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Computer Programs in Marine Science

National Oceanographic Data Center, Washington, D C

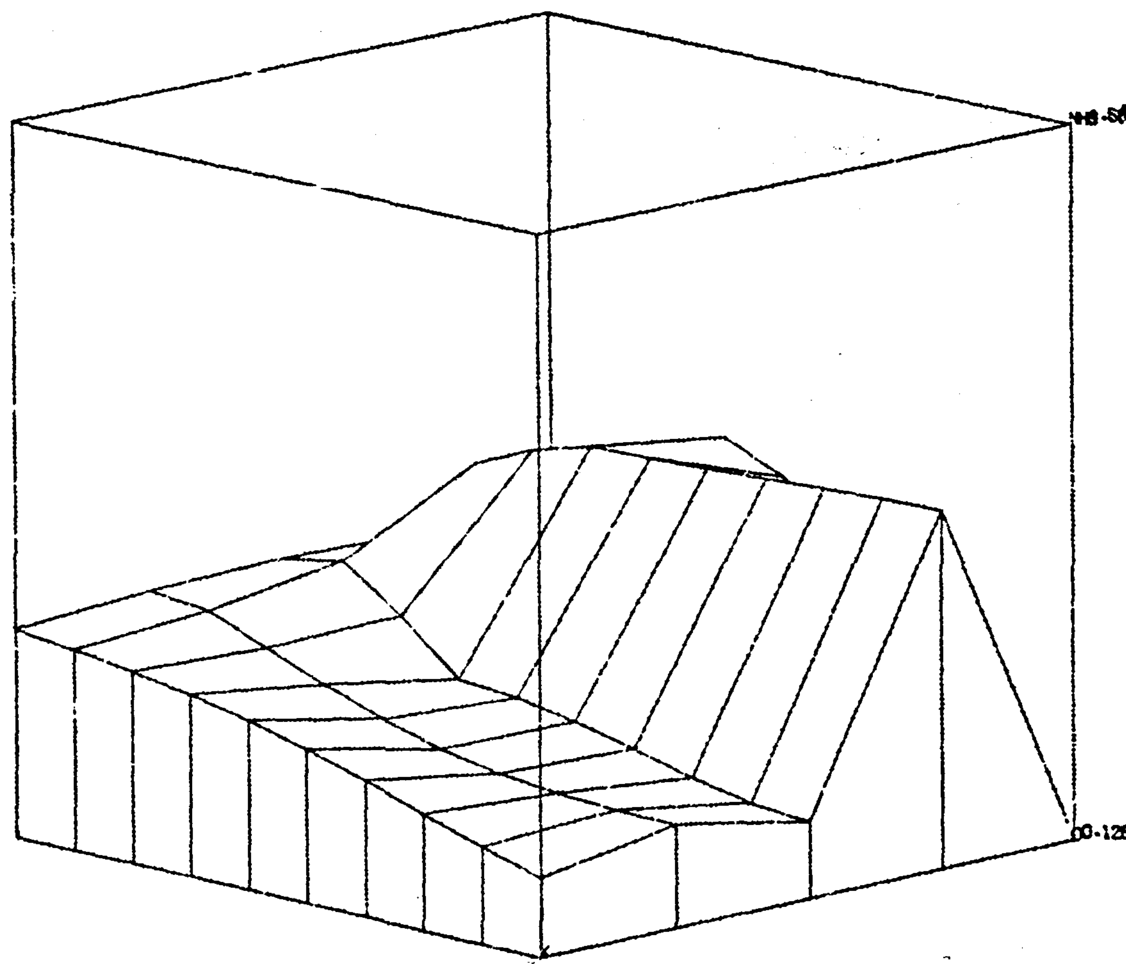
Apr 76

KEY TO OCEANOGRAPHIC RECORDS DOCUMENTATION NO. 5

Computer Programs in Marine Science

U.S. DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
Environmental Data Service

April 1976



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This edition is a followup of the previous edition of "Computer Programs in Oceanography." In this edition abstracts of seven hundred programs have been supplied by nearly eighty institutions in ten countries. (Author extracted)

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17B. IDENTIFIERS/OPEN-ENDED TERMS

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KEY TO OCEANOGRAPHIC RECORDS DOCUMENTATION NO. 5

Computer Programs In Marine Science

Compiled by Mary A. Firestone

NATIONAL OCEANOGRAPHIC DATA CENTER
WASHINGTON, D.C.
April 1976

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TABLE OF CONTENTS

INTRODUCTION

Since the last edition of "Computer Programs in Oceanography" (compiled by Cloyd Dinger) was published in 1970, the National Oceanographic Data Center (NODC) has received many requests from scientists throughout the international oceanographic community for updated information on available programs. The present edition is in answer to this demand. Abstracts of seven hundred programs have been supplied by nearly eighty institutions in ten countries (See table, pages vii-viii).

Those familiar with the previous edition will note several changes. Four new chapters have been added -- Fisheries, Engineering, Coastal and Estuarine Processes, Pollution -- and the title has been changed to reflect a broader interest than was implied in the term "oceanography". In addition to the institution, language, and hardware indexes, a general index has been provided, allowing the reader to search by parameter, method, author, etc. And, most importantly, the number of abstracts has nearly doubled.

Most of the programs listed herein are not available from the NODC. If the NODC holds a copy of the program, it will be so noted at the end of the abstract, and the form will be described (listing, deck, etc.); copies of these materials can be supplied. Requests which involve small amounts of materials and labor will be answered free of charge; for larger requests, an itemized cost estimate will be provided, and work will begin after funds or a purchase order have been received. (Contact the Oceanographic Services Branch; telephone (202) 634-7439.)

Many programs available in published form can be obtained from the following sources, as noted in the abstracts:

National Technical Information Service (NTIS)
U. S. Department of Commerce
5285 Port Royal Road
Springfield, VA 22161 Telephone (703) 321-8543

Assistant Public Printer
U. S. Government Printing Office (GPO)
Washington, DC 20402 Telephone (202) 783-3238

When ordering from NTIS or GPO, include the order number of the document, as well as payment in the form of check or money order. Telephone orders are accepted by both agencies if the purchaser has a deposit account.

Inclusion of information on a particular program does not guarantee that the program will always be available. When the originator feels that a program has become obsolete, support for that program often is discontinued. Every effort has been made to exclude all programs which definitely are not available to anyone. About one hundred programs from the previous edition have been retained because the NODC holds a reproducible, documented copy, or the originators have stated that they still support the programs. Judging from the requests received at NODC, many of these older programs are still of interest to the scientific community.

The NODC cannot assume responsibility for the accuracy of the abstracts, except those originated by our organization, or for the proper functioning of the programs. Most of these programs will not work, without modification, on a system other than the system for which they were designed.

Reports describing program libraries are available from several other federal agencies. "Scientific Program Library Abstracts" describes programs in the following categories: Regression and curve-fit, statistical analysis, matrix operations, simultaneous equations, numerical analysis, approximation of special function, operations research, computer simulation, time series analysis, sorts, applications programs, and miscellaneous. These programs were either written for or adapted to run on a Burroughs B5500 computer containing 32.6K 48-bit words of magnetic core storage, magnetic disk mass storage, and seven-channel tape drives. Contact:

Bureau of Mines, Division of ADP
U. S. Department of the Interior
P. O. Box 25407, Federal Center
Denver, CO 80225

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"Computer Software for Spatial Data Handling" is scheduled for publication in the summer of 1976; address inquiries to the Commission on Geographical Data Sensing and Processing of the International Geographical Union, 226 O'Conner Street, Ottawa, Ontario, Canada.

Several general-purpose programs are documented in "Computing Technology Center Numerical Analysis Library," report number CTC-39, available from NTIS for $12.00 paper copy, $2.25 microfiche. The Computing Technology Center is operated by the Nuclear Division of Union Carbide Corporation at the Oak Ridge National Laboratory in Oak Ridge, Tennessee.

"Argonne Code Center: Compilation of Program Abstracts," report number ANL-7411, supplement 8, may also be obtained from NTIS, for $13.60 paper copy, $4.25 microfiche. The Argonne Code Center is located at the Argonne National Laboratory, 9700 South Cass Avenue, Argonne, IL 60439. Programs maintained by the Center are chiefly intended for use in nuclear reactor research. Included in the Environmental and Earth Science category are programs for the following: Environmental impact studies, geology, seismology, geophysics, hydrology and ground water studies, bioenvironmental systems analyses, meteorological calculations relating to the atmosphere and its phenomena, studies of airborne particulate matter, climatology, etc.

Persons or organizations wishing to contribute program information for use in future editions and for reference in answering requests are asked to use standard form 185, Federal Information Processing Standard Software Summary; several copies of the form are printed as the last pages in this book, beginning on page 226.

The technical assistance of the following NODC personnel is acknowledged, with appreciation:

Albert M. Bargeski
Dean [illegible]
Georg[illegible] [illegible]. Heimerdinger
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Thomas Yowell

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University of Washington		
Williams College		
University of Wisconsin		
Woods Hole Oceanographic Institution		

PHYSICAL OCEANOGRAPHY

Transport Computations from Atmospheric Pressure

Language - FORTRAN I and IV
Hardware - IBM 1620/IBM 1130

Computes the steady-state mass transport in the ocean from atmospheric pressure data, according to a system of analysis designed by Dr. N.P. Fofonoff. Input: Sea level pressure cards from the extended forecast division of the U.S. National Weather Service. Output: Meridional and zonal components of Ekman transport, total meridional transport, integrated transport, and integrated geostrophic transport (mean monthly values for the specified grid of alternate five degrees of latitude and longitude in the northern hemisphere. FORTRAN I program is listed in FRB manuscript series report (Ocean. and Limnol.) No. 163, by Dr. Charlotte Froese, 1963.

Pacific Biological Station
Fisheries Research Board of Canada
P. O. Box 100
Nanaimo, B. C. V9R 5K6

Copy on file at NODC (FORTRAN I version for IBM 1620 only - above report)

STD Computations
STT02

Language - FORTRAN IV
Hardware - IBM 1130

Computes derived oceanographic quantities for Bisset-Berman STD casts. Printed output: Pressure, temperature, salinity, depth, sigma-t, specific volume anomaly, potential temperature and density, dynamic height, potential energy anomaly, oxygen content; sound velocity optional. FRB Manuscript Report (unpublished) No. 1071, by C.A. Collins, R.L.K. Tripe, and S.K. Wong, Dec. 1969.

Pacific Biological Station
Fisheries Research Board of Canada
P. O. Box 100
Nanaimo, B. C. V9R 5K6

Copy on file at NODC (above report)

Hydrographic Cast Computations
HYDRO

Language - FORTRAN IV
Hardware - IBM 1130

Computes derived oceanographic quantities for hydrographic casts. Printed output: Pressure, temperature, salinity, depth, sigma-t, specific volume anomaly, potential temperature and density, dynamic height, potential energy anomaly, oxygen content; sound velocity optional. FRB Manuscript Report (unpublished) No. 1071, by C.A. Collins, R.L.K. Tripe, and S.K. Wong, Dec. 1969.

Pacific Biological Station
Fisheries Research Board of Canada
P. O. Box 100
Nanaimo, B. C. V9R 5K6

Copy on file at NODC (above report)

Digitizes STD Data
DEEP

Language - FORTRAN
Hardware - Hewlett-Packard 2115A

Digitizes salinity-temperature-depth data on line, using time as a criterion for selecting points. Input are frequencies from the Bisset-Berman STD system and station heading data through a teletype. Output, on paper tape, has station identification fields, time interval between data points, and the STD data. Technical report No. 152 (unpublished manuscript), by A. Huyer and C.A. Collins, Dec. 1969. (See program WET, next page.)

Pacific Biological Station
Fisheries Research Board of Canada
P. O. Box 100
Nanaimo, B. C. V9R 5K6

Copy on file at NODC (above report)

STD Processing — Language - FORTRAN
WET — Hardware - Hewlett-Packard 2115A

For shipboard processing of digitized salinity-temperature-depth data. Input is on paper tape (output from program DELP). Output: The following parameters at standard pressures -- temperature, salinity, sigma-t, delta-d, specific gravity anomaly, specific volume anomaly, geopotential anomaly, and potential energy. Technical Report No. 152 (unpublished manuscript), by A. Huyer and C.A. Collins, Dec. 1969.

Pacific Biological Station — Copy on file at NODC (above report)
Fisheries Research Board of Canada
P. O. Box 100
Nanaimo, B. C. V9R 5K6

Station Data Retrieval — Language - ALGOL
HYDROSEARCH — Hardware - Burroughs 6700

Provides easy, inexpensive retrieval of hydrographic station data, with selection criteria expressed in terms of data properties. Output: Summary listing, detailed listing, cards, tape, or disk file. The program can be run either in batch mode or interactively; users can be local or remote via dial-up, ARPANET or FTS. User's Guide available.

Ed Coughran — Available from originator only
University of California, San Diego
P.O. Box 109
La Jolla, CA 92037 — Telephone (714) 452-4050

STD Data Processing — Language - FORTRAN IV
Hardware - CDC 3300

Processes salinity-temperature-depth recorded in the field. BCF Special Scientific Report-Fisheries No. 588, "Processing of Digital Data Logger STD Tapes at the Scripps Institution of Oceanography and the Bureau of *Commercial Fisheries*, La Jolla, California," by Dr. James H. Jones, June 1969.

Oceanic Research Division — Copy on file at NODC (above report)
Scripps Institution of Oceanography
P.O. Box 109
La Jolla, CA 92037

Salinity Anomaly — Language - FORTRAN II
ISALBP — Hardware - CDC 3100

Calculates the salinity anomaly from a standard T/S or Theta/S curve for North Atlantic Central water developed by L.V. Worthington. The results are output on the line printer. Author - A.B. Grant (June 1968).

Director — Available from originator only
Bedford Institute of Oceanography
P. O. Box 1006
Dartmouth, N. S. B2Y 4A2

Oxygen Saturation, Oxygen Anomaly — Language - FORTRAN II
ISATBP — Hardware - CDC 3100

Calculates the percentage of oxygen saturation in seawater, according to tables and formulae by Montgomery (1967), as well as an oxygen anomaly on a sigma-t surface, according to a tabulated curve by Richards and Redfield (1955). The results are output on the line printer, station by station. Author - A.B. Grant (June 1968).

Director
Bedford Institute of Oceanography
P. O. Box 1006
Dartmouth, N. S. B2Y 4A2

Available from originator only

Plot Theta-S Curves

Language - FORTRAN II
Hardware - CDC 3100/PDP-8/CalComp Plotter

Plots potential temperature vs. salinity. Input on cards. Output: Printed listing and punched paper tape. Station plot uses a PDP-8 computer, paper tape reader, and CalComp Plotter. Author - R. Reiniger.

Director
Bedford Institute of Oceanography
P. O. Box 1006
Dartmouth, N. S. B2Y 4A2

Available from originator only

Plots Station Positions

Language - FORTRAN II
Hardware - CDC 3100/PDP-8/CalComp Plotter

Plots cruise station positions on Mercator projection and writes in station number. "PLOTL" plotting routine used with PDP-8 and CalComp plotter. Author - R. Reiniger (Sept. 1968).

Director
Bedford Institute of Oceanography
P. O. Box 1006
Dartmouth, N. S. B2Y 4A2

Available from originator only

Nutrient Concentrations
PEAKS

Language - FORTRAN II
Hardware - CDC 3150

Reduces a set of discretely sampled voltages from the Technicon AutoAnalyzer to a set of peak heights and thence to a set of nutrient concentrations. Input: Magnetic tape produced by a Techal Digitizer and Kennedy Incremental Recorder; card deck containing identifiers for all samples and standards. Output: Tables of peak heights and of derived nutrient concentrations. Up to 8 parameters and 400 samples can be accomodated per run.

John L. Barron
Bedford Institute of Oceanography
P. O. Box 1006
Dartmouth, N. S. B2Y 4A2

Available from originator only

Telephone (902) 426-3676

STD Tables and Plots
STD

Language - FORTRAN IV
Hardware - HP 2100A/Disk/CalComp Plotter optional

Reduces data from Guildline STD and Hewlett Packard data logger to tables of salinity-temperature-depth information and prepares it for plotting. The equation giving salinity as a function of conductivity ratio, temperature, and pressure is due to Dr. Andrew Bennett.

John L. Barron
Bedford Institute of Oceanography
P. O. Box 1006
Dartmouth, N. S. B2Y 4A2

Available from originator only

Telephone (902) 426-3676

Consistency of Physical and Chemical Data
C 18 A 18 X

Language - COBOL and FORTRAN subroutines
Hardware - IBM 360-50/48K/Disk/2 tape units

Performs consistency check of physical and chemical data obtained during oceanographic cruises. Input: Disk pack with recorded and sorted data, parameter card indicating whether the input corresponds to physical or chemical data. Output: Listing of inconsistent data.

Capitan de Fragata Nestor
Lopez Ambrosioni
Centro Argentino de Datos Oceanograficos
Avenida Montes de Oca 2124
Buenos Aires, Republica Argentina

Available from originator only
Telephone 21-0061

Calculation of Thermometric Values
C 18 A 23 X

Language - COBOL and FORTRAN subroutines
Hardware - IBM 360-50/58K/Disk/2 tape units

Calculates thermometric depth and corrected temperatures. Input: Disk with physical data and calibration table of reversing thermometers. Output: Listing of evaluated and accepted physical data.

Capitan de Fragata Nestor
Lopez Ambrosioni
Centro Argentino de Datos Oceanograficos
Avenida Montes de Oca 2124
Buenos Aires, Republica Argentina

Available from originator only
Telephone 21-0061

Station Data System Final Values
C 18 A 32 X FQ

Language - COBOL and FORTRAN subroutine
Hardware - IBM 360-50/64K/Disk/2 tape unit

Interpolates temperature, salinity, and oxygen at standard depths; calculates sigma-t and sound velocity at observed and standard depths; also calculates specific volume anomaly and dynamic depth anomaly at standard depths. Input: Disk pack with accepted primary data records. Output: Listing of observed and computed values at observed and standard depths.

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Lopez Ambrosioni
Centro Argentino de Datos Oceanograficos
Avenida Montes de Oca 2124
Buenos Aires, Republica Argentina

Available from originator only
Telephone 21-0061

Daily Seawater Observations

Language - FORTRAN IV
Hardware - CDC CYBER 74

Input: Daily observations of temperature and salinity. Output: (1) Quarterly statistics, (2) annual statistics, (3) listing of seven-day normally weighted means for one year, and (4) plot of normally weighted means for one year. Author - H. Somers. Early version in FORTRAN II-D for the IBM 1620.

Marine Environmental Data Service
580 Booth Street
Ottawa, Ont. K1A 0H3

Available from originator only
Telephone (613) 995-2011

Data Management System for Physical and Chemical Data
OCEANS V

Language - COBOL, FORTRAN, PL/1, machine lang.
Hardware - CDC 6400 under SCOPE 3.3, 125K octal words/IBM 360-85 under MVT, 200K decimal bytes

The OCEANS V system is designed to make available any physical, chemical, or meteorological data collected as manual recordings or analog traces. The system is divided into a number of modules and presently processes data collected using Nansen bottles and mechanical bathythermographs. There are three stages to the system: (1) edit and quality control of newly collected data, (2) addition of these data to existing historical data, and (3) retrieval/report from these historical data.

D. Branch	Available from originator only
Marine Environmental Data Service	
580 Booth Street	
Ottawa, Ont. K1A 0H3	Telephone (613) 995-2011

Mass Transport and Velocities	Language - FORTRAN II
GEOMASS	Hardware - PDP 8 E/12K

Calculates velocities at standard depths between two stations relative to deepest common depth; also calculates trapezoidally mass transport between successive depths and culumative mass transport from surface. Assumes deepest common depth is level of no motion. Author - C. Peter Duncan.

