naval Research endorsed TENOC for the Chief of Naval Operations, in 1959. In 1961, President Kennedy forwarded to Congress a National Oceanographic Program, which represented the first formal submission of a coordinated package representing the oceanographic activities of all federal agencies. The decade of the 1960's saw a great expansion in oceanographic research, notably the cooperative international exploration of the Indian Ocean, but this was also a decade of fundamental change.

Between 1946 and 1956, ONR provided support for graduate training, but in 1957 its policy changed and the work of graduate students was supported entirely through research grants. In 1965, ONR priorities changed from building up and maintaining oceanographic capability and supporting oceanographic institutions to a program focused more specifically on increasing knowledge of ocean phenomena especially in subject and geographical areas relevant to the navy. This was a response to congressional direction to the Department of Defense to reduce its overall support for basic science, and it was a reflective adjustment to the growth of NSF. After this period, ONR depended upon NSF to take the lead role of broad, stable institutional support in oceanography. ONR funded more research in physical oceanography and solid earth geophysics and less research in biology. However, ONR continued to fund key projects in cooperation with NSF and other federal agencies.

The transition during the 1960's is illustrated by funding for John Isaacs' North Pacific Study. ONR provided the funds for this project when it began in 1967, but as the project grew into NORPAX, funding was provided by both ONR and NSF. NORPAX was a six-year study of ocean-atmosphere interaction in the North Pacific designed to improve long-range oceanographic and meteorological forecasting. This was the beginning of large-scale climate research at SIO.

RISE Expedition provides another example. In 1979, Fred Spiess was the principal investigator for a program to explore the East Pacific Rise spreading center in a series of near-bottom instrument surveys and manned submersible dives. This geophysical

expedition led to a major biological discovery of the first known hot geothermal vents (black smokers). The expedition found a series of dense communities of marine life associated with hydrothermal vents. While the expedition was sponsored by NSF, key instruments used in the operation, notably WHOI's ALVIN and MPL's Deep Tow was developed with support by ONR.

ONR and NSF cooperatively funded the Nimitz Marine Facility at SIO, a million dollar oceanographic shore facility built on six acres of land released by the Navy in Point Loma on San Diego Bay. When it was dedicated in 1966, Nimitz Marine Facility was the world's finest shore base in support of oceanographic research. ONR and ESSA funded Walter Munk's design of self-contained instrument capsules for deep-sea research. ONR joined NSF and NASA to fund the Scripps Satellite Oceanographic Facility in 1979, the first satellite monitoring system in the US dedicated to ocean studies.

ONR funding continues today. ONR continues to build oceanographic ships. On April 20, 1995 R/V ROGER REVELLE was launched and began a new era of oceanography.

#### References:

United States Navy Department. Department of the Navy Ten Year Program in Oceanography TENOC 1961-1970. Washington, D.C.: Department of the Navy. Office of the Chief of Naval Operations, 1961.

Vetter, Richard C., "Growth and Support of Oceanography in the United States, 1958-1968." Washington, D.C.: NAS/NRC, April 1970.

Vetter, Richard C. "NASCO: National Academy of Sciences-National Research Council Committee on Oceanography," in E. John Long, Ocean Sciences. Annapolis: U.S. Naval Institute, 1964, pp. 173-183.

### **A SAMPLE OF ONR SUPPORTED RESEARCH AT SIO BY YEAR, 1946-1985**

Deborah Day compiled the following unscientific sample of research projects at SIO sponsored by the Office of Naval Research by scanning early SIO reports to ONR on research contracts. These are found in the SIO Reference Series. Day also retrieved information on ONR sponsored research at SIO from SIO Annual Reports and from files of the SIO Contract and Grant Office. This is not a comprehensive list of all research at SIO funded by ONR.