Donald K. Atwood	Available from originator only
Marine Sciences Department	
University of Puerto Rico	
Mayaguez, PR 00708	Telephone (809) 892-2482

Station Data	Language - FORTRAN IV
TWIRP	Hardware - PDP 10

Interpolates oceanographic data; calculates sigma-t, dynamic depth anomaly, potential temperature, and delta-t. Input: Observed thermometric depths, temperature, salinity, and chemistry. Output: Temperature, salinity, sigma-t, potential temperature, delta-t at observed depths and all of these plus dynamic height anomaly interpolated to standard depths. Author - C. Peter Duncan.

Donald K. Atwood	Available from originator only
Marine Sciences Department	
University of Puerto Rico	
Mayaguez, PR 00708	Telephone (809) 892-2482

Thermometer Correction, Thermometric Depth	Language - FORTRAN IV
GIESE 04	Hardware - PDP 10

Corrects thermometers and calculates thermometric depth, as per formulae by Keyte. Input: Thermometer number, uncorrected reading, auxiliary thermometer reading, data, cruise number, station number, wire out. Output: Corrected temperatures, corrected unprotected thermometer readings, and thermometric depth. Author - Mary West.

Donald K. Atwood	Available from originator only
Marine Sciences Department	
University of Puerto Rico	
Mayaguez, PR 00708	Telephone (809) 892-2482

Oceanography Station Computer Program	Language - FORTRAN IV
	Hardware - Burroughs 6700/2125 words

Processes observed station data to obtain interpolated values of temperature, salinity, oxygen, specific volume anomaly, dynamic depth, sigma-t, and sound velocity. The three-point Lagrange interpolation equation and the Wilson sound velocity formula are used in the computations. Running time is two seconds per station.

Miguel Angel Alatorre
Instituto de Geofisica
Universidad N.A. de Mexico
Ciudad Universitaria
Mexico 20, D.F.

Copy on file at NODC

Telephone 548-65-00, ext. 537

Flexible System for Biological, Physical, and Chemical Data
SEDHYP (System d'Exploitation des Donnees en Hydrologie Profonde)

Language - FORTRAN IV
Hardware - XDS Sigma 7/40K 32 bit words with overlay

A very flexible system of about 5,000 cards which computes, interpolates, lists, and plots physical, chemical, and biological parameters. Input includes: List of the parameters to be listed, computed, interpolated, plotted, and copied on files; method of computation and interpolation; name of the parameter to be used as "interpolater"; list of the interpolation levels; format of the processed data. Output: Listings of the observed, computer, or interpolated parameters; plots of one parameter versus another parameter with all the curves on the same graph, or by groups of N curves on the same graph; copy of the values of one parameter on a working file for further use by other programs. The options, input on cards, are analysed and controlled; each station is stored in "common" area; then parameters are computed and interpolated. Files in a new format (FICPAR) are created; each file contains all the values of all the stations for one parameter. The plot is realized from two files of the FICPAR type. Documentation: Presentation de SEDHYP, Dec. 1973; also, Catalogues des methodes de calcul, d'interpolation et de reduction, Dec. 1973.

Mr. Stanislas, BNDO
Centre National pour l'Exploitation des Oceans
Boite Postale 337
29273 Brest Cedex, France

Available from originator only

Telephone 80.46.50, telex. 94-627

Subroutines for Physical, Chemical and Biological Parameters
C04 SAL, C44 TETA, C 46 SIGM Z, etc.

Language - FORTRAN IV
Hardware - XDS Sigma 7

Subroutines compute the following parameters: Depth, pressure, salinity, potential temperature, sigma-o, oxygen saturation percent, sigma-t, delta-st, potential sigma, alpha, delta-alpha, sigma-stp, nitrate, saturated oxygen, apparent oxygen utilization, sound velocity, dynamic depth, potential energy anomaly, salinity or temperature flux, Vaisala frequency. Input: Value of all parameters to be used in the computations and the catalog identification number of the chosen method. Documentation: "Catalogue des methodes de calcul des parameters physiques, chimiques et biologiques," Dec. 1973.

Mr. Stanislas, BNDO
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Boite Postale 337
29273 Brest Cedex, France

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Interpolation Subroutines
INTERP1, INTERP2, etc.

Language - FORTRAN IV
Hardware - XDS Sigma 7

Subroutines interpolate the values of a parameter at different levels; for each subroutine, the method is different: spline function, polynomial interpolation, linear interpolation, Lagrange polynomial interpolation. Input: The values of the parameter to be interpolated, the corresponding values of the parameter to be used as "interpolater" (e.g., depth), list of the levels of the "interpolater" for which interpolation is asked, the number of points to be used. Documentation: "Catalogue des methodes d'interpolation," Dec. 1973.

Mr. Stanislas, BNDO
Centre National pour l'Exploitation des Oceans
Boite Postale 337
29273 Brest Cedex, France

Available from originator only

Telephone 80.46.50, telex 94-627

Processes STD and CTD Data
SEDSTD (Systeme d'Exploitation des DONNEES STD, CTD)

Language - FORTRAN IV
Hardware - XDS Sigma 7/25K words

The system includes programs to copy the raw data from paper tape onto magnetic tape, to produce validated data from the raw data using calibration information, and to process the validated data. It is possible to reprocess the stations from raw data or validated data on magnetic tape. Option information to be supplied includes: identification number of the stations to be processed, whether the data are raw or validated, list of the depth levels to be listed, and scale of the parameters to be plotted. Output: Listings of depth or pressure, temperature, salinity (observed or computed from conductivity), oxygen, oxygen saturation percent, sigma-t, potential temperature, potential sigma, delta-alpha, and delta-d for each station; plots of temperature, salinity, oxygen and sigma-t vs. depth, and temperature vs. salinity for each station; magnetic tape files of raw and validated data. Documentation: Presentation de SEDSTD, Dec. 1973.

Mr. Stanislas, BNDO
Centre National pour l'Exploitation des Oceans
Boite Postal 337
29273 Brest Cedex, France

Available from originator only

Telephone 80.46.50, telex 94-627

Reads, Calculates, Interpolates Station Data
CAPRICORN

Language - FORTRAN IV
Hardware - IBM 360-65/320K bytes

Reads oceanographic station data from cards or NODC formatted 120-character-per-record tape. If desired, it can edit the NODC tape and/or calculate and interpolate oceanographic parameters for each station or calculate and interpolate variables at specified sigma theta surfaces or potential temperatures. (See subroutines F3, SECPG, EDIT, and PLTEDT.)

Ruth McMath
Department of Oceanography
Texas A&M University
College Station, TX 77843

Available from originator only

Telephone (71?) 845-7432

Station Data Calculations
F3

Language - FORTRAN IV
Hardware - IBM 360-65

This subroutine takes as input, through its common blocks, the observed values for depth, temperature, salinity, and, if available, oxygen, phosphate, silicate, nitrate, and nitrite. It then interpolates salinity and temperature to standard depths, using either a linear means or by weighting two Lagrangian three-point polynomials (depending on whether there are three or four properly distributed data points). The subroutine calculates the following for both the observed and standard depths: potential temperature, thermosteric anomaly, specific volume anomaly, sigma-t, the sigma values for depths of 0, 1000, 2000, 3000, 4000, and 5000 meters. Computations of sound velocity, dynamic height, and transport functions are made for standard depths only. The computation for stability is made at the observed depths only. The values of oxygen, phosphate, silicate, nitrate, and nitrite are simply printed out, if they are read. Subroutine F3 is a composite of programs written by various authors: The original "F" program was written by Kilmer and Durbury for the IBM 650. This program was expanded by Nowlin and McLellan for the IBM 7094 and again by Eleuterius for the IBM 360. The Scripps SNARKI program provided the basis for much of the present version. (See program CAPRICORN.)

Ruth McMath | Available from originator only
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Texas A&M University
College Station, TX 77843 | Telephone (713) 845-7432

Plots Station Data | Language - FORTRAN IV
PLTEDT | Hardware - IBM 360-65/Houston Omnigraphic Plotter

This subroutine generates a plot tape to make any of the following 13 plots: Temperature vs. depth, salinity vs. depth, sigma-t vs. depth, temperature vs. salinity, oxygen vs. sigma-t, oxygen vs. temperature, temperature vs. silicate, potential temperature vs. salinity, phosphate vs. depth, sound velocity vs. depth, stability vs. depth, silicate vs. depth, oxygen vs. depth. The size of the plots is 11 x 17 inches. (See program CAPRICORN)

Ruth McMath | Available from originator only
Department of Oceanography
Texas A&M University
College Station, TX 77843 | Telephone (713) 845-7432

Calculates Station Data | Language - FORTRAN IV
SECPG | Hardware - IBM 360-65

This subroutine computes the depths that correspond to input density surfaces. It then interpolates temperature, salinity, oxygen, phosphate, nitrate, and nitrite to these computed depths. Using these interpolated values for temperature and salinity, the following are calculated at each computed depth: Potential temperature, thermosteric anomaly, specific volume anomaly, sigma theta for depths of 0, 1000, 2000, 3000, 4000, and 5000 meters, transport, dynamic height and acceleration potential. Uses Lagrangian interpolation or linear interpolation, depending on point distribution. (See program CAPRICORN)

Ruth McMath | Available from originator only
Department of Oceanography
Texas A&M University
College Station, TX 77843 | Telephone (713) 845-7432

Station Data | Language - HP ASA Basic FORTRAN
HYD2 | Hardware - HP 2100/13K words/Keyboard/CalComp Plotter, paper tape punch, and magnetic tape unit optional

Computes station data. Input: Header information, depth, temperature, salinity, oxygen and silicate from a user-specified device. Output: Station data including depth, temperature, salinity, oxygen, silicate, pressure, potential temperature, dynamic height, etc. Plot or tape output optional.

Chris Polloni | Available from originator only
Woods Hole Oceanographic Institution
Woods Hole, MA 02543 | Telephone (716) 548-1400

Brunt-Vaisala Frequency | Language - FORTRAN IV
OBVFRQ | Hardware - XDS Sigma 7/204 words

Subprogram computes the Brunt-Vaisala frequency (radians/sec) from station data. Input: Gravitational acceleration, pressure, temperature, salinity. Requires double precision of program ATG.

Information Processing Center — Available from originator only
Woods Hole Oceanographic Institution
Woods Hole, MA 02543 — Telephone (617) 548-1400

Dynamic Height — Language - FORTRAN IV
DYNHT — Hardware - XDS Sigma 7/85 words

Subprogram calculates an array of dynamic heights for specified arrays of pressure and specific volume anomalies.

Jacqueline Webster — Available from originator only
Woods Hole Oceanographic Institution
Woods Hole, MA 02543 — Telephone (617) 548-1400

Potential Energy Anomaly — Language - FORTRAN IV
PEN — Hardware - XDS Sigma 7/103 words

Subprogram computes the potential energy anomaly from pressure and specific volume anomaly.

Jacqueline Webster — Available from originator only
Woods Hole Oceanographic Institution
Woods Hole, MA 02543 — Telephone (617) 548-1400

Various Parameters from Station Data — Language - FORTRAN IV
OCCOMP — Hardware - XDS Sigma 7/23K words

Computes various oceanographic parameters from NODC format station data; interpolates parameters to standard depths; computes *geostrophic velocity and volume transport* for successive stations.

Mary Hunt — Available from originator only
Woods Hole Oceanographic Institution
Woods Hole, MA 02543 — Telephone (617) 548-1400

Specific Volume Anomaly — Language - FORTRAN IV-H
SVANOM — Hardware - XDS Sigma 7

Subroutine computes the specific volume anomaly, given the pressure and the specific volume, from an empirical formula devised by Fofonoff and Tabata.

Mary Hunt — Copy on file at NODC (listing, documentation)
Woods Hole Oceanographic Institution
Woods Hole, MA 02543 — Telephone (617) 548-1400

Pressure Subroutine — *Language - FORTRAN IV-H*
PRESS — Hardware - XDS Sigma 7

Subroutine computes a series of pressures from a given series of depths, temperatures, salinities, and their latitude. The equation for pressure is integrated by successive approximations.

Mary Hunt — Copy on file at NODC (listing, documentation)
Woods Hole Oceanographic Institution
Woods Hole, MA 02543 — Telephone (617) 548-1400

Reads Station Data — Language - FORTRAN IV-H
DATA — Hardware - XDS Sigma 7

Subroutine reads oceanographic station data cards and returns the information therein to the user, one station for each call.

Mary Hunt — Available from originator only
Woods Hole Oceanographic Institution
Woods Hole, MA 02543 — Telephone (617) 548-1400

Geostrophic Velocity Difference Subroutine — Language - FORTRAN IV-H
VEL — Hardware - XDS Sigma 7

Computes geostrophic velocity difference between two oceanographic stations, according to a formula described by N.P. Fofonoff and Charlotte Froese.

Mary Hunt — Copy on file at NODC (listing, documentation)
Woods Hole Oceanographic Institution
Woods Hole, MA 02543 — Telephone (617) 548-1400

Volume Transport — Language - FORTRAN IV-H
VTR — Hardware - XDS Sigma 7

Computes volume transport between two stations.

Mary Hunt — Available from originator only
Woods Hole Oceanographic Institution
Woods Hole, MA 02543 — Telephone (617) 548-1400

Sigma-t — Language - FORTRAN IV-H
SIGMAT and DSIGMT — Hardware - XDS Sigma 7

Subroutine computes sigma-t from temperature and salinity by Knudsen's formula, rewritten by Fofonoff and Tabata. DSIGMT is the double-precision form of SIGMAT.

Mary Hunt — Copy on file at NODC (listing, documentation)
Woods Hole Oceanographic Institution
Woods Hole, MA 02543 — Telephone (617) 548-1400

Adiabatic Temperature Gradient — Language - FORTRAN IV-H
ATG — Hardware - XDS Sigma 7

Subroutine calculates adiabatic temperature gradient for specified values of pressure, temperature, and salinity, using an empirical formula developed by N.P. Fofonoff.

Mary Hunt — Copy on file at NODC (listing, documentation)
Woods Hole Oceanographic Institution
Woods Hole, MA 02543 — Telephone (617) 548-1400

Potential Temperature — Language - FORTRAN IV
POTEMP — Hardware - XDS Sigma 7/100 words

Subprogram computes the potential temperatures at a given temperature, salinity, and pressure, using a formula derived from a polynomial fit to laboratory measurements of thermal expansion.

Mary Hunt
Woods Hole Oceanographic Institution
Woods Hole, MA 02543

Available from originator only

Telephone (617) 548-1400

Specific Volume
SPVOL

Language - FORTRAN IV
Hardware - XDS Sigma 7/129 words

Subprogram computes the specific volume (ml/g) of seawater at a given temperature, pressure, sigma-o, and sigma-t, using formula by V.W. Ekman (rewritten by Fofonoff and Tabata). Input: values of sigma-t as calculated by subprogram SIGMAT.

Mary Hunt
Woods Hole Oceanographic Institution
Woods Hole, MA 02543

Available from originator only

Telephone (617) 548-1400

Oxygen
OPLOT

Language - FORTRAN IV
Hardware - CDC 3300

Computes oxygen in ml/l and percent saturation.

U.S. Coast Guard Oceanographic Unit
Bldg. 159-E, Navy Yard Annex
Washington, DC 20590

Available from originator only

Telephone (202) 426-4642

Chlorophyl
CHLO

Language - FORTRAN IV
Hardware - CDC 3300

Computes chlorophyl in mg/l.

U.S. Coast Guard Oceanographic Unit
Bldg. 159-E, Navy Yard Annex
Washington, DC 20590

Available from originator only

Telephone (202) 426-4642

Salinity
SALTY

Language - FORTRAN IV
Hardware - CDC 3300

Computes salinity in ppt with temperature correction and shear correction between each standard water sample.

U.S. Coast Guard Oceanographic Unit
Bldg. 159-E, Navy Yard Annex
Washington, DC 20590

Available from originator only

Telephone (202) 426-4642

Temperature-Salinity Class Volume
TSVOL

Language - FORTRAN IV
Hardware - CDC 3300

Calculates volume of water by T-S class, area within which station is located (in sq. km) and total volume for each T-S class.

U.S. Coast Guard Oceanographic Unit
Bldg. 159-E, Navy Yard Annex
Washington, DC 20590

Available from originator only

Telephone (202) 426-4642

Thermometer Correction
THERZ

Language - FORTRAN IV
Hardware - CDC 3300

Corrects deep-sea reversing thermometers using calibration factors; computes thermometric depth for unprotected thermometers, lists bad thermometers and their malfunctions, computes observed L-Z, plots L-Z curve (on line), computes used L-Z and picks from the L-Z curve the depths for the other bottles.

U.S. Coast Guard Oceanographic Unit
Bldg. 159-E, Navy Yard Annex
Washington, DC 20590

Available from originator only

Telephone (202) 426-4642

Transport
XPORT

Language - FORTRAN IV
Hardware - CDC 3300/CalComp Plotter

Calculates sigma-t, dynamic heights, solenoidal values of average temperature and salinity volume flow, current velocity at top of each solenoid, distance (n.m.) between stations, specific heat, heat and salt transport, net volume flow for each pair of stations, net volume flow in form of cold core and warm water for each station and plots solenoid graph on off-line plotter.

U.S. Coast Guard Oceanographic Unit
Bldg. 159-E, Navy Yard Annex
Washington, DC 20590

Available from originator only

Telephone (202) 426-4642

Plots Temperatures, Lists Mixed Layer Depths
WEEKPLOT

Language - FORTRAN
Hardware - Burroughs 6700/Less than 20K words/ CalComp Plotter

Plots sea temperature for one-degree quadrangles for the eastern tropical Pacific Ocean; also, computes and lists mixed layer depths. Mixed layer depths are computed by an empirical formula and modified by reports received from tuna fishing vessels. Input: Disk files of synoptic marine radio weather reports, prepared separately from punched cards.

A.J. Good
Southwest Fisheries Center
National Marine Fisheries Service, NOAA
P.O. Box 271
La Jolla, CA 92037

Available from originator only

Telephone (714) 453-2820, ext. 325

Constants for Harmonic Synthesis of Mean Sea Temperatures, HARMONIC

Language - ALGOL
Hardware - Burroughs 6700/Less than 30K words/ Disk input and output

Computes five constants to be used in harmonic synthesis of mean sea temperatures, by one-degree quadrangles. Monthly variations of mean sea temperature are treated by a Fourier series analysis. Disk file of constants, by one-degree quadrangles for the Pacific Ocean.

A.J. Good
Southwest Fisheries Center
National Marine Fisheries Service, NOAA
P.O. Box 271
La Jolla, CA 92037

Available from originator only

Telephone (714) 453-2820, ext. 325

Vertical Section Plots
ESTPAC

Language - FORTRAN 63
Hardware - CDC 3600/32K words/3 tape units/ Calcomp Plotter

Constructs vertical temperatures and salinity sections from STD magnetic tape on 30-inch-wide plotting paper. The product of the two dimensions (station distance x depth) of a data array times four must not exceed 32,000. NOAA Technical Report NMFS CIRC-365.

Kenneth A. Bliss — Available from originator only
Southwest Fisheries Center
National Marine Fisheries Service, NOAA
P.O. Box 271
La Jolla, C' 92037 — Telephone (714) 453-2820

Converts STD Data — Language - FORTRAN
RDEDTP — Hardware - CDC 3600/15K words/2 tape units

Reads raw STD data from tape, converts to engineering units, removes extraneous values, smooths and writes a new tape. U.S. Fish and Wildlife Service Spec. Sci. Rept. Fish. 588, by James H. Jones, 1969. This program is presently in the state of revision.

Kenneth Bliss — Available from originator only
Southwest Fisheries Center
National Marine Fisheries Service, NOAA
P.O. Box 271
La Jolla, CA 92037 — Telephone (714) 453-2820

Corrects STD Data — Language - FORTRAN
TPMOD — Hardware - CDC 3600/10K words/2 tape units

Reads STD data from output of program RDEDTP, calibrates data, adds station location and data, and writes a final corrected tape. U.S. Fish and Wildlife Service Spec. Rept. Fish. 588, by James J. Jones, 1969.

Kenneth Bliss — Available from originator only
Southwest Fisheries Center
National Marine Fisheries Service, NOAA
P.O. Box 271
La Jolla, CA 92037 — Telephone (714) 453-2820

Environmental Dynamics Subroutines — Language - BASIC
OCEANLIB — Hardware - IBM 360/Dartmouth DTSS

A series of subroutines: ALPHA calculates Alpha 35, 0, P for any depth by interpolating standard values from a random access file; GRAV computes the resultant gravity at any latitude, using the international gravity formula. SIGMAT calculates sigma-o and sigma-t using empirical formulas of Knudsen for sigma-o and LaFond for sigma-t. DENSITY calculates the in situ density of seawater, using empirical formulas developed by LaFond and others. SOUND computes sound velocity using the empirical formula developed by Leroy in 1968. POSIT computes the direction and distance between points on the earth's surface, using spherical trigonometry, allowing the earth's radius to vary.

LCDR W.C. Barney — Available from originator only
Environmental Sciences Department
U.S. Naval Academy
Annapolis, MD 21402 — Telephone (301) 267-3561

Geostrophic Current — Language - BASIC
CURRENT — Hardware - IBM 360/Dartmouth DTSS/14.5K

Calculates geostrophic current at standard depths between adjacent stations using method of dynamic height or geopotential anomalies. Requires OCEANLIB subroutines.

LCDR W.C. Barney
Environmental Sciences Department
U.S. Naval Academy
Annapolis, MD 21402

Available from originator only
Telephone (301) 267-3561

Monthly Sonic Layer Depthh

Language - FORTRAN
Hardware - IBM 7074

Calculates sonic layer depth from BT traces and converts position to plot on Mercator base without overprints. OS No. 53480. Author - D.B. Nix.

Data Systems Office
U.S. Naval Oceanographic Office
Washington, DC 20373

Available from originator only
Telephone (301) 763-1449

Vertical Temperature Gradients

Language - FORTRAN
Hardware - IBM 7074

Computes, from geographic station data, the vertical temperature gradient largest in absolute magnitude between successive standard depths, for each station. These gradients are tabulated in frequency distribution format, and averages are calculated for each one-degree square. OS No. 20126 Part 2. Author - C.S. Caldwell.

Data Systems Office
U.S. Naval Oceanographic Office
Washington, DC 20373

Available from originator only
Telephone (301) 763-1449

Water Clarity

Language - FORTRAN V
Hardware - UNIVAC 1108/3K words/Drum

Combines data taken with Scripps illuminameter, transmissometer, Secchi disk and Forel-Ule Scale. Logarithmetic combination of parameters are summed over observation intervals to yield meter by meter results. Input: Diffuse attenuation coefficients, transparency readings, depths of observations via cards. Output: Visibility loss at specific levels of the water column and contrast loss expressed in decibel values.

Philip Vinson
U.S. Naval Oceanographic Office
Washington, DC 20373

Available from originator only
Telephone (202) 433-3878

Oceanographic Data Computation
TPCONV

Language - FORTRAN EXTENDED
Hardware - CDC 6500/15K 60 bit words/Two tape units

Assembles temperature, salinity, and sound velocity at forty standard oceanographic depths from any preselected ocean area onto magnetic tape. Also included for each oceanographic station is the layer depth, layer sound velocity, in-layer gradient, below-layer gradient, axis depth and axis depth sound velocity. Output used by program SUMMARY. NUC Tech. Note 1223.

John J. Russell
Naval Undersea Center
Code 14
San Diego, CA 92132

Available from originator only
Telephone (714) 225-6243

Variance and Standard Deviation
SUMMARY

Language - FORTRAN EXTENDED
Hardware - CDC 6500/63K 60 bit words/Disk/ Two tape units

Orders selected oceanographic data at each of forty standard levels and selects maximum, 10, 20, 30, 40, 50, 60, 70, 80, 90, 25 and 75th percentiles, and minimum. Also computes variance and standard deviation at each of the forty standard depths. Input: Data generated by the program TPCONV. Output: Deck of eighty-one cards - two cards at each of the forty standard depths. First card contains maximum, percentiles (above), minimum, number of observations, and identification at one depth. The second card contains variance, number of observations, mean, depth number, and identification. NUC Tech. Note 1224.

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Naval Undersea Center
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San Diego, CA 92132

Available from originator only

Telephone (714) 225-6243

Sigma-T
INVREJ

Language - ANSI FORTRAN
Hardware - CDC 3300

Removes inversions in sigma-t profiles prior to calculation of buoyance-frequency profile. The following options are available: binomial smoothing, minima rejection, maxima rejection, and local smoothing.

K. Crocker
Naval Underwater Systems Center
Newport, RI 02840

Available from originator only

Telephone (401) 841-3307

STD Processing
OCEANDATA

Language - ANSI FORTRAN
Hardware - CDC 3300/UCC plotter

Converts raw Plessey CTD-STD data (frequency or period average) to parametric form, corrects salinity for time constant mismatch, rejects invalid data, averages data by designated intervals (normally 1 decibar). Provides listing, plots, disk and tape files of corrected raw data and reduced data. Several special purpose editions available.

K. Crocker
Naval Underwater Systems Center
Newport, RI 02840

Available from originator only

Telephone (401) 841-3307

Internal Waves
WITCOMB

Language - USASI FORTRAN
Hardware - CDC 3300/26K words

Calculates internal wave eigenvalues (dispersion curves) and eigenfunctions as solutions to the linear internal wave equation. Input: Density as a function of depth in the ocean from the surface to the bottom. Data points do not have to be equally spaced in depth. Output: Density profile (smoothed), buoyance-frequency profile, dispersions curves (all listings); plotter tape for preceding plus eigenfunctions. Performs numerical integration of internal wave equation using assumed values of frequency and wavenumber until boundary conditions are satified by trial and error.

Alan T. Massey
Naval Underwater Systems Center
Newport, RI 02840

Available from originator only

Telephone (401) 841-4772

Interpolation for Oceanographic Data

Language - FORTRAN
Hardware - CDC 3200/IBM 1620

Interpolates the values of depth, temperature, and salinity at isentropic levels (constant values of the density functions). Uses a four-point Lagrangian polynomial. Exception: Modifications are made where common oceanographic conditions distort the polynomial. Technical Report TM-312 by J. Farrell and R. Lavoie, Feb. 1964.

Naval Underwater Systems Center
Newport, RI 02840

Copy on file at NODC (above report)

STD-S/V Data
S2049

Language - FORTRAN V
Hardware - UNIVAC 1108/CalComp Plotter

Performs general purpose processing of STD-S/V data; includes conversion to oceanographic units, editing, ordering relative to increasing depth, calculation of dependent variables, and plotting of results. Input: Pressure or depth, temperature, salinity or conductivity, and sound speed in units of frequency, period or geophysical units. Density computed by integration of P, T, S throughout the water column; sound speed by Wilson's equation; potential temperature by Fofonoff's equation. Output: Magnetic tape, listing, plots of profiles, T vs. S, cross-sections, geographic contours; measured parameters plus density, sound speed, potential quantities, Brunt-Vaisala frequency.

Michael Fecher
Naval Underwater Systems Center
New London, CT 06320

Available from originator only

Telephone (203) 442-0771, ext. 2834

Thermometric Depth Calculation
CAST

Language - HP FORTRAN IV under RTE
Hardware - HP 2100S/12K words core/10K for RTE/CalComp Plotter

Uses thermometer readings from Nansen bottles to calculate thermometric depths of the bottles, following method described in instructions for filling out Naval Oceanographic Office "A Sheet." Thermometric depths are printed with input data; L-Z graph is plotted.

J. Dean Clamons
Shipboard Computing Group, Code 8003
Naval Research Laboratory
Washington, DC 20375

Available from originator only

Telephone (202) 767-2024

Thermometer Data File Handler
THERMO

Language - HP FORTRAN IV under RTE
Hardware - HP 2100S/12K words core/10K for RTE

Maintains and builds a disk file containing correction factors for thermometers used on Nansen casts. Program is interactive and can add, delete, change, or list data for each thermometer.

J. Dean Clamons
Shipboard Computing Group, Code 8003
Naval Research Laboratory
Washington, DC 20375

Available from originator only

Telephone (202) 767-2387

Internal Gravity Waves
DISPER

Language - FORTRAN
Hardware - CDC 3800

Calculates frequency - wavenumber dispersion relations for internal gravity wave models. Input: Brunt-Vaisala frequency distribution, wavenumber range, mode number range. Output: Frequency as a function of wavenumber for specified modes, in tabular or line printer plot form. NRL Report 7294, "Numerical Calculation of Dispersion Relations for Internal Gravity Waves," by T.H. Bell, Sept. 1971.

T. H. Bell
Ocean Sciences Division
Naval Research Laboratory
Washington, DC 20375

Available from originator only

Telephone (202) 767-3122

Sea Surface Temperature
Analysis Model
MEDSST

Language - FORTRAN/COMPASS
Hardware - CDC 3100/CDC 3200/32K 24 bit words

Performs a synoptic sea-surface temperature analysis, using a Laplacian relaxation technique to generate the final field. EPRF Program Note 5, "Mediterranean Sea-Surface Temperature Analysis Program MEDSST," by A.E. Anderson, Jr., S.E. Larson, and L. I'Anson.

Sigurd Larson
Environmental Prediction
Research Facility
Naval Postgraduate School
Monterey, CA 93940

Available from originator only

Telephone (408) 646-2868

Objective Thermocline Analysis

Language - FORTRAN IV-H
Hardware - IBM 360/CDC 6500

Reads digitized bathythermograph traces and then analyzes them objectively by Gaussian and non-Gaussian methods for the top, center, and base of the main thermocline. Additionally, such features as multiple thermoclines, inversions, and thermal transients are identified and their key points are included in the information data printout. "Objective Digital Analysis of Bathythermograph Traces," thesis by Eric F. Grosfils, Dec. 1968.

Naval Postgraduate School
Monterey, CA 93940

Available from NTIS, Order No. AD 689 121/LK, $5.75 paper, $2.25 microfiche.

Wet Bulb Temperature
WETBLB

Language - FORTRAN IV
Hardware - CDC 6600

Computes the wet bulb temperature from the inputs of dry bulb temperature, pressure, and relative humidity. This is sometimes useful for generating homogeneous archive outputs (filling in missing wet bulb temperatures from the other variables).

Jerry Sullivan
Center for Experiment Design and
Data Analysis, NOAA/EDS
Washington, DC 20235

Available from originator only

Telephone (202) 634-7288

Internal Wave Oscillations
ZMODE

Language - FORTRAN
Hardware - CDC 6600 & 7600 (original program), UNIVAC 1108 (modified version)/31K words

Computes eigenfunctions and dispersion relations for internal wave oscillations in a density-stratified water column, using Newton-Raphson approximation technique to obtain solutions for eigenfrequencies and associated mode functions. Input: STD data on cards. Output: Tabular output of density, Brunt-Vaisala frequency, dispersion relations, eigenfunctions. User's Manual (RDA-TR-2701-001) by R&D Associates, Santa Monica, California, for implementation on CDC 6600 and CDC 7600; modified User's Manual by A. Chermak for AOML's UNIVAC 1108.

Andrew Chermak | Available from originators only

Ocean Remote Sensing Laboratory
Atlantic Oceanographic and Meteorological Laboratories, NOAA
15 Rickenbacker Causeway
Miami, FL 33149

Telephone (305) 361-3361

Isentropic Interpolation

Language - FORTRAN
Hardware - IBM 360-65/61K bytes

Provides values of several variables at selected density (sigma-t) levels; interpolation by cubic spline, with modifications for oscillation. Input: NODC SD2 (station data) file. Output: Interpolated values of depth, temperature, salinity, pressure, specific volume anomaly, dynamic height and acceleration potential, on magnetic tape. Author - Douglas R. Hamilton.

Oceanographic Services Branch
National Oceanographic Data Center
NOAA/EDS
Washington, DC 20235

Copy on file at NODC
Telephone (202) 634-7439

Potential Temperature and/or Density
POTDEN

Language - Assembler
Hardware - IBM 360-65/50K bytes

Reads the NODC SD2 (station data) file and replaces temperature and/or sigma-t with potential temperature and/or density. Requires subroutine PODENS. Author - Walter Morawski.

Oceanographic Services Branch
National Oceanographic Data Center
NOAA/EDS
Washington, DC 20235

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Telephone (202) 634-7439

SIGMAT

Language - FORTRAN
Hardware - IBM 360-65/740 bytes (object form)

Computes sigma-t, giving a rounded floating point answer accurate to four significant decimal digits (xx.xx); also returns the computed variable FS (a function of sigma-t), a short floating point number. Author - Robert Van Wie.

Oceanographic Services Branch
National Oceanographic Data Center
NOAA/EDS
Washington, DC 20235

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Telephone (202) 634-7439

Dynamic Depth Anomaly
DYANOM

Language - FORTRAN IV-G
Hardware - IBM 360-65

Subroutine computes dynamic depth anomaly. Author - Robert Van Wie.

Oceanographic Services Branch
National Oceanographic Data Center
NOAA/EDS
Washington, DC 20235

Copy on file at NODC
Telephone (202) 634-7439

Computes Salinity from Conductivity, T, P
SALINE

Language - FORTRAN
Hardware - IBM 360-65

Computes salinity from conductivity in milli mhos/cm, pressure in decibars, and temperature in degrees C. Valid for temperature range 0-30 degrees C, salinity range 20-40 ppt, pressure range 0-3000 decibars; measurements outside these ranges may cause a significant error in the resulting salinity computation. Author - Philip Hadsell.

Oceanographic Services Branch
National Oceanographic Data Center
NOAA/EDS
Washington, DC 20235

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Telephone (202) 634-7439

Volume Transport Function
QFUN

Language - FORTRAN
Hardware - IBM 360-65

Computes the volume transport function at each depth of a hydrographic station. Author - Ralph Johnson.

Oceanographic Services Branch
National Oceanographic Data Center
NOAA/EDS
Washington, DC 20235

Copy on file at NODC
Telephone (202) 634-7439

Potential Temperature, Potential Density
PODENS

Language - FORTRAN IV-G
Hardware - IBM 360-65

Computes potential temperature and potential density from depth, temperature, and salinity. Author - Dave Pendleton.

Oceanographic Services Branch
National Oceanographic Data Center
NOAA/EDS
Washington, DC 20235

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Telephone (202) 634-7439

Volume Transport
VOLTRN

Language - FORTRAN IV
Hardware - IBM 360-65

Computes volume transport between any two stations, according to the formulas in D. Pendleton's "Specifications for a subroutine which computes the transport function," NODC, August 29, 1972. Author - Ralph Johnson.

Oceanographic Services Branch
National Oceanographic Data Center
NOAA/EDS
Washington, DC 20235

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Telephone (202) 634-7439

Computes Pressure
PRESSR

Language - FORTRAN IV
Hardware - IBM 360-65

Computes pressure from latitude, depth, temperature, salinity, and sigma-t. Must be called serially through a cast since the calculation of pressure at each depth after the surface involves the depth, density, and pressure of the preceding depth. Author - Sally Heimerdinger.

Oceanographic Services Branch
National Oceanographic Data Center
NOAA/EDS
Washington, DC 20235

Copy on file at NODC
Telephone (202) 634-7439

Temperature Difference Calculations
TEMPDIFF

Language - Assembler
Hardware - IBM 360-65/36K bytes

Takes selected BT's or sections of the BT geofile and sums the temperature difference for each Marsden square, one degree square and month; these may be summed over 10-, 15-, or 20-meter intervals. Input: BT records sorted by Marsden (ten-degree) squares. Author - Walter Morawski.

Oceanographic Services Branch
National Oceanographic Data Center
NOAA/EDS
Washington, DC 20235

Copy on file at NODC

Telephone (303) 634-7439

RSMAS Data Processing and Analysis Programs; Data Management System (DMS)

Language - FORTRAN*
Hardware - UNIVAC 1106/PDP-11

Data Processing:

DMSED is a general-purpose editor for DMS files; editing may be by hand or by algorithm. (PDP-11)

DMSCHP automatically chops a DMS time series into profiles. (PDP-11)

AACAL aligns, calibrates, and pre-edits data from Aanderaa current meter; output is DMS file. (PDP-11)

MK2CAL transcribes and calibrates Mark II Cyclesonde (unattended current profiler) data; output is DMS file. (PDP-11)

DERIVE appends to a DMS file new quantities derived from the input file; repertoire is expandable. (UNIVAC, PDP-11)

DMSORT concatenates DMS files from various sources, sorts according to selected keys, segments into class intervals, and outputs a DMS file. (UNIVAC)

MATRIX Ø1 interpolates data in depth-time coordinates to a uniform grid with various input and output options. (UNIVAC)

Data Analysis:

PLSAD computes a wide variety of statistical and dynamical quantities from time series of STD and/or PCM profiles; requires data on a uniform, rectangular grid. (UNIVAC)

IWEG computes internal wave eigenvalues and eigenfunctions. (UNIVAC)

CHRSEC computes dynamical fields and internal wave rays for x, z sections; requires mean sigma-t and mean velocity fields on a common level but otherwise nonuniform grid. (UNIVAC)

SPKTRA computes auto-and cross-spectra by Tukey (correlation) method. (UNIVAC)

CMXSPC computes auto- and cross-spectra in polarized form for single or a pair of complex-valued series; input is selected output of SPKTRA. (UNIVAC)

TIDES4 computes amplitude and phases for specified frequencies by least-squares; for pairs of series, tidal ellipse parameters are computed. (UNIVAC)

METFLX computes all meteorological fluxes from observed meteorological parameters by bulk formulas. (UNIVAC)

EMPEIG1 computes cross covariance matrix and finds its eigenvalue and (orthogonal) eigenvectors. (UNIVAC)

(*Reading and writing DMS files in machine-level language)

Christopher N.K. Mooers or Henry T. Perkins
Division of Physical Oceanography
Rosenstiel School of Marine and Atmospheric Science
University of Miami
10 Rickenbacker Causeway
Miami, FL 33149

Available from originator only

Telephone (305) 350-7546

CHEMISTRY

CO_2 and D.O. SAT

Language - FORTRAN
Hardware - IBM 360/less than 5000 bytes

Calculates percent saturation of dissolved oxygen and concentration of free CO_2. Follows standard methods (American Public Health Association, 1971) for oxygen and Garrels and Christ (1965) for CO_2 ("Minerals, Solutions, and Equilibria," R.M. Garrels and C. Christ, Harper and Row). Input: Data cards with sample identification, temperature, pH, phenolpthalein alkalinity, bicarbonate alkalinity, and dissolved oxygen. An average correction factor for total dissolved solids is included in each run. Output: Printed and punched sample identification, temperature, dissolved oxygen, percent saturation, carbonate alkalinity, bicarbonate alkalinity, bicarbonate, K_1, and free CO_2. "A Computer Program Package for Aquatic Biologists," by Paul J. Godfrey, Lois White, and Elizabeth Keokosky.