- 1946
  - Robinson, et. al: Processing Bathythermograph Observations (funding for this activity continued for 20 years)
- 1947
  - Munk: Tracking storms; tsunamis, air-sea boundary processes (Munk receives funding every year to present)
  - Sverdrup: Forecasting fog

- Shepard: Submarine geology (funding for this activity continued for more than 20 years)
- Shepard: Investigation of April 1, 1946 Hilo tsunami
- 1950
  - MidPac Expedition
  - Frautschy: Kullenberg corer
  - Goldberg: Radiochemical Laboratory for study of trace elements in the sea (continued for a dozen years)
  - Isaacs: Temperature gradient in bottom sediments
  - Revelle: Discovery of MidPac Mountain Range
  - Van Dorn: Deep water current measurements
- 1951
  - Isaacs: Midwater Trawl
  - Cox: Sea surface Glitter (with Munk)
  - Raitt: Seismic refraction studies
  - Phleger/Parker: Marine Foraminifera Lab (supported for 20+ years)
  - Northern Holiday Expedition
- 1952
  - R. Arthur: Physical oceanography (Arthur's work was supported for 15 years by ONR)
  - ZoBell: Marine Microbiology (ONR provided funds which allowed ZoBell to participate in Galathea Danish Deep Sea Expedition)
  - Shellback Expedition (funded with BuShips)
  - Bramlette and Riedel: Investigation of MidPac cores/Radiolaria (Reidel's work in Radiolaria was supported by ONR for 20 years)
  - Goldberg: Chemistry & evolution of manganese nodules
  - Reid: Study of water masses (Reid received 15 years of steady funding for study of circulation)
  - Maxwell: Bottom temperature gradient studies (with Bullard and Revelle)
  - Stewart: Submarine canyon photography (beginning of funding of scuba, underwater cameras at SIO)
  - Capricorn Expedition (first expedition to use scuba as a tool)
  - Revelle, North: Underwater swimming problems (first grant for training of navy and lab personnel in underwater swimming equipment)
  - Fisher: Northeastern Pacific Foredeep Study (beginning of Fisher's long work on trenches)
  - Goldberg and Rao: Calcium uptake by mussels
  - Richards: Volcano studies (began with his dissertation on eruption of Boqueron and continued for 8 years)
- 1953
  - M. Johnson: Wood-boring organisms
  - Limbaugh: Underwater swimming problems (including testing of Bradner's wet suit)
  - TransPac Expedition
  - Arrhenius & Goldberg: Pelagic sedimentation

- Goldberg: Geochemistry of trace elements in marine organisms (continued to 1958)
- 1954:
  - Munk: Long period waves
  - Bramlette: Study of expedition cores (Albatross, MidPac, etc.)
  - Wooster & Cromwell: Investigation of Easter Equatorial Pacific
  - Kampa: Diurnal vertical migratory cycle of deep scattering layer (supported for 10 years, later with Boden)
  - Acapulco Trench Expedition (ONR paid ship expenses only)
  - Bieri & Brinton: Animal Plankton (This is ONR support for CalCOFI)
- 1955:
  - Mason: Magnetic field measurements of the sea (long term support of using Flexgate Magnetometer on expeditions, including the Pioneer survey)
  - Knauss, Robinson, Atkinson, and Pattullo: Acoustic Structure of the North Pacific
  - Rakestraw & El Wardani: Study of stagnant basins
  - Eastropic Expedition
  - Limbaugh: Diving Methods and training
  - Riedel: Determining the age of deep-sea sediments
- 1956:
  - Keeling: Support for his participation in Eastropic Expedition
  - Arrhenius: Geochemistry Research
  - Suess & Craig: Research Lab for Isotopic Chemistry (ONR support continued for some years)
  - Kampa/Boden: Bioluminescence study
  - Munk: Irregularities of the Earth's rotation
  - Fisher: Sea Floor Studies
  - Pattullo & Knauss: IGY planning activities (at the end of the year, NSF funding took over this activity)
  - Reid: Oceanic Observations of the Pacific
- 1957:
  - Revillagigedo Expedition (SIGRE) (funded in cooperation with Mexican government)
  - Reid: Descriptive oceanography
  - Fager & Flechsig: Natural populations in nearshore habitats in La Jolla (Fager's work was supported by ONR over the next 25 years and included uses of divers and submersibles)
  - Van Dorn: Impulsively generated waves (connected with Pacific atomic tests)
  - Folsom: Instrumentation
  - Revelle & Suess: They credit ONR in publication of Tellus article on building of atmospheric CO<sub>2</sub>
  - Mukluk Expedition
  - Shor: Reflection and refraction of explosive waves by the sea bottom on Mukluk Expedition

- Downwind Expedition (ONR paid for the seawater chemistry work on this IGY expedition) (Shor had ONR grants for seismic refraction work for the following 20 years)
- 1958:
  - Knauss: Equatorial countercurrent
  - Neushul: Submarine biological studies in the Antarctic (ONR funds enabled him to participate in the Argentine Antarctic Expedition and to write a report on Antarctic diving)
  - Menard: Plotting soundings, inspecting echograms, updating charts to reflect SIO expedition results
  - Isaacs: Deep Moored instrument stations
  - Snodgrass: Electronic BT
  - V. Anderson: Construction of RUM (also testing, beginning in 1960)
- 1959:
  - Inman: Sand Movement (actually Inman was funded earlier with Shepard, but worked alone on many grants specifically concerning beaches and sand movement; ONR support of Inman's work continued for many years)
  - Phleger: Geomorphology of Mexican Lagoons
- 1960:
  - Cox: Generation of long period waves (Cox's work in physical oceanography was supported by ONR for more than a decade)
  - Reid: Study of Eastern boundary currents
  - Knauss: Measurement of ocean currents
  - Monsoon Expedition
  - Bramlette: coccolithophorids of the deep ocean
  - Goldberg: Dissolved organic matter in ocean water
  - Limbo Expedition (joint with NSF)
  - G. Ewing: MPL Sea Surface Studies growing out of Project Sorrento
  - F. Fisher: Sound propagation in the ocean
  - Spiess: Wave acceleration measurements; FLIP
  - Vacquier; Geomagnetism (Mapping of PIONEER survey results)
  - V. Anderson: Artemis Experimental RUM development (ONR provided long term support for this project)
  - Pettersson & Goldberg: Feldspar in marine sediments
  - Chamberlain & Inman: Transport of sediment in submarine canyons
  - Inman: Littoral sand transport
  - Trapani: Conversion of USS SNATCH to R/V ARGO
  - J. Lewin: Deposition of silica by diatoms
- 1961:
  - R. Fisher: Deep Sea Soundings (Bathymetric chart of the Gulf of California)
  - Isaacs: Buoys
  - STEP I Expedition (BCF, IATTC & NSF also provided funding)
  - R. Parker: Micro-invertebrate studies
  - Inman: Gulf of California beaches
  - Craig & Gordon: Iotopic oceanography (work on Monsoon Expedition)

- Goldberg, Pettersson, Griffin: Dolomite in the Mohole drilling (examination of sediment cores)
- Isaacs, Holt, Schick: Deep anchored buoys
- Shepard: Canyon studies on Japanyon Expedition
- Rasmussen: Expendable bathythermographs
- 1962:
  - Arctic Studies: data collection and reduction
- 1963:
  - Knauss & Reid: Swansong Expedition
  - Arthur: Dynamics of rip currents (One of the many projects done by Arthur with ONR funding)
  - Reid: Circulation of the Pacific Ocean (this is a continuation of work begin in the 1950's)
  - T.J. Chow: Chemical oceanography
  - Fager: Distribution of bottom organisms and zooplankton
  - Menard: Bathymetry (synthesis of all SIO work on Pacific basin)
  - Inman: Mechanics of sedimentation
  - Van Andel: Marine Sediments (shiptime)
  - Curry: Sediments and structure of continental margins
  - Spiess & MPL: Instrumentation on TRIESTE (this is the beginning of six years of work/research on loss of THRESHER)
- 1964:
  - Carrousel Expedition
- 1965:
  - Cox: Electromagnetic Fluctuation in the Sea
  - Cox: Internal waves
  - Holland & Arthur: Wind-driven ocean circulation
  - Keeling: Carbon dioxide measurements (processing of data collected on IGY cruises)
  - La PARED Expedition
  - Wooster & Stevers: Climatological Studies, Eastern South Pacific (with Isaacs North Pacific Study, one of the first SIO projects in climatology)
  - Wooster & Stommel: Somali current reconnaissance
  - R. Fisher: Ocean basins (supported by ONR for a decade or more)
  - Menard: Sea floor topography
  - Shepard: Submarine valleys and La Jolla Canyon saucer dives (joint with NSF)
  - Curry: Marine geology of continental margins (beginning of a decade or more of funded research)
  - Goldberg & Griffin: Mineralogy of deep-sea sediments
  - Peterson: Vulcanology (Person worked on ONR funds until he moved to DSDP)
  - Van Andel: Marine Sediments (supported by ONR to 1968)
  - Inman: Sedimentation
  - Inman & Murray: Currents in submarine canyons
  - Winterer: Ancient and modern sediments