Paul J. Godfrey
Department of Natural Resources
Cornell University, Fernow Hall
Ithaca, NY 14850

Copy on file at NODC (listing, documentation)

Telephone (607) 256-3120

Alkalinity
ALCT

Language - FORTRAN IV
Hardware - CDC 3150

Calculates total alkalinity, carbonate alkalinity, pH, and log (k(A)) for a potentiometric alkalinity titration. Endpoints are found by Gram plot method; complete procedure has been described by Dyrssen and Sillen. Input: Paper tape from DATOS data set and ASR-33 Teletype; a set of sample salinities on disk, tape, or cards; one or two cards containing run information. Output: Line printer plots of the titration curves; extensive information about each sample run; and a summary sheet with the four parameters for each sample.

John L. Barron
Bedford Institute of Oceanography
P. O. Box 1006
Dartmouth, N. S. B2Y 4A2

Available from originator only

Telephone (902) 426-3676

Specific Conductivity with Pressure Effect

Language - FORTRAN
Hardware - IBM 360

Computes specific conductivities from measured values of resistance for the electrolytic solution and the pressures at which the measures were made. Also determines other useful quantities needed to determine the effect of pressure on the ionic conductance through the upper 2000 meters of the ocean's water column. The conductivity increase which results solely from solution concentration changes during compression is determined and found to be a significant error source. Thesis by Michael E. Mays, Dec. 1968.

U.S. Naval Postgraduate School
Monterey, CA 93940

Available from NTIS, Order No. AD 686 654, $4.75 paper copy, $2.25 microfiche.

Percentage Saturation of Oxygen in Estuarine Waters, B528

Language - FORTRAN IV-G
Hardware - IBM 360-65

Computes the percentage saturation of dissolved oxygen in estuarine or brackish water. Because of the temperature compensation at a fixed 25 degrees C in the conductivity measurements, salinity is given as input and is used to compute chlorinity. This computed chlorinity, with the accompanying temperature, is used to determine the oxygen solubility of the water. The maximum percentage saturation of the dissolved oxygen in the water is calculated from the given oxygen content and the computed oxygen solubility. The same procedure is used to ascertain the minimum percentage saturation of oxygen. Independent of the dissolved oxygen data, there is another set of measured temperature and conductivity from which salinity is computed. Author - Patricia A. Fulton.

Computer Center Division	Copy on file at NODC (listing, documentation)
U.S. Geological Survey	
National Center	
Reston, VA 22092	Telephone (703) 860-7106

Water Chemistry - Dielectric Constant — Language - FORTRAN IV
M0101 — Hardware - IBM 360-65

Calculates the dielectric constant of water (0 to 360 degrees C [water saturated for T over 100 degrees C]), the density of water (0 to 360 degrees C), the extended Debye-Hueckel activity coefficients of charged species, the activity products for 33 hydrolysis reactions including oxides, hydroxides, carbonates, sulfides, and silicates, the concentrations and activities of ten ion pairs or complexes, and of 22 aqueous species, the oxidation potential calibrations, the standard state oxidation potentials and Eh values at equilibrium for 13 redox reactions, moles and ppm of cations at equilibrium with 42 solid phases and the chemical potentials for each of the 42 reactions along with activity product/equilibrium constant ratios for the hydrolysis reactions.

Computer Center Division	Copy on file at NODC (deck, documentation)
U.S. Geological Survey	
National Center	
Reston, VA 22092	Telephone (703) 860-7106

COASTAL AND ESTUARINE PROCESSES

Three-Dimensional Estuarine Circulation Model
Language - FORTRAN IV
Hardware - UNIVAC 1108/40K 6 character words

Produces a fully three-dimensional simulation of estuarine circulation for arbitrary lateral and bottom geometry, inflowing rivers, openings to the sea, salinity, wind effect, and other related parameters.

Alan J. Fuller
Department of Meteorology (IFDAM)
University of Maryland
Space Science Building
College Park, MD 20742
Available from originator only
Telephone (301) 454-2708

Multi-Layer Hydrodynamical-Numerical Model
Language - FORTRAN IV
Hardware - CDC 6500/CDC 7600

Computes the current patterns using a two-layer hydrodynamical-numerical model for bays, estuaries, and sections of coastline. This program applies the finite difference hydrodynamic equations to a two-layer system. As optional output, it can produce currents and layer elevation fields, surface pollutant diffusion fields, and detailed special point information. EPRF Tech. Note. 2-74, "A Multi-Layer Hydrodynamic-Numerical Model," by T. Laevastu.

Taivo Laevastu
Environmental Prediction
Research Facility
Naval Postgraduate School
Monterey, CA 93940
Available from originator only
Telephone (408) 646-2937

Single Large Hydrodynamical-Numerical Model
Language - FORTRAN IV
Hardware - CDC 6500/IBM 360

Computes tidal, permanent, and wind-induced flows for bays, estuaries, or sections of the coastline, using the finite difference form of the hydrodynamic equations. Input includes bottom bathymetry and tides at an open boundary. Output: Wave elevation and current speed and direction fields, diffusion of pollutants field, if desired; detailed data for up to twelve points. EPRF Technical Note 1-74, "A Vertically Integrated Hydrodynamical-Numerical Model," by T. Laevastu.

Kevin M. Rabe
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Estuarine Model
NONLNRA
Language - FORTRAN
Hardware - IBM 370-165/150K characters

Solves a system of non-linear algebraic equations for a vertical plane estuary model. Output: Salinity and two velocity component profiles as a function of two space variables.

L.J. Pietrafesa
Center for Marine and Coastal Studies
North Carolina State University
Raleigh, NC 27607
Available from originator only
Telephone (919) 787-6074

MIT Salinity Intrusion Program

Language - FORTRAN IV
Hardware - IBM 360-65/120 K bytes

Provides predictions of unsteady salinity intrusion in a one-dimensional estuary of varying cross-section, using finite difference solution to the equations of motion and conservation of salt; coupling is accounted for through a density term in the momentum equation. Input: Schematized geometry, upstream inflows as a function of time, ocean salinity and tidal elevations at the ocean. Output: (1) Surface elevations, cross-sectional discharges and salinities as a function of time; (2) high-water slack salinities by tidal cycle; (3) longitudinal dispersion coefficients; (4) plots. Technical Report No. 159, "Prediction of Unsteady Salinity Intrusion in Estuaries: Mathematical Model and User's Manual," by M.L. Thatcher and D.R.F. Harleman, Ralph M. Parsons Laboratory, Massachusetts Institute of Technology, 1972. Also MIT Sea Grant Publications 72-21.

M. Llewellyn Thatcher
Southampton College
Southampton, NY 11968

Available from MIT or from the author.

Telephone (516) 283-4000

Dynamic Deterministic Simulation
SIMUDELT

Language - FORTRAN IV
Hardware - IBM 360/5 tape units/CalComp Plotter optional

Simulates growth of a subaqueous deposit where a fresh water stream enters a saline basin. Tidal effects and longshore transport also are included. Input: Stream width and depth, water discharge, sediment load, profile of basin bottom, tidal range, length of tidal cycle, and transport parameter. Output: Tables of particle trajectories, graphs of distribution of different size grains in deposit, plots of delta development in plan, and elevation views.

K. Kay Shearin
University of Delaware
P.O. Box 2826
Lewes, DE 19958

Available from originator only

Telephone (302) 645-6674

Beach Simulation Model

Language - FORTRAN IV
Hardware - IBM 1130/16K words/3 disks/CalComp Plotter

A computer simulation model to study relationships among barometric pressure, wind, waves, longshore currents, beach erosion, and bar migration. Fourier series are used to represent major trends in weather and wave parameters. Barometric pressure plotted as a function of time; longshore current velocity computed as function of first derivative of barometric pressure. Nearshore area represented by a linear plus quadratic surface with bars and troughs generated by normal and inverted normal curves. Wave and current energies computed for storm and poststorm recovery periods are used to simulate coastal processes which cause erosion and deposition. A series of maps are produced to show changes in nearshore topography through time. ONR Tech. Report No. 5, "Computer Simulation Model of Coastal Processes in Eastern Lake Michigan," Williams College.

William T. Fox
Department of Geology
Williams College
Williamstown, MA 01267

Available from originator only

Telephone (413) 597-2221

Estuarine Density Currents and Salinity
DENSITY

Language - FORTRAN
Hardware - IBM 370-155/250K bytes

Performs numerical calculation of steady density currents and salinities in an estuary in three dimensions by numerical solution of finite-difference equations for a number of quasi-timesteps. Input: Local geometry, depths, tidal currents, latitude, boundary salinities. Output: x-y-z paper plot of velocities and vector representation of circulation patterns with complementary 35mm color slides. Determines primary orientation of 45° oblique photographs, identifies specific dye patch movements, and averages velocity over a known time span. "Airphoto Analysis of Estuarine Circulation," by H.G. Weise, M.Oc.E. Thesis.

Dennis Best or L.S. Slotta — Available from originator only
Ocean Engineering Program
Oregon State University
Corvallis, OR 97331 — Telephone (503) 754-3631

Upwelling — Language - FORTRAN
CSTLUPWL — Hardware - CDC 6400/150K characters/2 tape units

Provides sigma-t and three velocity component profiles as a function of two space variables for a steady-state, two-dimensional upwelling. Input: Independent variable and independent parameter sizes.

L.J. Pietrafesa — Available from originator only
Center for Marine and Coastal Studies
North Carolina State University
Raleigh, NC 27607 — Telephone (919) 787-6074

Mathematical Water Quality Model for Estuaries — Language - FORTRAN IV
Hardware - IBM 360/350K

Computation of water quality parameters of dissolved oxygen, biological oxygen demand, etc., for the Neuse Estuary, North Carolina. Input: Upstream discharge and water quality data. Output: Water levels, velocities, and water quality parameters at downstream locations. Uses numerical solution of shallow-water systems matched with explicit solutions of the mass balance equation. Sea Grant Report, in preparation.

Michael Amein — Available from originator only
Dept. of Civil Engineering
North Carolina State University
Raleigh, NC 27607 — Telephone (919) 737-2332

Computation of Flow through Masonboro Inlet, North Carolina — Language - FORTRAN IV
Hardware - IBM 360/350K

Computation of discharges and water levels at complex coastal inlets. Implicit numerical solution of one-dimensional shallow water equations. Input: Tidal elevations at sea, water levels on the land side of inlets. Output: Velocity, discharges, and water levels. Sea Grant Report UNC-SG-73-15. Also, Journal of Waterways and Harbors Div., Proc. ASCE, Vol. 10, No. WW1, February 1975, pp. 93-110.

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Circulation in Pamlico Sound — Language - FORTRAN
Hardware - IBM 360/320K

Provides the water surface elevations, water velocity plots, and flows through inlets for Pamlico and Albemarle Sounds, North Carolina. Input: Wind fields, inflows, ocean tides.

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North Carolina State University
Raleigh, NC 27607

Available from originator only

Telephone (919) 737-2332

Three-Dimensional Simulation Package
AUGUR

Language - FORTRAN IV/COMPASS
Hardware - CDC 6400/SCOPE 3.4 Operating System

AUGUR is a general three-dimensional simulation package designed to handle general spatial bookkeeping problems and basic input-output of data, thus leaving the main problem of modeling to the user. The specifications are:

(1) to handle 1 to a maximum of 33,000 volumes;
(2) to handle a one-, two-, or three-dimensional space in any one of the following structures:

(a) 1 x 1 x 1	(e) NC x 1 x 1	where NC = maximum volumes along the west to east axis
(b) 1 x NR x 1	(f) NC x NR x 1	
(c) 1 x NR x ND	(g) NC x NR x ND	NR = maximum volumes along the south to north axis
(d) 1 x 1 x ND	(h) NC x 1 x ND	ND = maximum volumes along the lower to upper axis

(3) to determine the following information of each volume:

(a) corner coordinates
(b) volume centroid
(c) centroids of the volume's faces
(d) projected areas onto XY, XZ, and YZ planes of the volume's faces
(e) the volume measurement

(4) to allow the user to handle:

(a) 1 to 40 state variables in each volume
(b) velocities at the centroid of each volume or (but not both) at the centroids of each face of the volume
(c) boundary conditions for state variables and velocities

(5) to allow the user to initialize all state variables and velocities of each volume;
(6) to allow the user to define the corner coordinates of each volume;
(7) to set up the space in a right-handed coordinate system;
(8) to allow free field data input (to a certain extent);
(9) to use Adams-Bashforth predictor equation for the simulation with Euler's equation as a starter with the option to replace these equations;
(10) to be able to save the simulated data on tape in order to continue the simulation later on or to plot the data;
(11) to provide the option of suppressing certain output.

Due to the generality of the specifications, AUGUR requires much more computer core storage than a program written for a specific model. In order to reduce the core requirement, AUGUR has been subdivided into semi-independent parts called overlays, thus allowing only currently needed programs to occupy core while keeping the unneeded ones on disk until later. Further reduction of core is made possible by keeping in core only those data arrays of volumes which are to be used immediately and storing the data arrays of volumes not currently in use on disk. University of Washington Ref. No. M74-88, NSF GX 33502, IDOE/CUEA Technical Report 7, "AUGUR, A Three-Dimensional Simulation Program for Non-Linear Analysis of Aquatic Ecosystems," by D.L. Morishima, P.B. Bass, and J.J. Walsh, November 1974.

Department of Oceanography
University of Washington
Seattle, WA 98195

Copy on file at NODC (Program code on magnetic tape). Documentation (above report) available from NTIS, Order No. PB 245 566, $8.00 paper, $2.25 fiche.

Salinity Distribution in One-Dimensional Estuary, ARAGORN — Language - FORTRAN; Hardware -

A model is constructed for an estuary to predict the salinity distribution for a given fresh-water inflow, with application to the upper Chesapeake Bay and the Susquehanna River. Based on a salt continuity equation in which the seaward salt advection is balanced by turbulent diffusion toward the head of the bay. In final form, it is a linear, second-order, and parabolic partial differential equation with variable coefficients which are functions of both space and time. Tech. Report 54, Ref. 69-7, by William Boicourt, May 1969.

Cheaspeake Bay Institute
The Johns Hopkins University
Baltimore, MD 21218

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Modeling an Ocean Pond — Language - FORTRAN; Hardware - IBM 370-155

Models hydrodynamic characteristics of coastal waters, using the Galerkin weighted-residual method through which the finite element scheme can be implemented without a knowledge of the particular variational principle of the governing equation. Marine Technical Report 40, "Modeling an Ocean Pond: A Two-Dimensional, Finite Element Hydrodynamic Model of Ninigret Pond, Charlestown, Rhode Island", by Hsin-Pang Wang, University of Rhode Island, 1975.

Department of Mechanical Engineering and Applied Mechanics
University of Rhode Island
Kingston, RI 02881

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Estuarine Chemistry
MYACHEM — Language - FORTRAN IV/WATFIV; Hardware - IBM 370

From raw hydrographic data and nutrient chemistry data absorbences, computes actual values as compared with standards, along with instantaneous tide height of station. Estuarine low salinity procedures are applied. Output: Formatted concentrations of nitrite, nitrate, ammonia, urea, dissolved oxygen, silicate, and phosphate. Author - Stephen A. Macko.

B.J. McAlice
Ira C. Darling Center (Marine Laboratory)
University of Maine at Orono
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Available from originator only
Telephone (207) 563-3146

Estuarine Tides
TIDE — Language - WATFIV FORTRAN; Hardware - IBM 370

Computes instantaneous tide height, range, and tide character, given corrections. Author - Stephen A. Macko.

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Mathematical Model of Coastal Upwelling: Drift, Slope, and Littoral Currents
OCE01P07 — Language - FORTRAN IV; Hardware - IBM 360-40/23K bytes

Calculates and prints drift, slope, and littoral current tables, as well as their corresponding flux tables - a total of 33 tables. Input: Orientation of the coast, latitude of the site, direction of the wind, velocity of the wind. Output: For drift currents, the results are presented in ten tables, corresponding to each tenth of the H/D ratio, where H is the depth of the site and D is the depth of the friction layer (a function of latitude and wind velocity); in each table the drift currents are shown at 20 levels of the local depth; at each level, values for the following elements are given - velocity, angle with the wind, direction, angle with the slope, slope component of velocity, and component of velocity parallel to the coast. The drift fluxes are presented in an eleventh table and calculated at each tenth of the H/D ratio, giving values for the following elements - rate of flow (m^3/sec), angle with the wind, angle with the slope, direction, slope component of the rate of flow, and component of the rate of flow parallel to the coast. Slope currents and fluxes and littoral currents and fluxes are presented in tables similar to those of drift currents and fluxes, but without values for angle of currents and fluxes with the wind.

CF Emmanuel Gama de Almeida
Diretoria de Hidrografia e Navegacao
BCO Nacional de Dados Oceanograficos
Primeiro Distrito Naval - Ihla Fiscal
Rio de Janeiro - GB-20.000, Brasil

Copy on file at NODC (listing, documentation in English and Portuguese)

Beach and Nearshore Maps

Language - FORTRAN IV
Hardware - IBM 1130/8K words

Topographics maps of the beach and nearshore area are computed and plotted based on nine profiles from a baseline across the beach. Profiles are spaced at 100-foot intervals along the beach with survey points at five-foot intervals along each profile. Linear interpolation is made parallel to the baseline between adjacent profiles. Numbers and symbols are printed to form the maps. Profiles for a series of days are used to print maps of erosion and deposition by subtracting elevations for each day from the elevations for the previous day. ONR Tech. Report No. 4, "Beach and Nearshore Dynamics in Eastern Lake Michigan", by Davis and Fox, 1971.

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Williams College
Department of Geology
Williamstown, MA 01267

Available from originator only

Telephone (413) 597-2221

Numerical Model, Dynamics and Kinematics of Partially Mixed Estuaries

Language - FORTRAN
Hardware -

A real-time numerical model is developed to describe the dynamics and kinematics of partially mixed estuaries. The governing equations are formally laterally averaged and realistic estuarine bathymetry is included. The external inputs to the model are salinity and tidal amplitude as a function of time at the ocean boundary and the freshwater discharge at the river boundary. The model includes the continuity, salt, and momentum balance equations coupled by equations of state. The numerical technique conserves volume, salt, and momentum in the absence of dissipative effects. Simulations show that using a constant vertical eddy viscosity and diffusivity produce unrealistic salinity distributions, but have minor effects on the surface amplitudes; results from the application of the model to the Potomac Estuary, using a stability dependent eddy viscosity and diffusivity, yield distributions comparable to field observations. Further numerical experimentation illustrates the response of the circulation to changes in the boundary friction and the river discharge. Reference 75-9, Technical Report 91, "A Numerical Investigation into the Dynamics of Estuarine Circulation," by Alan Fred Blumberg, October 1975.

Chesapeake Bay Institute
The Johns Hopkins University
Baltimore, MD 21218

Copy on file at NODC (above report)

ENGINEERING

Deep Ocean Load Handling Systems
DOLLS

Language - FORTRAN IV
Hardware - CDC 6600

Provides a capability to evaluate any selected deep ocean load handling system on the basis of critical mission parameters; allows comparison of candidate systems, development of an optimum system, and sensitivity analyses. Input: Mission objectives, mission scenario, mission parameters, analytical parameters. Output: Scenario with times and costs in individual step and cumulative form. "A Method for Evaluation and Selection of Deep Ocean Load Handling Systems," Vol. I, Final Report, Vol. II, User's Manual; supplementary Letter Report.

L.W. Hallanger
Civil Engineering Laboratory
Naval Construction Battalion Center
Port Hueneme, CA 93043

Copy on file at NODC (Deck)

Telephone (805) 982-5787

Load Motion and Cable Stresses
CAB1

Language - FORTRAN IV
Hardware - CDC 6600

Determines the transient and/or steady-state load motion and cable stresses in a vertically suspended load due to excitation at top or release from non-equilibrium position. Uses the method of orthogonal collocation in the "length" variable in order to reduce the equations to a set of ordinary differential equations. These are solved by a predictor-corrector method. Input: Cable length, cable density, Ea, load radius, load density, fluid density, added mass and drag coefficient on load (sphere only), initial tension at load, frequency and amplitude of forced motion. Output: Time history of cable tensions, velocities, and time history of load motion.

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Naval Construction Battalion Center
Port Hueneme, CA 93043

Copy on file at NODC (Deck)

Telephone (805) 982-4625

Soil Test Data
TRIAX

Language - FORTRAN IV
Hardware - CDC 6600/100K characters

Uses standard technique for reduction of triaxial soil test data. Input: Axial displacement of sample, axial load, original area, original height, consolidation pressure, volume change, and pore water pressure. Output: Axial strain, pore water pressure change, principal stress difference, $\bar{A}$, minor and major principal effective stress, principal stress ratio, P, Q.

H.J. Lee
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Naval Construction Battalion Center
Port Hueneme, CA 93043

Copy on file at NODC (Deck)

Telephone (805) 982-5624

Dynamic Stress Response of
Lifting Lines, CABANA

Language - FORTRAN IV
Hardware - CDC 6600/2 tape units

Predicts dynamic responses of a lift line/payload system with long line length. Response operators are calculated from explicit equations; the output spectrum is used in a statistical calculation to determine the probability distributions. Input: Cable physical properties and elasticity, payload physical descriptions, surface excitation in the form of displacement spectrum or acceleration spectrum. Output: Dynamic tension or payload motion operators as a function of frequency, probability distribution of dynamic tension and motion, and design peak tension. CEL Technical Report R-703, "Dynamic Stress Response of Lifting Lines for Oceanic Operations," by C.L. Liu, Nov. 1970.

Francis C. Liu	Copy on file at NODC (Deck)
Civil Engineering Laboratory	
Naval Construction Battalion Center	
Port Hueneme, CA 93043	Telephone (805) 982-4613

Dynamic Response of Cable System — Language - FORTRAN IV
SNAPLG — Hardware - CDC 6600

Determines dynamic responses of a two-dimensional cable system in the ocean with in-line masses, based on lumped mass approximation; equations of motion were solved numerically by predictor-corrector method; cable segment takes tension only. Input: Cable static position, cable physical and elastic properties, in-line mass characteristics, current profile, surface excitation in sinusoidal form. Output: Tension and mass point location as functions of time. CEL Tech. Note N-1288, "Snap Loads in Lifting and Mooring Cable Systems Induced by Surface Wave Conditions," by F.C. Liu, Sept. 1973.

Francis C. Liu	Copy on file at NODC (Deck)
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Changes in Electromechanical Cable — Language - FORTRAN IV
RAMSC — Hardware - CDC 6600

Determines the internal and external changes of a multi-strand electromechanical cable under end constraints and loadings. Based on helical wire model, equations are solved numerically by progressive iteration. Input: Cable construction details, wire physical properties, external loadings and constraints. Output: Cable end torque or torsion, elongation, internal changes. Note: RAMSC and RADAC have been combined to form program TAWAC.

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End Responses in Electromechanical Cable — Language - FORTRAN IV
RADAC — Hardware - CDC 6600

Predicts the elongation, end rotation, or end moment of a double-armored electromechanical cable. Based on helical wire model, the problem is solved numerically by progressive iteration. Input: Cable physical and elastic properties, end loadings and/or conditions, detailed description of cable construction. Output: End responses in the form of end moment or end torsions, cable elongation, cable geometric changes, wire tensions. Note: RAMSC and RADAC have been combined to form program TAWAC.

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Unmanned Free-Swimming Submersible — Language - BASIC
UFSS Plotting Program — Hardware - HP 9830A/4K words core/24K words addtional/Plotter plus ROM

Calculates radius of mission possible for theoretical UFSS (Unmanned Free-Swimming Submersible) when internal energy usage (hotel load) is varied. Uses simple iteration to select relative speed for most efficient energy usage per actual distance covered. Input: Minimum, maximum, and increment on external volume and hotel load of UFSS; responses (yes or no) for speed matrix; response (yes or no) for another run with an ocean current one half knot greater than previous plot. Output: Speed matrix (if desired) up and downstream, matrix of radii covering volume and hotel load variations; graphic output of radii matrix as a function of external volume and hotel load as a parameter. Documentation: OTD-OI-74-02-01.

Edward J. Finn	Available from originator only
Ocean Instrumentation Branch	
Naval Research Laboratory, Code 8422	
Washington, DC 20375	Telephone (202) 767-2112

Unmanned Free-Swimming Submersible	Language - BASIC
UFSS Variable Hotel Load	Hardware - HP 9830A/2K words

Calculates ranges possible with theoretical UFSS when internal energy usage (hotel load) is varied, using iteration to determine speed for most efficient energy usage per actual distance covered. Input: Minimum, maximum and increment on external volume of UFSS and on hotel load in watts; response to question on desire to have most efficient speeds printed. Output: Matrix of ranges covering volume and hotel load variations; speed matrix (if desired); terminal plot of data in the matrix. Documentation: OTD-OI-74-01-01.

Edward J. Finn	Available from originator only
Ocean Instrumentation Branch	
Naval Research Laboratory, Code 8422	
Washington, DC 20375	Telephone (202) 767-2112

Unmanned Free-Swimming Submersible	Language - BASIC
Nominal UFSS Program	Hardware - HP 9830A/2K words

Calculates distance covered by theoretical unmanned free-swimming submersible vehicle with specific energy package, using iteration to determine speed for most efficient energy usage per actual distance covered. Output: Data about model; most efficient speed with ocean current and range (one-way) as a function of external volume of the UFSS.

Edward J. Finn	Available from originator only
Ocean Instrumentation Branch	
Naval Research Laboratory, Code 8422	
Washington, DC 20375	Telephone (202) 767-2112

Steady-State Trapezoidal Array Configurations	Language - FORTRAN V Hardware - UNIVAC 1108

Steady-state configurations under forces due to currents are determined. Finite element (lump mass) three-dimensional statics equations are solved using Skop's method of imaginary reactions. NUSC/NL Tech. Memo. SA2302-0170-72, "On the Parameters Governing Steady State Distortion of a Bottom Moored, Subsurface Buoyed, Linear Cable Array in Various Current Fields," by J.D. Wilcox, Sept. 1972.

J.D. Wilcox	Available from originator only
Naval Underwater Systems Center	
New London, CT 06320	Telephone (203) 442-0771

Anchor Last, Buoy System Development Dynamics	Language - FORTRAN V Hardware - UNIVAC 1108

Equations of motion for a surface or subsurface buoy system initially stretched out are solved as the anchor is dropped. The equations of motion for buoy, cable (modeled as a number of lump masses) and anchor are integrated in the time domain, using a fourth order Runge-Kutta algorithm. Velocity-squared drag and hydrodynamic masses concentrated at each lump. Input: Physical parameters of items to be modeled. Output: x-z positions, tensions and angles, sequential plots. NUSC/NL Technical Memorandum TA12-134-71, March 1971.

Gary T. Griffin	Available from originator only
Naval Underwater Systems Center	
New London, CT 06320	Telephone (203) 442-0771

Cable-Towed Buoy Configurations in a Turn — Language - FORTRAN V; Hardware - UNIVAC 1108

Steady-state configurations under forces due to a ship on a turn are determined. The three-dimensional steady state cable equations are integrated with a fourth order Runge-Kutta algorithm from the towed body up to the ship. Input: Physical parameters of items to be modeled. Output: Buoy attitude x-y-z positions, ship speed, buoy speed, tensions and angles. Three-dimensional plots available. Project CORMORAN Memo 0132 (4.10.3), "Steady State Towline Configurations in a Turn," Sept. 1973.

Gary T. Griffin	Available from originator only
Naval Underwater Systems Center	
New London, CT 06320	Telephone (203) 442-0771

Free-Floating Spar-Array Dynamics — Language - FORTRAN V; Hardware - UNIVAC 1108

The equations of motion for spar buoy, cable (lump mass model), and an extended three-leg structure are solved in the time domain using a fourth order Runge-Kutta algorithm. Auxiliary computation of spar buoy bending in the waves is included. Input: Physical parameters of the items to be modeled. Output: Spar buoy x-z motions and tilt, hydrophone motions on the ends of the three-leg structure. NUSC/NL Technical Memorandum No. TA12-2[illegible]-71, Nov. 1971.

Gary T. Griffin	Available from originator only
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Free-Floating Spar Buoy Dynamics — Language - FORTRAN V; Hardware - UNIVAC 1108

The equations of motion for the spar buoy are solved in the time domain using a fourth order Runge-Kutta algorithm. Auxiliary computations of the spar buoy bending due to waves are included. NUSC Tech. Memo. No. TA12-257-71, "The Spar Buoy System," by G.T. Griffin, Nov. 1972. NUSC Tech. Memo. No. 2212-90-67, "A Guide for the Design of Spar Buoy Systems," by K.T. Patton, July 1967.

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Ship Suspended Array Dynamics — Language - FORTRAN V; Hardware - UNIVAC 1108

Equations of motion for a vertically suspended cable array are solved in the time domain as the ship drifts and responds to waves. The cable is broken up into a elastically connected lump masses, each having two degrees of freedom. The 2 x n equations of motion are solved simultaneously in the time domain using a fourth order Runge-Kutta algorithm. Velocity-squared viscous forces and hydrodynamic masses are concentrated at each lump. NUSC Tech. Memo. No. 2212-202-68, "A Study of the Stability of the Five-Hydrophone, Ship-Suspended General Dynamics Array," by G.T. Griffin, Oct. 1968.

Gary T. Griffin
Naval Underwater Systems Center
New London, CT 06320
Available from originator only
Telephone (203) 442-0771

Boomerang Corer Descent/Ascent Trajectories
Language -
Hardware -

Boomerang corer trajectories due to currents are calculated. The three-dimensional body equations are integrated in the time domain using a fourth order Runge-Kutta algorithm.

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Available from originator only
Telephone (203) 442-0771

Buoy-Ship Dynamics
Language - FORTRAN V
Hardware - UNIVAC 1108

The equations of motion for the buoy moving in a plane (3-D Heave, Surge and Pitch) and constrained by the A-frame and vangs are solved in the time domain using a fourth order Runge-Kutta algorithm. Ship response to the quasi-random sea state is computed using Lewis's dimensionless RAO's. NUSC letter ser. TA12:83, "Results of First Order Study of Ship-to-Buoy Mooring Study."

Kirk T. Patton or Gary T. Griffin
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Available from originator only
Telephone (203) 442-0771

Buoy System Dynamics
Language - FORTRAN V
Hardware - UNIVAC 1108

Six degree-of-freedom equations of motion for the buoy are solved in the time domain using a fourth order Runge-Kutta integration algorithm. These equations are coupled with the set of partial differential equations for cable dynamics through tensions and velocities at the buoy. The equations of motion for the cable are solved in the space-time domain using a method of characteristics approach, i.e., a modification of Hartree's method. Output motions and tensions for the buoy and along the cable are plotted as power spectra using FFT methods. The program has been used for the design of oceanographic and acoustic buoy systems and for evaluation of NOAA Data Buoy design.

Kirk T. Patton and Gary T. Griffin
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Available from originator only
Telephone (203) 442-0771

Fixed Thin Line Array Dynamics
Language - FORTRAN V
Hardware - UNIVAC 1108

Equations of motion for the cable array are solved in the time domain for excitation by currents. The array is broken up into n elastically connected lump masses, each having three degrees of freedom. The 3 x n equations of motion are solved simultaneously, using a fourth order Runge-Kutta algorithm. Velocity-squared viscous forces and hydrodynamic masses are concentrated at each lump.

Kirk T. Patton or Gary T. Griffin — Available from originator only
Naval Underwater Systems Center
New London, CT 06320 — Telephone (203) 442-0771

Fixed Thin Line Array Steady State Configurations — Language - FORTRAN V; Hardware - UNIVAC 1108

Steady-state configurations under forces due to currents are determined. The three dimensional steady-state cable equations are integrated using a fourth order Runge-Kutta algorithm. One fiftieth the array length is typically used as the integration step size.

Kirk T. Patton or Gary T. Griffin — Available from originator only
Naval Underwater Systems Center
New London, CT 06320 — Telephone (203) 442-0771

Marine Corer Dynamics — Language - FORTRAN V; Hardware - UNIVAC 1108

The equations of motion for a corer free-falling through the water column (or, for the case of a cable-lowered corer, free-falling through its trip height) are integrated in the time domain, using a fourth order Runge-Kutta algorithm. Upon impact with the bottom, frictional forces due to the sediment are introduced and the corer comes to rest. Output: Terminal velocity, velocity at impact, penetration of corer and compaction of recovered sample. "An Analysis of Marine Corer Dynamics," by K.T. Patton and G.T. Griffin, Marine Technology Society Journal, Nov.-Dec. 1969.

Kirk T. Patton and Gary T. Griffin — Available from originator only
Naval Underwater Systems Center
New London, CT 06320 — Telephone (203) 442-0771

Steady-State Buoy System Configurations — Language - FORTRAN V; Hardware - UNIVAC 1108

Steady-state configurations under forces due to winds and currents are computed. The three-dimensional cable equations are integrated with a fourth order Runge-Kutta algorithm from the buoy down to the anchor. An iterative method is used to modify the buoy's displacement until the vertical cable projection matches the water depth; 1/1000 the cable length is used as the integration step size. Instrument packages mounted in or on the line can be accounted for also. Output: buoy drift and cable x-y-z positions, tensions, two angles and stretch as functions of cable length. Three-dimensional plots also available. NUSC Tech. Memo. 2212-212-68, "On the Equilibrium Configuration of Moored Surface Buoys in Currents," by K.T. Patton, Oct. 1968. USL Tech. Memo. 2212-116-69, "A Study of Three NAFI Buoy Moorings," by G.T. Griffin, June 1969. NUSC Tech. Memo. 2212-170-69, "An Analysis of Optimizing NAFI Buoy Shallow Water Moorings," by G. Griffin and P. Bernard, Sept. 1969.

Kirk T. Patton or Gary T. Griffin — Available from originator only
Naval Underwater Systems Center
New London, CT 06320 — Telephone (203) 442-0771

Steady-State Subsurface Buoy System Configurations — Language - FORTRAN V; Hardware - UNIVAC 1108

Steady-state configurations under forces due to currents are computed. The three-dimensional cable equations are integrated with a fourth order Runge-Kutta algorithm from the buoy down to the anchor; 1/1000th the line length is typically used as the integration step size. Output: x-y-z cable positions, tensions, stretch and angles (all in dimensionless form) as a function of dimensionless cable length. Three-dimensional plots also available. NUSC Report

4379, "Nondimensional Steady State Cable Configurations," by G.T. Griffin, Aug. 1972; NUSC Tech. Memo. TA12-50-73, "Remote Terminal Usage to Compute Subsurface Single Leg Array Configurations" by G.T. Griffin, Nov. 1973.

Kirk T. Patton or Gary T. Griffin — Available from originator only
Naval Underwater Systems Center
New London, CT 06320 — Telephone (203) 442-0771

Towed Array Dynamics — Language - FORTRAN V
Hardware - UNIVAC 1108

Equations of motion for the towline, towed array, and drogue are solved in the time domain for response to ship motions, etc. The equations are integrated using a fourth order Runge-Kutta algorithm. The program first computes the steady-state configuration and tensions which serve as initial conditions for the dynamics section. Also, using the steady-state data, the Strouhal excitation frequencies and amplitudes are computed along the towline.

Kirk T. Patton or Gary T. Griffin — Available from originator only
Naval Underwater Systems Center
New London, CT 06320 — Telephone (203) 442-0771

Towed System Configurations — Language - FORTRAN V
Hardware - UNIVAC 1108

Steady-state configurations for towed systems are determined. Effects of current and ship turns can be included. The three-dimensional cable equations are integrated with a fourth order Runge-Kutta algorithm from the towed body up to the ship. For steady ship turns, the centrifugal force is also integrated up the cable. 1/100th to 1/1000th the cable length is used as the integral step size. Output: x-y-z positions, tensions, stretch, and angles as functions of cable length. Can be dimensionless. Three-dimensional plots also available. NUSL Tech. Memo. 933-0175-64, "Towline Configurations and Forces" by K.T. Patton, Oct. 1964; NUSC/NL Report No. 4379, "Nondimensional Steady State Cable Configurations," by G.T. Griffin, Aug. 1974; Project CORMORAN Memo. D112/4.10.3, "Two-dimensional Steady-State Towed System Configurations," by G.T. Griffin, March 1973.

Kirk T. Patton or Gary T. Griffin — Available from originator only
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Towed System Dynamics — Language - FORTRAN V
Hardware - UNIVAC 1108

Equations of motion for the towed body and for the cable (when treated as a lump mass model of n lumps) are solved in the time domain using a fourth order Runge-Kutta algorithm. The towed body is allowed six degrees of freedom, and each cable element has three. "Dynamics of a Cable-Towed Body System," by G.T. Griffin, MS Thesis, University of Rhode Island, Kingston, Jan. 1974.

Kirk T. Patton or Gary T. Griffin — Available from originator only
Naval Underwater Systems Center
New London, CT 06320 — Telephone (203) 442-0771

Trapezoidal Array Deployment Dynamics — Language - FORTRAN V
Hardware - UNIVAC 1108

Equations of motion for a trapezoidal array are solved in the time domain as the second anchor is lowered and the ship is underway. The two subsurface buoys and the four cables are broken up into six elastically connected lump masses, each having three degrees of freedom. The eighteen equations of motion are solved simultaneously in the time domain, using a fourth order Runge-Kutta algorithm. Velocity-squared viscous forces and hydrodynamic masses are concentrated at each lump. NUSC Report No. 4141, "Dynamics of Trapezoidal Cable Arrays," by G.T. Griffin and K.T. Patton, March 1972.

Kirk T. Patton or Gary T. Griffin Naval Underwater Systems Center New London, CT 06320	Available from originator only Telephone (203) 442-0771

Trapezoidal Array Dynamics — Language - FORTRAN V; Hardware - UNIVAC 1108

Equations of motion for a subsurface trapezoidal cable array are solved in the time domain for response to currents. The two subsurface buoys and the three cables are broken up into six elastically connected lump masses, each having three degrees of freedom. The eighteen equations of motion are solved simultaneously using a fourth order Runge-Kutta algorithm. Velocity-squared viscous forces and hydrodynamic masses are concentrated at each lump. NUSC Report No. 4141, "Dynamics of Trapezoidal Cable Arrays," by G.T. Griffin and K.T. Patton, March 1972.

Kirk T. Patton or Gary T. Griffin Naval Underwater Systems Center New London, CT 06320	Available from originator only Telephone (203) 442-0771

Steady-State Cable Laying — Language - FORTRAN IV; Hardware -

The three-dimensional steady-state cable equations are integrated using an Euler method. Ship speed and cable payout rate constant. Output: x-y-z positions of the cable and tensions. "Final Report to NUSL - Analysis of Cable Laying," by J. Schram, 1969.

R. Pierce Naval Underwater Systems Center New London, CT 06320	Available from originator only Telephone (203) 442-0771

Towed Array Configurations — Language - FORTRAN V; Hardware - UNIVAC 1108

Steady-state towed array configurations are computed. The two-dimensional cable equations are integrated with a fourth order Runge-Kutta algorithm from the drogue up to the ship; 1/1000th the total cable length is used as the integrated step size. Output: x-z positions, tensions, stretch, and angle as functions of cable length. Plot routine available.