- McGowan: Distribution of biological material in the Sea
- Riedel: Radiolaria and deep-sea stratigraphy (continuation of long term ONR support)
- Isaacs: Moored instrument station
- J. Snodgrass: Instrumentation
- Spiess: MPL participation in SeaLab II
- Clark, Flechsig, Grigg: Ecological Studies during SeaLab II
- 1966:
  - ZETES Expedition (jointly funded with NSF)
  - EXJIBA Expedition
  - SPHERES, MAI HAI Expedition
  - Bradner: Seismic background noise measurement
  - Hendershott: Numerical study of tides (beginning of several years of ONR support for Hendershott)
  - Reid: Pacific water mass movement
  - Van Dorn: Waves
  - Chow: Geochemistry of lead isotopes (beginning of ONR support for Chow's study of lead in the marine environment)
  - Folsom: Fallout observations
  - B. Boden: Sonic-scattering layer studies
  - Fager: Shallow bottom organisms
  - Frautschy: Ocean engineering (design of T-AGOR)
  - Van Dorn: Wave enhancement and runup (cosponsored by DASA)
  - Isaacs: Isaacs-Brown Opening, Closing Trawl
  - Paulling & Silverman: Ship design
  - McGowan & Brown: Opening, Closing Paired Zooplankton net (a.k.a. Bongo net design)
  - Boreas Expedition (joint with NSF)
  - Anderson: Artemis/RUM
- 1967:
  - B. Boden: Bioluminescence on DISCOVERY SOND Expedition
  - Fager: Nearshore benthic communities
  - Haxo: Photosynthetic Action Spectra of Phytoplankton
  - Haxo: Organic materials in upper 60 microns of Sea surface
  - Craig: Chemical and geochemical oceanography (analysis of Nova Expedition data)
  - Folsom: Survey of Oceanic fallout
  - Goldberg: Clay minerals in World Ocean (with Griffin)
  - Goldberg: Geological record of glaciers
  - Goldberg: Talc in the sedimentary cycle
  - NOVA Expedition
  - Menard & Mammerrickx: Abyssal hills, magnetic anomalies and the East Pacific Rise
  - Van Andel: Marine sediments
  - Cox: Electromagnetic signals

- Isaacs: Physical Changes, upper layers of Pacific (related to North Pacific Study)
- Reid: Intermediate and deep circulation
- EASTROPIC Expedition (with BCF and NSF)
- J. Miles: Waver generation and hydrographic stability (first of many years of support of Miles)
- Spiess: La Coste Romberg Gravity Meter (funded over several years)
- Munk & Snodgrass: Deep Sea Tide Capsules
- Paulling and Silverman: Ship design
- 1968
  - Spiess: FLIP
  - CLIMAX I Expedition (with NSF and others)
  - PIQUERO Expedition (with NSF, AEC)
  - LUSIAD Expedition data analysis (with NSF)
  - CIRCE Expedition (with NSF)
  - Advanced Ocean Engineering Laboratory (founded and support by ARPA funds administered through ONR)
  - Arthur: Dynamics of ocean circulation
  - Berger: Radiolarian skeletons
  - Isaacs: Bootstrap corer
  - Menard & Atwater: SeaFloor Spreading
  - Cox: Thermal microstructure in the ocean
  - Taft: Kuroshio (ONR support for Taft continued over several years)
  - Taft & Wooster: Equatorial current measurement
  - Winterer: Analysis of data collected in Coral Sea
  - Shepard: History of sea level changes
  - Shepard, Dill: Slope sediments, Magdalena Delta, Colombia
  - Craig: Dissolved CO<sub>2</sub> in Ocean
  - Craig: Isotopic relationships and chlorinity of sea ice
  - J. Snodgrass: Navy navigation satellite system
  - Isaacs: North Pacific Study (Deep Moored Instrument Stations, data analysis)
- 1969:
  - Folsom: Radioactivity in the marine environment (part of ONR long term support for Folsom's work)
  - Rasmussen (MPL): Ocean acoustics (ONR support continued to 1972, then ARPA)
  - Anderson (MPL): Sonar perimeters for ASW
  - Rudnick (MPL): Ambient Sea Noise
  - Inman: Longshore transport of sand
  - Liebermann (MPL): Ocean acoustics
- 1970
  - SEVENTOW Expedition (with NSF)
  - Hendershott and Munk: Tides
  - F. Snodgrass: ELTANIN Cruise 41
- 1971