S. Rupinski Naval Underwater Systems Center New London, CT 06320	Available from originator only Telephone (203) 442-0771

Cable Configuration — Language - FORTRAN IV; Hardware - IBM 1800

Computes the equilibrium configuration and tensions of a cable towing a submerged body for faired, unfaired, and discontinuous (lower part faired) cables. The output on the line printer gives the values of the input data followed by various calculated values. The solution is found for the "heavy general cable" law of cable loadings as described by M.C. Eames (1968). Execution time: About 30 seconds for each case. NIO Program No. 168. Author - Catherine Clayson.

National Institute of Oceanography Wormley, Godalming, Surrey, England	Copy on file at NODC (listing, documentation)

GEOLOGY AND GEOPHYSICS

Convection in Variable Viscosity Fluid
CONVEC

Language - FORTRAN IV
Hardware - CDC 6600/140K bytes/Disc/ Tektronix graphics terminal

Computes streamlines, temperatures, and shear heating in a highly viscous fluid of variable viscosity (Earth's upper mantle), relief gravity, and heat flow. "ADI Solution of Free Convection in a Variable Viscosity Fluid," by M.H. Houston, Jr., and J.-Cl. De Bremaecker, Jour. Comp. Phys., Vol. 16, No. 3, 1974.

J.-Cl. De Bremaecker
Rice University
P.O. Box 1892
Houston, TX 77001

Copy on file at NODC

Telephone (713) 528-4141

Gravitational Attraction, Two Dimensional Bodies, TALWANI 2-D GRAVITY, W9206

Language - FORTRAN IV-H
Hardware - IBM 360-65

Calculates the vertical component of gravitational attraction of two-dimensional bodies of arbitrary shape by approximating them to many-sided polygons. The technique is from Talwani, Worzel, and Landisman in J.G.R., Vol. 64(1), 1959. Output: Gravity values are printed in tables; the calculated profile and the observed profile (if one exists) are plotted on the line printer in either a page size plot or an extended plot with the x-axis running down the page. Contains option of units in miles, kilofeet, or kilometers.

Computer Center Division
U.S. Geological Survey
National Center
Reston, VA 22092

Copy on file at NODC (listing, documentation)

Telephone (703) 860-7106

X-Ray Diffraction Analysis

Language - FORTRAN IV
Hardware - XDS Sigma 7/20K 32 bit words/RAD

Provides mineralogic analysis of marine sediments from X-ray diffraction data. Input: Tape containing data generated by X-ray diffractometer. Output: List of "d" spacings, 2θ angles, intensities and peak heights of diffraction maxima, list of minerals and estimated amounts in samples analyzed.

John C. Hathaway
Office of Marine Geology
U.S. Geological Survey
Woods Hole, MA 02543

Available from originator only

Telephone (617) 548-8700

Sediment Grain Size Analysis

Language - FORTRAN IV
Hardware - IBM 1130

Calculates statistical parameters for sediment grain size analysis. Moment measures routine (Sheppard's correction applied) from Schlee and Webster (1965); linear interpolation for Folk and Inman Graphic Measures. Input: Phi size, cumulative frequency percent couplets. Output: Moment measure of mean, standard deviation, skewness, kurtosis, Folk Graphic Measures, Inman Graphic Measures, mode and median values, histogram plots.

Gerald L. Shideler
U.S. Geological Survey
P.O. Box 6732
Corpus Christi, TX 78411
Telephone (512) 888-3241

Program maintained by:
Computer Center Division
U.S. Geological Survey
Federal Center
Denver, CO 80225

Magnetic Anomalies
MAG2D

Language - FORTRAN IV
Hardware - XDS Sigma 7/32K 32 bit words/ Plotter

Computes theoretical magnetic anomalies for two-dimensional bodies magnetized in any specified direction. Vertical, horizontal, and total field anomalies are computed at a series of observation points equally spaced along a profile. A graphic display of the anomaly and the bodies may be output to the CalComp or Versatec Plotter. A line printer plot of the anomaly is made. Modification of program by W.B. Joyner, USGS, Silver Spring, MD. Requires Woods Hole Oceanographic Institution subroutines, MOVE, AXIS, SYMBOL, NUMBER and PLOTDFER.

James M. Robb
U.S. Geological Survey
Office of Marine Geology
Woods Hole, MA 02543

Copy (main program) on file at NODC (listing, documentation)

Telephone (617) 548-8700

Geophysical Data Reduction and Plotting Programs

Language - OS3 FORTRAN IV/COMPASS
Hardware - CDC 3300

A system of programs to process and plot marine gravity, magnetic, and bathymetric data. The programs check for data errors, merge geophysical data with navigation, and plot the processed data as profiles or on computer-generated Mercator projection charts. Tech. Report. No. 180, by M. Gemperle and K. Keeling, May 1970.

Geophysics Group
School of Oceanography
Oregon State University
Corvallis, OR 97331

Available from originator only

Processing and Display of Marine Geophysical Data

Language - OS3 FORTRAN IV/COMPASS
Hardware - CDC 3300

A system of programs to process and plot marine gravity, magnetic, and bathymetric data using improved navigation techniques and standard data formats. The navigation programs use EM Log and Doppler Speed Log data and gyro headings combined with Magnavox 706 satellite navigator fixes to determine data point positions and Eotvos corrections. All outputs from processing programs and inputs to plotting programs are in standard NGSDC format for marine geophysical data. Tech. Report. by M. Gemperle, G. Connard, and K. Keeling (in press, 1975).

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School of Oceanography
Oregon State University
Corvallis, OR 97331

Available from originator only

Marine Seismic Data Reduction and Analysis

Language - OS3 FORTRAN IV
Hardware - CDC 3300

A series of programs to reduce, display, and analyze marine seismic data. These data include reversed and single-ended seismic refraction, wide-angle reflection, and marine micro-earthquakes. Supplementary programs compute seismic wave arrival times and distances using theoretical earth models consisting of plane dipping layers. Tech. Report by S.H. Johnson et al (in press, 1975).

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A Library of Geophysics Subroutines
GLIB

Language - OS3 FORTRAN IV/COMPASS
Hardware - CDC 3300

The library consists of various subroutines commonly used in geophysical data reduction and plotting and not available in the OS3 FORTRAN library. The subroutines fall into five general categories: (1) Plotting - general purpose plotter subroutines, (2) Time and data conversion, (3) Arithmetic functions not contained in the OS3 FORTRAN library, (4) File control programs peculiar to the OS3 operating system, (5) Miscellaneous subroutines. Tech. Report by K. Keeling, M. Gemperle, and G. Connard (in press, 1975).

Geophysics Group School of Oceanography Oregon State University Corvallis, OR 97331	Available from originator only

Reduction, Display and Storage of Navigation, Gravity, Magnetic and Depth Data	Language - FORTRAN IV (most of the programs) Hardware - IBM 1130/Peripherals described below

Processes data recorded by a data logger, prepares profiles and maps, and provides reduced data in a form suitable for data banking and interpretation. The first stage of the processing is to de-multiplex the data to separate disk files, and at the same time automatically edit where possible and flag errors that occur. The second stage is to filter data affected by ship motion, and the third stage is to optimize the navigation by merging dead-reckoning, hyperbolic or satellite data, and from this calculate depths, and gravity and magnetic anomalies. Graphical presentation of the data is in the form of profiles and maps. The maps include the ship's track and posted geophysical values or profiles along the ship's track. The finally reduced data may be stored on magnetic tape in any of the International Geophysical Data Exchange Formats. With this system it is possible to reduce data and produce maps and final reports within three weeks of the end of the survey. The complete system can be used at sea with one engineer and one operator/programer, or the data logger alone may be used at sea and then only an engineer would be required.

The IBM 1130 has a central processing unit with 8K 16-bit words of core storage, an integral disk drive, and a console typewriter. Peripherals include two extra IBM disk drives, a Data Disc fixed-head disk drive, Tektronix Model 4012 visual display unit with a Tektronix Model 4610-1 hard copy unit, a 76 cm CalComp drum plotter, Facit punch tape input/output, and two RDL Series 10500 magnetic tape decks. A Data Dynamics 390 teletypewriter is used for off-line punch tape preparation and, when necessary, as a remote terminal via a Modem linked in parallel with the visual display unit.

Equipment that has been successfully interfaced with the Decca Data Logger include a Decca Main Chain Mk 21 Receiver, Decca Hifix, Sperry Gyrocompass Mk 227, Microtechnica Gyrocompass, LaCoste and Romberg Shipborne Gravity Meter, Askania Gss2 and Gss3 Gravity Meters, Anschutz Gyro-Stabilized Platform, Barringer Proton Magnetometer, Edo-Western Precision Depth Recorder (333C-26) linked to an Edo-Western Digitrack (261C), Two-Component Magnetic Log, Walker Electric Log, and a Marquart Doppler Sonar 2015A.

"Computer System for Reduction, Display and Storage of Navigation, Gravity, Magnetic and Depth Data Recorded in Continental Shelf or Deep-Ocean Areas," a series of twelve software manuals, produced by the Department of Geodesy and Geophysics, Cambridge University, Oct. 1974, under contract to the National Environment Research Council.

Computer Unit Institute of Oceanographic Sciences Research Vessel Base, No. 1 Dock Barry, South Glamorgan, Wales, UK	Copy on file at NODC (Above manuals)

Computation and Plotting of Magnetic Anomalies and Gradients	Language - FORTRAN II Hardware - IBM 7094/CalComp plotter

Computes the anomaly profiles for total field, horizontal and vertical components, first and second vertical derivatives, and first and second horizontal derivatives over a uniformly magnetized two-dimesional polygon of irregular cross-section. Output may be printed or plotted. "Potential Applications of Magnetic Gradients to Marine Geophysics," by William E. Byrd, Jr., June 1967; program modified and expanded from Talwani and Heirtzler (1964).

Department of Geology and Geophysics
Massachusetts Institute of Technology
Cambridge, MA 02139

Available from NTIS, Order No. AD 655 892/LK, $5.75 paper, $2.25 microfiche.

Geomagnetic Field
MFIELD

Language - FORTRAN IV
Hardware - XDS Sigma 7/372 32 bit words*

Calculates regional total geomagnetic field at a specified latitude and longitude and time. Subroutine is initialized with the harmonic coefficients from any specified input device via a separate subroutine. Shared variables are placed in COMMON. (See I. A. G. A. Commission 2, Working Group 4, 1969. International Geomagnetic Reference Field 1965. J. Geophys. Res., 74, pp. 4407-4409.) *Subroutine COEFF requires 271 words.

Robert C. Groman
Woods Hole Oceanographic Institution
Woods Hole, MA 02543

Available from originator only
Telephone (617) 548-1400, ext. 469

Marine Geophysical Data Reduction

Language - FORTRAN IV
Hardware - IBM 360-65

Corrects soundings for sound velocity variations (if desired), computes residual magnetic anomalies from magnetic total-intensity values, and reduces marine gravity values to free-air anomalies corrected for Eotvos effect and drift. Each geophysical data point is associated with a date-time group, a geographic position, and an approximate mileage along track. The output is in the form of separate magnetic tapes and listings each for bathymetric, magnetic, and gravity data, in a format suitable for direct input to display or analytical programs. NOAA Technical Memorandum ERL AMOL-11, "A Computer Program for Reducing Marine Bathymetric, Magnetic, and Gravity Data," by Paul J. Grim, Atlantic Oceanographic and Meteorological Laboratories, Miami, Florida, January 1971.

Paul J. Grim, Code D621
Marine Geology and Geophysics Branch
National Geophysical and Solar-Terrestrial Data Center, NOAA/EDS
Boulder, CO 80302

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Plots Profiles of Bathymetry and Magnetic or Gravity Anomalies

Language - FORTRAN IV
Hardware - IBM 360-65/CalComp 563 Plotter

Produces bathymetric and magnetic anomaly profiles in a form suitable for publications with little or no additional drafting. The horizontal scale can be the distance along the trackline in nautical miles or kilometers, or degrees of latitude or longitude. The input consists of digitized bathymetric and magnetic anomaly data on separate magnetic tapes. The horizontal and vertical axes of the profiles are determined automatically with reference to the maximum and minimum values of the input data. Control cards contain variables that further determine how the data are to be plotted. The program can also be used for plotting gravity anomaly profiles by substituting the gravity anomaly in milligals for the magnetic anomaly in gammas on the input tape. One of the control card variables causes the vertical axis to be labeled either gammas or milligals. Magnetics and bathymetry can be plotted together (the bathymetry is always below the magnetics) or either can be plotted separately. In addition, the same data can be replotted in a different manner (for example, with a different vertical exaggeration) if desired. ESSA Technical Memorandum ERLTM-AOML 8, "Computer Program for Automatic Plotting of Bathymetric and Magnetic Anomaly Profiles," by Paul J. Grim, Atlantic Oceanographic and Meteorological Laboratories, Miami, Florida, July 1970.

Paul J. Grim, Code D621
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National Geophysical and Solar-Terrestrial Data Center, NOAA/EDS
Boulder, CO 80302

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Lists Raw Data
ZLIST

Language -
Hardware - UNIVAC 1108

Lists a single file of MG&G standard raw data tape, according to a standard format. Requires subroutine DLIST (HRMIN). Author - R.K. Lattimore.

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Atlantic Oceanographic and Meteorological Laboratories/NOAA
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Miami, FL 33149

Available from originator only

Telephone (305) 361-3361

Plots Trackline
QCKDRAW

Language -
Hardware - UNIVAC 1108

Using as input the standard MG&G navigation cards, plots a trackline with or without tick marks delineating time intervals. The user is given external control of the map size, latitude and longitude map boundaries, the number of files to be mapped, the time marks, and annotation. The trackline is plotted up to the boundary limits specified, allowing the user to plot only a sector of the navigation deck loaded. Because the size of the actual plotting sheet is 28 inches, internal boundaries may also be required. In this case, bookkeeping devices within the program will assign trackline to the appropriate submaps and plot each in sequence. Author - J.W. Lavelle.

Director, Marine Geology and Geophysics
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Miami, FL 33149

Available from originator only

Telephone (305) 361-3361

Plots Contour-Crossing Intervals
DOUBLX

Language -
Hardware - UNIVAC 1108

Calculates contour-crossing intervals, determine highs and lows along a trackline, and plots both, using as input a USA Standard format data tape. Annotation of the extreme is also provided. The user is given control of the map size, the latitude and longitude boundaries, the number of files to be mapped, the contouring interval, and the data field from which the data is chosen. If the data which are being handled require more than one plotting sheet, an appropriate choice of latitude and longitude boundaries will allow the entire job to be handled at one time, with the plots drawn consecutively. Author - J.W. Lavelle.

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Plots Geophysical Data
PLOTZ

Language -
Hardware - UNIVAC 1108

Produces a plotter tape to display raw depth, magnetic, or gravity data vs. time, with the aspect-ratio automatically determined to facilitate comparison with the original records. Scale factor (fathoms, gammas, or gravity meter units per inch) must be specified; if maximum and minimum values are not specified, the raw data will be scanned and the values determined. Requires subroutines LIMITS, DIGICT, HRMIN, PLOT (includes PLOTS and FACTOR), NUMBER, SYMBOL. Author - R.K. Lattimore.

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Telephone (305) 361-3361

Lists Every Hundredth Value
SNOOP

Language -
Hardware - UNIVAC 1108

Scans a tape containing data in the standard MG&G format, listing every 100th value and the last value before an end-of-file mark. Author - R.K. Lattimore.

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Available from originator only

Telephone (305) 361-3361

Navigation Computations
TPNAV

Language -
Hardware - UNIVAC 1108

Accepts standard MG&G navigation data cards, computes course and speed made good and Eotvos correction between adjacent positions, compares this with input course and speed if given; creates a binary tape with position, azimuth, and distance information required for interpolation of position in programs FATHOM, GAMMA, and GAL. Author - R.K. Lattimore.

Director, Marine Geology and Geophysics
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Available from originator only

Telephone (305) 361-3361

Edits Geophysical Data
ZEDIT

Language -
Hardware - UNIVAC 1108

Performs two editing functions on MG&G standard raw data tape: (a) Deletion by index number; (b) insertion of new data by date-time group; such data can be put on tape (e.g., output from program HANDY) or in card format, one value per card. Data to be inserted must be ordered by date-time group. Requires subroutines DLIST (HRMIN). Author - R.K. Lattimore.

Director, Marine Geology and Geophysics
Atlantic Oceanographic and Meteorological Laboratories/NOAA
15 Rickenbacker Causeway
Miami, FL 33149

Available from originator only

Telephone (305) 361-3361

Geophysical Data Conversion
HANDY

Language -
Hardware - UNIVAC 1108

Converts data in the MG&G standard data-card format to a binary tape suitable for input to the raw-data editing, evaluation, and processing programs (e.g., FATHOM, PLOT?, ZEDIT). Requires subroutine DLIST (HRMIN). Author - R.K. Lattimore.

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Lists Geophysical Data
LISTP

Language -
Hardware - UNIVAC 1108

Lists the contents of a tape containing one or more files of reduced marine geophysical data. Require subroutine PPLIST (modification of PTLIST). Author - R.K. Lattimore.

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Course, Speed, Eotvos Correction
LOXNAV

Language -
Hardware - UNIVAC 1108

Accepts standard MG&G navigation data cards, computes courses and speed made good and Eotvos correction between adjacent positions,; if course and speed are given on input, compares input with computed values. Author - R.K. Lattimore.

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Converts Geophysical Data
PHONEY

Language -
Hardware - UNIVAC 1108

Converts marine geophysical data from 120-column image (10 images to the block), even-parity BCD on 7-track tape (produced by program UNIFOO on the CDC 6600) to the standard MG&G storage format. Author - R.K. Lattimore.

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Sound Velocity Variation and Navigation
FATHOM

Language -
Hardware - UNIVAC 1108

Given smooth-track navigation data and sounding values indexed by time, the program corrects for sound-velocity variation (if desired), ship's draft (if desired), and computes latitude, longitude, and distance along track for each observation; the output is in the standard MG&G reduced-data format. Requires subroutines GP, HRMIN, QUIT (TPLIST). Author - R.K. Lattimore.

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Regional Field, Residual Magnetic Anomaly
GAMMA

Language -
Hardware - UNIVAC 1108

Given smooth-track navigation data and total-field magnetic measurements indexed by time, the program computes regional field, residual magnetic anomaly, latitude, longitude, and distance along track for each observation. Output is in the standard MG&G reduced-data format. The regional field is computed as follows: For each input navigation point, or for each 20 n. m. interval along track (if navigation points are farther apart), a regional-field value is computed according to the method of Cain et al using the IGRF 1965 parameters. Regional field values for each observation are interpolated linearly. Requires subroutines FIELD, GOFIND, GPMAG, HRMIN, SETUP, QUIT (TPLIST). Author - R.K. Lattimore.

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Gravity
GAL

Language -
Hardware - UNIVAC 1108

Given smoothed-track navigation data and gravity meter dial readings indexed by date/time, this program will (1) compute Eotvos correction between adjacent navigation points; (2) reduce the dial reading to observed gravity corrected for instrument drift and Eotvos effect; (3) determine latitude, longitude, and distance along track for the observations; (4) compute the free-air anomaly from the 1930 International formula for theoretical gravity. Requires subroutines GOFIND, GPGAL, HRMIN, QUIT (TPLIST). Author - R.K. Lattimore.

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Plots Profiles of Geophysical Data
DISPLOT

Language -
Hardware - UNIVAC 1108/offline CalComp plotter

This program will scale and generate the necessary plotter commands to produce a graph of sounding, depth, magnetic or gravity value vs. distance along track. The source data consist of as many as four magnetic tapes containing unformatted standardized geophysical data, such as are produced by MG&G reduction programs (Grim, 1971). As many as nine Y-quantities may be plotted against one X-axis. Options provide for: (1) converting distance in nautical miles to kilometers; (2) scanning the data and annotating the upper X-axis, at the appropriate point, with crossings of even degrees of latitude or longitude; (3) omitting all axes; (4) plotting the profile reversed, or from right to left against distance values which increase from left to right; (5) drawing the zero Y ordinate; and (6) "Assembling" a single profile from more than one source, i.e., from different places on a single tape, or from different tapes. The input data are not edited. Multiple profiles may overlap one another as indicated by space limitations or aesthetics. NOAA Technical Memorandum ERL AOML-11, "A Computer Program for Reducing Marine Bathymetric, Magnetic, and Gravity," by Paul J. Grim, January 1971. Author - Robert K. Lattimore, October 1971.

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Telephone (305) 361-3361

Converts Digitizer Data
DYGYT

Language -
Hardware - UNIVAC 1108

Converts digitizer data on punched cards to MG&G standard raw-data tape. Requires subroutine DLIST (HMRMIN). Authors - Developed by J.W. Lavelle, modified for 1108 by R.K. Lattimore.

Director, Marine Geology and Geophysics
Atlantic Oceanographic and Meteorological Laboratories/NOAA
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Edits Reduced Geophysical Data
EDIT

Language -
Hardware - UNIVAC 1108

Performs editing operations on a file of reduced marine geophysical data as follows: (a) Deletions (maximum 2000); (b) insertion of new data or modification of single points (maximum 1500); (c) block adjustments to Z1, Z2, Z3, Z4 (maximum 1500 points). The total number of editing operations may not exceed 2499; with the exception of deletions; like operations must be grouped together and ordered by index number. Permitted modifications (b above) include replacing Z1, Zr on a card, interpolating geographic position and mileage given date/time and Z1-Z4, and insertion of completely-specified data, i.e., date/time, latitude, longitude, distance along track, Z1, Z2, Z3, Z4. Requires subroutines QUE, QTWO, QUETWO, DAY, TPLIFF. Author - R.K. Lattimore.

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Seamount Magnetization

Language - FORTRAN
Hardware - IBM 7074

Computes the magnitude and direction of magnetization of a uniformly magnetized body from its shape and magnetic intensity. OS No. 53533. Author - G. Van Voorhis.

Data Systems Office
U.S. Naval Oceanographic Office
Washington, DC 20373

Available from originator only

Telephone (301) 763-1449

Observation Draping (Gravity)

Language - FORTRAN
Hardware - IBM 7074

Reduces observation data taken with Lacoste-Romberg sea/air or submarine gravimeters to observed gravity value and free-air anomaly. Interpolates geographic position from smoothed fix, course, and speed. Generates BC chart and x,y coordinates for Mercator projection for each station. OS No. 53543. Author - R.K. Lattimore.

Data Systems Office
U.S. Naval Oceanographic Office
Washington, DC 20373

Available from originator only

Telephone (301) 763-1449

True Ocean Depth
FATHCR

Language - FORTRAN
Hardware - UNIVAC 1108/10K words

Given the Fathometer depth and velocity profile, computes the true ocean depth. The velocity profile is broken into constant gradient segments, the travel time integrated along the profile, and the profile is extrapolated to continue to the estimated travel time of the Fathometer record.

Peter D. Herstein
Naval Underwater Systems Center
New London, CT 06320

Available from originator only

Telephone (203) 442-0771, ext. 2305

Plots Track and Data Profile
TRACK

Language - FORTRAN
Hardware - CDC 3600/3800

Plots a track and the superimposed bathymetry or magnetic profile on a polar stereographic projection. This profile series is plotted perpendicular to the track, using uncorrected meters or fathoms. Input: Data on tape, map parameters, and command words via cards.

James V. Massingill
Environmental Sciences Section
Naval Research Laboratory
Washington, DC 20375

Available from originator only

Telephone (202) 767-2024

GEODATA

Language - FORTRAN
Hardware - CDC 3600/3800

Stores navigation, bathymetry, and magnetic data on magnetic tape in BCD form. Uses the format recommended by the National Academy of Sciences.

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Geophysical Data Storage and Retrieval
GEOFILE

Language - FORTRAN IV
Hardware - CDC 3150/32K words/Disk/3 tape units

Data storage and retrieval system for BIO's geophysical data. The programs sort, edit, merge, and display data recorded at sea. Input: Magnetic tapes from BIODAL s[illegible]pboard data logging system, bathymetry data on punched cards, and navigation data. Output: Magnetic tape containing all information recorded during cruises relevant to processing of geophysical data, sorted by geographical location. Computer note BI-C-7[illegible]-3.

Larry Johnston
Bedford Institute of Oceanography
P. O. Box 1006
Dartmouth, N. S. B2Y 4A2

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Telephone (902) 426-3410

Magnetic Signatures
MAGPLOT

Language - FORTRAN
Hardware - CDC 3600/CDC 3800/706,768 words/On-line plotter

Separates and characterizes the various components of magnetic noise in magnetometer records taken from a sensor towed at sea. Gives a printout of histogram data for each of three wavelength filters: N (amplitude) vs. amplitude; N (wavelength) vs. wavelength. Also produces plots of filtered magnetic fields as function of distance. Program is briefly described in NRL Formal Report No. 7760, "Geological and Geomagnetic Background Noise in Two Areas of the North Atlantic."

Perry B. Aiers — Available from originator only
Naval Research Laboratory
Washington, DC 20375 — Telephone (202) 767-2530

Sediment Size — Language - FORTRAN
Hardware - UNIVAC 1108/9K 36 bit words

Produces frequency distributions for soil particle size values; applied to marine sediments.

Joseph Kravitz — Copy on file at NODC (deck with documentation)
U.S. Naval Oceanographic Office
Washington, DC 20373 — Telephone (202) 433-2490

Bottom Sediment Distribution Plot — Language - FORTRAN V
Hardware - UNIVAC 1108/23K/Drum/3 tape units/ CalComp 905/936 system

Produces a plot of bottom sediment notation on a Mercator projection, and a list of all data, including cores, within specified area.

William Berninghausen — Copy on file at NODC (deck with documentation)
U.S. Naval Oceanographic Office
Washington, DC 20373 — Telephone (301) 763-1189

Sand, Silt, and Clay Fractions — Language - ALGOL
DSDP/GRAIN — Hardware - Burroughs 6700/19K words

Computes sand, silt, and clay fractions in sediments. The laboratory method consists of dispersing the sediment in Calgon solution, sieving the sand fraction, and pipetting the silt and clay fractions. Input: Three card files for laboratory data and one card file for interpreting an identifier attached to each sediment sample. Output: Listing with option for ternary plots and punched cards.

Peter B. Woodbury — Available from originator only
Deep Sea Drilling Project
Box 1529
La Jolla, CA 92037 — Telephone (714) 452-3526

Soil and Sediment Engineering Test Data — Language - FORTRAN II-D
Hardware - IBM 1620 II/IBM 1627 Model I Plotter

Engineering Index of Core Samples: Reduces data and tabulates results for tests on bulk wet density, vane shear strengths, original water content, liquid limit, plastic limit, and specific gravity of solids; in addition, from the above results, other index properties are simultaneously computed and tabulated; the output table lists results in columns representing each depth segment analyzed.

Grain Size Analysis with Direct Plotting: Input data are sample identification, sample weights, hydrometer readings, and sieve readings. Output on plotter is a particle size distribution curve. Another program provides output on cards of a table with proper headings and values for particle diameters and percent finer by weight.

Carbonate - Organic Carbon Analysis of Sediments: Reduces data from the carbon determinator and tabulates results of the analysis of deep ocean sediments for carbonate and organic carbon percentages; output is in same format as in program for engineering index properties, to which the output from this program is added.

Direct Shear Test with Direct Plotting: Reduces data and plots shear stress vs. shear displacement with appropriate headings and labels; another program, Direct Shear Test, uses the same data formats but presents the results in the form of tabulations rather than plots.

Triaxial Compression Test with Direct Plotting: Reduces the data from triaxial compression tests and plots stress vs. strain with headings for sample identification, lateral pressure, etc. Another program reduces the same raw data and presents the results in the form of tabulations, one for each test.

Consolidation Test (E vs. log time plot): Reduces the data obtained from consolidation test readings. Input includes sample identification and characteristics and test characteristics. The output is in two forms: plots and punched cards. The log of time is plotted vs. the void ratio. The cards are used as input to the next consolidation test program.

Consolidation test (E vs. log P and C(V) vs. log P plots): Develops plots for void ratio vs. log of pressure and coefficient of consolidation vs. log of pressure. The input consists of output cards from the previous program, together with the values of void ratio and pressure at 100% consolidation and the time and void ratio at 50% consolidation. These data were obtained from the plots of void ratio vs. log of time in accordance with the Terzaghi consolidation theory.

Permeability Test with Direct Plotting: Reduces test data and plots curve of permeability vs. time with appropriate headings and labels. The plotting scale is a variable incorporated in the program since permeability values for fine-grained soils vary throughout a wide range.

Settlement Analysis: Estimates settlement values from laboratory test results, for deep ocean foundation investigations. Input: Sediment properties and structure characteristics. Output: A table listing total settlement, footing dimensions, structure load, change in thickness of incremental layers and corresponding depth in sediment, initial stress, and change in stress.

Summary Plots: Plots the results from the laboratory analysis of core samples. The input data are the output results on cards from the previous programs and miscellaneous analyses. Since the link system of programing is used, the items to be plotted can be increased or decreased with slight modifications, depending on the user's requirements. Output is a sequence of plots. The depth into the sediment column is plotted with reference to the ordinate, and the various properties along the abscissa on variable scales.

NCEL Report No. R 566, "Computer Reduction of Data from Engineering Tests on Soils and Ocean Sediments," by Melvin C. Hironaka.

Civil Engineering Laboratory Naval Construction Battalion Center Port Hueneme, CA 93043	Available from NTIS Order. No. AD 666 311, $5.75 paper, $2.25 microfiche.

BIOLOGY

WHOI Biology Series

Language - FORTRAN IV
Hardware - XDS Sigma 7/plotter optional

FTAPE	9,000 words
FLISHT	9,054 words
CHKSPIT	32,430 words
SELECT	58 words
CHANAT	16,751 words
PREPLOTG	12,200 words
PLOTSPECG	18,000 words
STATAB	4,164 words

FTAPE generates a tape containing station data, species data, and systematic order information. FLISHT prints a list in systematic order of the species from the tape, including stations, numbers, sizes, and weights, with a final summary. Subsets can be specified with subroutine SELECT.

CHKSPIT summarizes catch information from any specified set of stations on the tape made by FTAPE, including data for all species, a listing of the top-ranking species by number and weight, various diversity indices, and percent similarity between sets. CHANAT analyzes a transect for faunal breaks, following the method of Backus et al (1965, "The Mesopelagic Fishes Collected during Cruise 17 of the CHAIN, with a Method for Analyzing Faunal Transects," Bull. Mus. Comp. Zool. Harvard, 134 (5):1?.-158), using the data on the tape made by FTAPE.

PREPLOTG and PLOTSPECG plot a distribution map for any species on the tape made by FTAPE, with indications of vertical distribution, catch rates, and negative data; the two programs must run together; input includes a tape from NODC with world map outlines; output can be plotted on CalComp or Versatec Plotters.

STATAB prints in readable format the information contained in the station data file made by FTAPE or on the input cards.

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Woods Hole Oceanographic Institution
Woods Hole, MA 02543

Available from originator only

Telephone (617) 548-1400, ext. 354

Optimal Ecosystem Policies
OEP

Language - FORTRAN
Hardware - IBM 370/180K/REGION=180

To approximate optimal management policy for an aquatic stream ecosystem, program produces a sequence of converging values of an objective function, optimal values of decision variables, and simulation of the ecosystem using optimal decisions. Input: Parameter values (defaults built in), program constants, species interaction matrices. Deterministic or Monte Carlo simulations (user specified) are fit to state equations, from which the optimal policy is found using the discrete maximum principle.

Robert T. Lackey
Department of Fisheries and
Wildlife Sciences
Virginia Polytechnic Institute
and State University
Blacksburg, VA 24601

Available from originator only

Telephone (703) 951-6944

Inverse Problem in Ecosystems Analysis

Language - FORTRAN IV
Hardware - UNIVAC 1108/10K 6 character words

Performs systematic analysis and modeling of interacting species in complex ecosystems, using a previously unpublished iterative technique for regression analysis as well as statistical hypothesis testing. Input: a user-written subroutine defining the general structure of the ecosystem and a set of species population vs. time data to be analyzed. Output: A mathematical model of the ecosystem which has the most simple structure adequate to explain the observations. For an example, see "A Systematic Approach to Ecosystems Analysis," by Curtis Mobley, J. Theoretical Biology, 41, 119-136 (1973). Program documentation in NRI Tech. Ref. 72-84.

Curtis Mobley	Available from originator only
Dept. of Meteorology (IFDAM)	
University of Maryland	
College Park, MD 20742	Telephone (301) 454-2708

Toxicity Bioassay — Language - FORTRAN IV Level G

PROBIT ANALYSIS — Hardware - IBM 360/4K bytes

A routine method for the analysis of all-or-none acute toxicity bioassay data. Input: Number of concentrations, tabular text statistics (F, "t," Chi-square), number of organisms tested and number dead in each concentration and control. In general, mortality must be related to concentration. A minimum of three concentrations, with a partial kill both above and below 50% is required. Output: $LC_{30,\ 50,\ 70,\ 90}$ values with upper and lower 95% confidence limits; intercept, slope and standard error of regression line, and several additional measures of goodness. "Probit Analysis," by D.J. Finney, Cambridge University Press, 1971. Program written by A.L. Jensen, School of Natural Resources, University of Michigan, Ann Arbor, Michigan 48104.

Patrick W. Borthwick	Copy on file at NODC (listing, documentation)
Gulf Breeze Environmental Research Laboratory	
Environmental Protection Agency	
Sabine Island, Gulf Breeze, FL 32561	Telephone (904) 932-5326

Species Affinities — Language - FORTRAN

REGROUP — Hardware - CDC 3600

The program first determines the numbers of occurrences and joint occurrences of the species in the set of samples; it then calculates an index of affinity for each pair of species. The species are ordered in terms of the numbers of affinities they have, and this list is printed along with a list of names, code numbers, and numbers of occurrences. The program then determines the largest group that could be formed, tests to see whether that many species all have affinity with each other and, if they do, prints out the group. If they do not, it tries the next smaller group, etc. Those species which had affinity only with this group - and/or earlier groups -- are listed. The remaining species are reordered and the process continues until all species have been put either in groups or in the list of species with affinities with groups. Limits -- 200 species. Author - E.W. Fager.

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P.O. Box 1529	
La Jolla, CA 92037	

Productivity — Language - FORTRAN IV

OXYGEN — Hardware - CDC 6600

Determines productivity by oxygen diurnal curve method. Input includes oxygen concentration and oxygen probe parameters. Output contains net and gross productivity and P/R plus original data. Author - William Longley.

Marine Science Institute	Copy on file at NODC (listing, documentation)
The University of Texas	
Port Aransas, TX 78373	

Species Diversity
JOB

Language - FORTRAN IV
Hardware - CDC 6600/50 K 60 bit words

Calculates species diversity index for numbers of organisms and/or weight of organisms, utilizing the diversity index equation derived from Margalef. The program calls subroutine SEASON, which calculates seasonal averages for a given station, seasonal limits being indicated by a control card. This subroutine outputs mean, standard deviation, and range of diversity indices for each seasonal group. Other desired groupings may be entered by a groupings control card. Author - A.D. Eaton.

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Productivity
ECOPROD

Language - FORTRAN IV
Hardware - CDC 6600/25 K 60 bit words

Computes gross and net productivity, respiration, P/R ratio, photosynthetic quotient, efficiency, and diffusion coefficient, given sunlight data and diurnal measures of oxygen and/or carbon dioxide. Author - William Longley.

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Port Aransas, TX 78373

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Concentrations per Square Meter of Surface

Language - FORTRAN IV
Hardware - IBM 7074-II/7040 DCS/2231 words

Computes various chemical and biological compound concentrations as well as productivity rates per square meter of water surface from integrated values on per volume basis. Ten concentrations and rates are integrated over up to seven pairs of optional depth limits. Report UWMS-1006, June 1966. Source deck has 771 cards. Authors - Leilonie D. Gillespie and Linda S. Green.

Department of Oceanography
University of Washington
Seattle, WA 98105

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Combined Chlorophyll and Productivity

Language - FORTRAN IV
Hardware - CDC 6400

Computes assimilation of productivity in seawater; also computes the quantities of chlorophyll A, B, and C, and the amount of carotenoids in seawater. The chlorophyll program determines the amount of plankton pigments using the equations of Richards and Thompson. The productivity program (Carbon 14) determines the production of marine phytoplankton by using Neilsen's method. Output consists of both printed matter and of library cards; the cards may be used as input to a multiple regression program to derive a relation between productivity and chlorophyll A; a plot routine may be called to graph one or several variables as a function of depth, or to display the horizontal distribution of any given property. Written by Marsha Wallin, Nov. 1963, based on two programs prepared in 1962 for the IBM 709 by M.R. Rona; revised in 1969 for the CDC 6400.

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University of Washington
Seattle, WA 98105

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Phytoplankton Numbers, Volumes and Surface Areas by Species

Language - FORTRAN IV and MAP
Hardware - IBM 7094-II/7040 DCS/23,836 words

Two programs, differing only in input format, compute concentrations of cell numbers, cell surface areas, and cell and plasma volumes in marine phytoplankton populations, with option to compute mean cell areas, mean cell volumes, and mean plasma volumes, as well as the ratios: cell area to cell volume and cell area to plasma volume. The input quantities are obtained from microscopic examination of seawater samples. A subroutine computes the area, volume, and plasma volume of a cell from measured dimensions of diverse species. Source deck has 1221 cards. Special Report No. 38, M66-41, July 1966, by Paavo E. Kovala and Jerry D. Larrance.

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University of Washington
Seattle, WA 98105

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Program to Generate a Taxonomic Directory of Deep-Ocean Zooplankton

Language - FORTRAN IV
Hardware - UNIVAC 1108/20K words

Generates a data file (taxonomic directory) which classifies and catalogs various species of deep-ocean zooplankton collected in water samples for the purpose of studying the population and distribution statistics of these species. Input: Cards containing either the phylum, class, order, genus, or species name and the appropriate identifying numbers associated with each of these categories. NUSC Technical Memorandum No. TL-104-71, May 1971.

Drew Drinkard
Naval Underwater Systems Center
New London, CT 06320

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Telephone (203) 442-0771, ext. 2127

Deep-Ocean Zooplankton Distribution

Language - FORTRAN IV
Hardware - UNIVAC 1108/30K words

The purpose of the program is to study the distribution statistics of the deep-ocean zooplankton species within a particular taxonomic category. The distribution characteristics of the individual species are examined for both the individual net samples which have been collected at various sampling depths and the combined net samples for a given tow. Input: Station data, sample data, species abundance data on cards, and a hash table species directory (program available for generating such a hash table). Records total count for each species to which the various organisms collected in the samples belong. For the individual net samples, computes the percentage of the total taxonomic category which each species in the sample represents. For the combined net samples, both the percentage of the total taxonomic category and the percentage of the entire sample (all taxa included) are computed. Finally, the population density of each species within its taxonomic category is calculated. NUSC Technical Memorandum No. TL-107-71, May 1971.