- Spiess: Chase Disposal area
- Namias and Born: North Pacific Sea Surface Temperature Patterns
- Cox: Electrical conductivity of oceanic lithosphere
- Namias: Predicting some atmospheric and oceanic variables for the winter 1971-72 (This and other ocean-atmosphere studies by Namias were supported by ONR over several years)
- 1972
  - South-Tow Expedition (mostly NSF funding, some ONR)
  - CATO Expedition (with NSF)
  - Bullock & Ridgway: Acoustical studies of marine mammals
  - Grow: Geophysical study of Aleutian Arc (with NSF)
  - Brown: Windmill generator of bumblebee buoy (with MLRG)
  - Clinton: Soil mechanics with ORB-RUM
- 1973
  - Anderson: Vertical array, Operation Church Anchor
  - Lonsdale: Abyssal sedimentation, Panama Basin (with NSF)
  - Spiess: Deep Tow Instrumentation System (with NSF)
  - North Pacific Experiment (joint with NSF)
  - Garrett & Munk: Internal waves
- 1974
  - COCOTOW Expedition (with NSF)
  - Knox: Reconnaissance of the Indian Ocean Equatorial Undercurrent
  - Munk: Sound Channel in an exponentially stratified ocean, with application to SOFAR
  - White & McCreary: El Nino study
  - Spiess: Core MPL Research (this was funded annually for many years)
  - Anderson, Spiess: Environmental acoustics research
  - Inman, Winant: Fluid sediments interaction on beaches and shelves
  - Nierenberg: Ocean Studies (funded annually for many years)
  - Williams (MPL): Turbulence in Pacific Equatorial undercurrent
  - Lonsdale: Abyssal Geomorphology, Samoan Passage
  - Detrick: Fracture Zone A near bottom geophysical study (w/NSF)
  - Bernstein, Barnett, White: Mesoscale ocean eddies in the North Pacific
- 1975:
  - Spiess: Supplemental funding of ORB
  - Spiess: MPL funding ADA
  - Knox: Observations of Equatorial Currents in the Indian Ocean (funding continued for several years)
  - Munk: Study of variable structure of the ocean interior (with ARPA)
  - Foster: Numerical models of heat flow
- 1976
  - Emery, Wert: Mean TS Curves
  - Squier: High Resolution, Narrow Beam Echo Sounder (on FLIP)
  - Shor, Raitt: Seismic Refraction Studies (with NSF)
  - INDOPAC Expedition (with NSF & UC)
- 1977

- Pinkel: Measurement of Mid-Scale Plankton Distribution with Sonar
- Spiess: FLIP refit and instrumentation
- Bernstein: Merging Satellite and Conventional Oceanographic Data to Explore mesoscale Pacific circulation (Beginning of ONR support for Satellite Data Center work at SIO)
- Anderson & Spiess: Fine scale surveys of NW Pacific
- Miles: Wave propagation (continues for a decade)
- 1978
  - INDOMED Expedition (with other funders)
  - Mammerickx: Bathymetry of the Rivera Fracture Zone
  - Cox: ELF studies of the ocean crust
  - Cox: EM probing of the ocean crust (continues for several years)
  - L. Cheng: Heavy Metal Concentrations in the Ocean Surface film using Halobates as an indicator
  - Reines: DUMAND workshop
  - Orcutt: OBS calibration
  - Bernstein: The SIO SRS Faculty (with NASA)
  - NORPAX (with NSF)
  - Cox: Internal wave studies
  - Dorman & Orcutt: Participation in ROSE Explosion seismology studies
  - Flick, Guza, Inman, Winant: Fluid sediment interaction on beaches and shelves
  - Anderson & Spiess: Advances ASW operational/technical concepts
  - Munk, Worcester, Zetler: OAT for measuring large scale variability
  - Lonsdale: Submersible exploration, Guaymas Basin in SDV-4 SEACLIFF
- 1979
  - Spiess: Deep Tow technology transfer
  - R. Fisher: Shipboard equipment
  - Nealson: Mechanism of bioluminescence
  - R. Austin: Assessment of modeling of ocean optical properties
  - Luyendyk: Analysis of Magnetic anomalies, TOW TWO II and SEVENTOW Expedition
- 1980
  - Austin: Deep ocean optical data cruise R/V Oceanographer
  - Austin: Marine bioluminescence studies
  - N.E. Clark: Large-scale heat exchange processes across the air/sea interface in the Indian Ocean (with NORDA)
  - Lonsdale & Spiess: IDOE Manganese Nodule Program (Deep Tow surveys)
  - Anderson & Spiess: Beamformer project
- 1981
  - Agnew: Sea level variations and ocean dynamics in the Aleutian Islands
  - Anderson & Watson: Marine physics applied to USN Undersea missions
  - Anderson & Watson: Seafloor backscatter studies with SeaBeam
  - Austin: Ocean optical properties
  - Hessler: Long term deployment of Free-Vehicle Camera systems

- 1982
  - Gilbert: Symposium on mathematical geophysics (with NASA, DARPA, others)
  - Lange: Physics and biology of the upper ocean (with NSF)
  - Backus & Gilbert: Geophysical inverse problems
  - Anderson: Active baffle development under ACSAS Task II hydrophone and inner decoupler
  - Anderson & Watson: Interdisciplinary research program at MPL
  - Jordan, Moore, Orcutt: Modernization of SIO's OBS support instrumentation
  - Chave: EM fields in the ocean
  - Austin: Optical Data cruise on USNS Desteiguer
  - Craig: Equipping a dedicated lab for geochemical research using DSV
  - Guza: Gravity waves
  - Shor: Shipboard computer replacement R/V Melville and Thomas Washington
  - Fenical: Natural shark repellants: Chemical studies of marine defensive agents
  - Curray: Increasing Seismic reflection capabilities on R/V Thomas Washington
  - Lovberg & Zumberge: Atomic wavelength standard for high precision geodesy
  - Inman, & Winterer: Multisystem, multichannel high-resolution seismic reflection profiling system in support of research in submarine geology and geophysics
- 1983
  - R. Fisher: Participation in Indian Ocean workshop
  - Knox: W. Munk Symposium proceedings publication
  - Shor: Instrumentation for shipboard use
  - Gautier: Variability of the Surface Radiation Budget during MILDEX derived from satellite measurements
  - F. Fisher & Williams: Fixed vertical array
  - Emmel: Echo characteristics as related to sediment types, and late Pleistocene History of the N Andaman sea
  - Orcutt: Purchase of high speed array processor
  - Bray: Moored observations of thermohaline circulation in the N Gulf of California (continues several years, joint with NSF)
  - Cutchin: Operation of ship of opportunity XBT deployment program in the Pacific
- 1984
  - Niiler: Measurements of Circulation in the NE Pacific Thermocline (with NSF)
  - Shor: SOMTS
  - Shor: NMF repair and dredging
  - Hodgkiss: Application of adaptive least-squared lattice structions to problems in underwater acoustics

- Flick, Guza, Inman: Fluid-sediment interactions on beaches and shelves
- F. Fisher: Chemical Sound Absorption in the Ocean
- Heiligenberg: Detection/Evaluation of biologically relevant signals
- 1985
  - Nierenberg: Secretary of the Navy Chair at SIO
  - Shor: Propulsion system, R/V Melville and R/V Knorr
  - Anderson & Winant: Real time telecommunication of oceanographic observation
  - Knox, Munk, Worcester: Ocean Acoustic Tomography in the Greenland Sea
  - Guza: Toward directional properties of gravity waves