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Deep-Ocean Zooplankton Population Statistics

Language - FORTRAN IV
Hardware - UNIVAC 1108/30K

Produces population statistics for both the individual net samples collected at various depths and for the combined net samples. Input: Station data, sample data, species abundance data on cards, and a taxonomic directory on mass storage device. Each species is identified by phylum and class with the aid of the taxonomic directory. The organisms are counted according to the phylum or class. Total counts for the entire sample are calculated for each category. The population densities of each category are computed. Also calculated is the percentage of the total sample that each taxonomic category represents. NUSC Technical Memorandum No. TL-106-71, May 1971.

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PIGMENT RATIO

Language - FORTRAN IV
Hardware - IBM 360/less than 5000 bytes

Computes ratios: Chl a/Carot, Pheo/Carot, (Chl a + Pheo)/Carot, Chl b/Carot, Chl c/Carot, and Fluor/(Chl a + Pheo). Input: Sample identification, chlorophylls a, b, c, carotenoids, pheopigments, and fluorescence on cards. Output: Printed sample identification and ratios. "A Computer Program Package for Aquatic Ecologists," by Paul J. Godfrey, Lois White, and Elizabeth Keokosky.

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Cornell University, Fernow Hall
Ithaca, NY 14850

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Telephone (607) 256-3120

SUCCESSION

Language - FORTRAN IV
Hardware - IBM 360/4440 bytes

Computes succession rate of community based on measure proposed by Jassby and Goldman of relative change in each species' biomass. See "A Quantitative Measure of Succession Rate and Its Application to the Phytoplankton of Lakes," by A.D. Jassby and C.R. Goldman, 1974, Amer. Naturalist 108:688-693. Input: Integrated species biomasses and sampling date in calendar days. Output: Printed sample identification values, dates defining interval in each succession rate, and succession rate. "A Computer Program Package for Aquatic Ecologists," by Paul J. Godfrey, Lois White, and Elizabeth Keokosky.

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Species Abundance
SPECIES

Language - PL/1
Hardware - IBM 360/250K

This series of three programs was developed to accept species abundance data in its simplest form, check it for errors, produce lists of species abundances where comparisons may be made between days, depths, lakes, stations or years, and convert the input data to a form acceptable to packaged programs. Output: Listings of species abundances, summary data including total abundance, number of species and diversity, and subtotals within user-determined groups, punched output of summary data. "A Computer Program Package for Aquatic Ecologists," by Paul J. Godfrey, Lois White, and Elizabeth Keokosky.

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Yield Per Recruit
RYLD, BIOM

Language - FORTRAN IV
Hardware - IBM 1130

Computes the approximate yield of a fish stock per recruitment by either of two methods (arithmetic or exponential approximations), or simply computes the stock biomass when there is no fishing. Output: An equilibrium yield matrix with up to 400 entries corresponding to 20 ages at entry and 20 multipliers. Technical Report No. 92 (unpublished manuscript), No. 1968.

Authors - L.V. Pienaar and J.A. Thomson. Earlier version written by L.E. Gales, College of Fisheries, University of Washington.

Fisheries Research Board of Canada
Biologica. Station
Nanaimo, B.C.

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Chlorophyll
CHLOR

Language - FORTRAN
Hardware - IBM 370

Calculates chlorophyll in mg/m^3 according to B&P extraction, spectrophotometric technique. Input: Raw absorbences. Author - Stephen A. Macko.

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Phytoplankton Population Density

Language - WATFIV FORTRAN
Hardware - IBM 370

Computes species densities and population percentages and relative diversity from cell counts. Output formatted according to taxonomy in FAO Fisheries Technical Paper #12. Author - Stephen A. Macko.

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Species Diversity
DVRSTY

Language - WATFIV FORTRAN
Hardware - IBM 370

From unformatted raw data, produces species diversity, and diversity matrix.

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FISHERIES

Length Frequency Analysis
LENFRE

Language - FORTRAN
Hardware - Burroughs 6500

Uses three methods of stratification to expand sample length frequencies in different strata. The program was developed for tuna fishery samples. Input: Sample length frequencies for up to 80 strata, alpha and beta for the length-weight relation, von Bertalanffy growth parameters. Output: Tables of sample length frequencies, expanded length frequencies (expanded by total catch), weight in each length interval, by strata; total frequencies for all strata combined; average length and weights and age; catch per unit effort.

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Yield per Recruit for Multi-Gear Fisheries
MGEAR

Language - FORTRAN
Hardware - Burroughs 6500/6,200 words

Computes estimates of yield per recruit and several related parameters for fisheries that are exploited by several gears which may have differing vectors of age specific fishing mortality. The Ricker yield equation is used. Input is limited to 4 types of gear, 30 age intervals, and 10 levels of fishing mortality. Output: Besides tables of yield per recruit, landings per recruit when fish below minimum size are caught and then discarded dead, average weight of fish in catch, and yield per recruit per effort as functions of minimum size and amount of fishing effort are provided for each gear and for the entire fishery. The program has been used for evaluating proposed minimum size regulations for the yellowfin tuna fishery of the tropical Atlantic, a fishery exploited by four types of vessels (bait boats, small purse seiners, large purse seiners, and longliners) having quite different vectors of age specific fishing mortality.

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Resources Allocation in Fisheries Management
PISCES

Language - FORTRAN IV
Hardware - IBM 370/125K

Uses a Monte Carlo simulation to predict the effect of fisheries management programs upon the distribution and abundance of angler consumption. Input: State fisheries agency data and management plan. Output: (1) Predictions of the number and location of angler-days throughout a state; (2) Standard deviations. "PISCES: A Computer Simulator to Aid Planning in State Fisheries Management Agencies," by R.D. Clark, MS Thesis, VPI&SU.

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Computer-Implemented Water Resources
Teaching Game, DAM

Language - FORTRAN IV
Hardware - IBM 370/120K/Interactive terminal desirable

Using a simulation of an existing reservoir system, this computer-assisted instructional game illustrates the management of a large multiple-use reservoir system. Input: Student management decisions for (1) a regional planning commissioner, (2) a fisheries manager, (3) a power company executive, (4) a recreation specialist, and (5) a city mayor. Output: Status of reservoir system, including human components.

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A Generalized Exploited Population Simulator
GXPOPS

Language - FORTRAN
Hardware - Burroughs 6500/CDC 3600

GXPOPS is a generalized exploited population simulator designed for use on a wide variety of aquatic life history patterns. Population processes programed into the present version are (1) month-specific and density-independent mortality rates on the recruited population, (2) density-independent growth, (3) sex-specific and age-specific, but density-independent, maturation, (4) reproductive success due to random mating, and (5) density-dependent or density-independent recruitment. Mortality, growth, and maturation can be made density-dependent through the addition of subroutines. The unit length of time is the reproductive cycle, commonly a year in temperate species; computations are performed each one-twelfth of a unit, thereby representing a month for most species.

There are three output options. For each year the complete output option lists monthly (1) the average year class size, yield in numbers and weight for any six consecutive year classes, (2) the total initial population size, (3) the average total fishable population, (4) the total yield in numbers and weight, and (5) the average sex ratio. Annual summaries of initial population, average population, average fishable population, yield in number and weight, and the spawning success are provided by year class for the total population and for the fishable total population. The moderate option lists only the monthly summary totals and the annual summary by year class. The minimum option, suited for long simulations, lists only the annual summary by year class and for the total and fishable total population. GXPOPS is dimensioned to handle the computations for up to 30 year classes, but, in order to economize on space, the output is dimensioned to list up to 6 consecutive year classes only. The FORMAT statements must be rewritten to list an additional number of year classes. "A general life history exploited population simulator with pandalid shrimp as an example," by William W. Fox, Jr., Fishery Bulletin, U.S., 71 (4): 1019-1028, 1973.

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Generalized Stock Production Model
PRODFIT

Language - FORTRAN
Hardware - CDC 3600/Burroughs 6500

Input: (Option 1) A catch and fishing effort history and a vector of significant year class numbers are read in; the catch per unit effort is computed internally and the averaged fishing effort vector is computed with subroutine AVEFF; (Option 2) The vectors of catch per unit effort and averaged (or equilibrium) fishing effort are read in directly. Output includes a listing of the input data, the transformed data, initial parameter estimates, the iterative solution steps, the management implications of the final model $^*U_{max}$, U_{opt}, f_{opt}, and Y_{max} and their variability indices, the observed and predicted values and error terms, estimates of the catchability coefficient, and a table of equilibrium values. ($^*U_{max}$ is the relative density of the population before exploitation; U_{opt} is the relative population density providing the maximum sustainable yield; f_{opt} is the amount of fishing effort to obtain the maximum sustainable yield; and Y_{max} is the maximum sustainable yield.) 'Fitting the generalized stock production model by least-squares and equilibrium approximation," by William W. Fox, Jr, Fishery Bulletin, U.S., in press.

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Normal Distribution Separator — Language - FORTRAN
TCPA1 — Hardware - Burroughs 6700

Separates a length-frequency sampling distribution into K component normal distributions. Used to estimate age group relative abundance in length samples of unageable species. The method is statistically superior to graphical procedures. Also, the program will produce estimates of the percent composition by age group and the number of fish in the sample from each age group. Output includes a plotted histogram, the observed frequencies, and all estimated values. The value of K may be from one to ten. "Estimation of parameters for a mixture of normal distributions," by V. Hasselblad, Technometrics 8(3):431-441, 1966. Author - Victor Hasselblad; modified by Patrick K. Tomlinson.

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Spawner-Recruit Curve Fitting — Language - FORTRAN
TCPA2 — Hardware - Burroughs 6700

Estimates the parameters of the Ricker spawner-recruit curve, $R = ASe^{-bS}$, from fitting the logarithmic transformation $Ln(R/S) = LnA - bs$, by the method of least squares. S is the spawning bio-mass, R is the recruit biomass, and A and b are constants. From the fitted curve a table of spawning stocks and resultant recruitments is produced. The curve is discussed in "Handbook of computations for biological statistics of fish populations," by W.E. Ricker, Bull. Fish.Res.Bd. Canada (119):1-300, 1958. Author - Patrick K. Tomlin.

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Weight-Length Curve Fitting — Language - FORTRAN
TCPA3 — Hardware - Burroughs 6700

Fits a curve giving weight as a function of length of the form $W = a L^b$ where W is the weight and L is length. It produces a table of fitted weights and lengths and provides various related statistics. The method of fitting involved linearization by common logarithms and the usual least-squares procedure for fitting a straight line. Author - Norman J. Abramson; modified by Patrick K. Tomlinson and Catherine L. Berude.

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Age Composition Estimation — Language - FORTRAN
TCPB1 — Hardware - Burroughs 6700

Estimates ages composition using a double sampling scheme with length as strata. Also provides estimates assuming simple random sampling of aged fish. Under the double sampling scheme, the first sample is of lengths (length frequency) to estimate length-strata sizes; the second or main sample is for ages. The second sample can be drawn (1) independently, (2) as a subsample of the first, or (3) as a subsample within length strata. "A method of sampling the Pacific albacore (Thunnus germo) catch for relative age composition," by D.J. Mackett, Proc.World.Sci. Meet.Biol.Tunas & Rel.Sp., FAO Fish.Rpt. No. 6, Vol. 3, 1963. Author - D.J. Mackett.

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Best Current Estimate of Numbers, Percentages, and Weights of Fish Caught, TCPB2 — Language - FORTRAN
Hardware - Burroughs 6700

Given any number of length detail cards for fish sampled during a given bimonthly (or other) period, this program calculates by primary area and gear: (1) The number of fish sampled at each length-frequency interval; (2) the percentage of fish sampled at each length-frequency interval; (3) the smoothed percentage of fish sampled at each length-frequency interval; (4) the average weight of the fish. With the input of the corresponding catch data the program makes estimates of the number of fish caught at each length-frequency interval for the given period by primary area and gear. The program also makes estimates for the given period for both gears combined for each of the primary and secondary areas of (1) through (4) above. It estimates the same thing for each gear separately and for each of the secondary areas. Finally the program makes estimates for the given period and all preceding periods of that year combined for each gear separately and both gears combined for each of the primary and secondary areas of (1) through (4) above and the total weight of fish caught at each length-frequency interval. Limitations: (a) The cards for each period must be kept separately, and the periods must be in chronological order; (b) gear 2 must follow gear 1 in the catch cards; (c) although any number of periods may be run consecutively, it must be kept in mind that all of the periods will be summed to compute the best current estimate; (d) the maximum number of length frequencies is 80, gears 2, and primary areas 7. Author - Christopher T. Psaropulos.

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Length-Frequency Distribution of Market Measurement Sampling, TCPB3 — Language - FORTRAN
Hardware - Burroughs 6700

Given any number of length detail cards for fish sampled with input of corresponding catch data during a year period, this program (using the same methods as TCPB2) summarizes, by quarter, market measurement area code, and for each gear, or combined: (1) The average weight, and the number of fish caught at each quarter; (2) the raw and smoothed percentage of fish sampled and caught at each length-frequency interval; (3) the number of fish sampled and caught at each length-frequency interval. Author - Christopher T. Psaropulos.

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Von Bertalarffy Growth Curve Fitting
TCPC1

Language - FORTRAN
Hardware - Burroughs 6700

Fits the von Bertalanffy growth-in-length curve to unequally spaced age groups with unequal sample sizes for separate ages. It fits the equation D_t = length (at age t) = $A+BR^t$; 0<R<Fl (1) by least squares when data of the form (length, age) are given in pairs (L_t, t). The program minimizes the function $Q = \sum^n (L_t - A - BR^t)^2$ by use of the partial derivatives evaluated near zero.

Output is in the von Bertalanffy form, where $A = L_\infty$, $R = e^{-k}$ or $K = -\log_e R$, $B = -L_\infty L^{kto}$ or t_o = $[\log_e(-B)-\log_e A]/K$.

The output gives values of the expected length at age using equation (1) evaluated at ages selected by the user. The pairs (L_t, t) may be read into the program in two different ways. The first assumes that no type of ordering or sorting has occurred and that each (L_t, t) represents a single fish. The second method allows for frequency distributions and the user provides a triple (L_t, t, m) where m is the number of times (or some weighting factor) the pair (L_t, t) is to be used. Author - Patrick K. Tomlinson.

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Von Bertalanffy Growth Curve for Unequal Age Intervals
TCPC2

Language - FORTRAN
Hardware - Burroughs 6700

Uses the method of Tomlinson and Abramson to fit length at age data to the von Bertalanffy growth equation $L_t = L_\infty (1 - e^{-k(t-t_o)})$ where L_t = length at time t, L_∞ = asymptotic length, K = growth constant, and t_o = theoretical time at which L_t = 0. The age intervals do not need to be equal. Limitations: The number of lengths for each age group must be at least two and not more than 500. (If only one length, or a single mean length, is available for a given age group, it may be punched twice.) The maximum number of age groups is 40. The output includes: (1) estimates of L_∞, K, and t_o from each iteration of the fitting process; (2) final estimates of L_∞, K, and t_o; (3) standard errors of L_∞, K, and t_o; (4) fitted lengths for age 0 through the maximum included in the input; (5) mean lengths of the samples at each age group; (6) standard errors of the mean lengths in the samples; (7) the number of lengths in each age group; (8) variance-covariance matrix; (9) standard error of estimate. "Computer programs for fisheries problems," by Norman J. Abramson, Trans.Amer.Fish.Soc. 92(3):310, 1963. Fitting a von Bertalanffy growth curve by least squares including tables of polynomials," by Patrick K. Tomlinson and Norman J. Abramson, Fish.Bull.Calif.Dept.Fish & Game 116:69 p., 1961. Author - N.J. Abramson. (See also TCPC 3.)

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Von Bertalanffy Growth Curve for Equal Age Intervals
TCPC3

Language - FORTRAN
Hardware - Burroughs 6700

Similar to TCPC2. However, the age intervals must be equal with at least two observed lengths at each age. The program always yields estimates when a least-squares solution exists, and immediately terminates the run when there is no solution. In this respect it is superior to TCPC2, which occasionally does not converge to estimates even when a solution exists. Author - N.J. Abramson.

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Von Bertalanffy Growth Curve Fitting
TCPC4

Language - FORTRAN
Hardware - Burroughs 6700

Estimates the parameters K and L_∞ of the von Bertalanffy growth-in-length curve when only the lengths of individual fish at two points in time are known. This allows the curve to be fitted to tag release and recovery data. Fits equation (1) by least squares when data are of the form (initial length, final length, time elapsed).

$$L_{t+\Delta t} = L_t R^{\Delta t} + A(1-R^{\Delta t}); \; 0<R<1 \qquad (1)$$

L_t is the initial length; $L_{t+\Delta t}$ is the final length, and Δt is the time elapsed. Given n triples (L_t, $L_{t+\Delta t}$, Δt) and equation (1), the program minimizes the function.

$$Q = {}^{n} [L_{t+\Delta t} - L_t R^{\Delta t} - A(1-R^{\Delta t})]^2$$ by use of the partial derivations evaluated

near zero. Output is in the von Bertalanffy form, where L = A and K = $\log_e R$. The output gives values of the expected length using equation (1) evaluated at an initial length and time lapse selected by the user. The user enters one initial length and a time lapse. The program computes the final lengths. The triples are punched on cards, with one triple per card. No provisions are made for frequency distributions or weighting factors. The program will handle up to 5000 triples. Author - Patrick K. Tomlinson.

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Estimation of Linear Growth and von Bertalanffy Growth Equation from Tag Data
TCPC5

Language - FORTRAN
Hardware - Burroughs 6700

This program is used to estimate the rate of linear growth per unit time and the parameters L_∞ and K of the von Bertalanffy growth equation from data on the lengths at release and at recapture, and the times at liberty for two or more tagged fish. Known bias(es) in the lengths at release for fish of one or two groups can be corrected by use of the constants a and b in the equation y = a+bx, where x is the uncorrected length and y is the corrected length. Before estimating L_∞ and K by the method of program TCPC4, the program calculates the mean rate of linear growth per time interval and its standard deviation. If option 1 is specified, the data for any fish which grew at rates which differ by three or more standard deviations from the mean rate are eliminated; if option 2 is specified, no data are eliminated. Author - Patrick K. Tomlinson; modified by Jo Anne Levatin.

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Fishing Power Estimation
TCPD1

Language - FORTRAN
Hardware - Burroughs 6700

Estimates the fishing power of individual vessels or class relative to a standard vessel or class and the densities of fish by time-area strata relative to a standard time-area stratum. Program first estimates log fishing powers, using the method described by Robson (1966). Then the estimates are converted from log relative fishing power and log density to the original scales, employing a bias-correcting factor given in Laurent (1963). The program handles up to 2000 catch observations from a combined total of not more than 200 distinct boats and time-area strata; it arbitrarily selects the lowest numbered boat as the standard vessel and the lowest numbered area-data in which the standard vessel fished as the standard time-area strata. "Log-normal distribution and the translation method: description and estimation problems" by Andre G. Laurent, Jour.Amer.Stat.Assn. 58(301):231-235, 1963. "Estimation of the relative fishing power of individual ships," by D.S. Robson, Res.Bull.Inter.Comm.NW.Atlantic.Fish. (3):5-14, 1966. Author - Catherine L. Berude.

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Survival Rate Estimation
TCPE1

Language - FORTRAN
Hardware - Burroughs 6700

Estimates a survival rate from the age composition of a sample. Computes a number of statistical measures associated with a vector of catch number N_0, N_1, ..., N_I where N_j = number of fish caught of (coded) age "j." Four options are available:

Option 1 assumes that (a) recruitment and annual survival are constant for all age groups entered in catch vector; (b) all ages in catch vector are fully available to sampling gear; (c) ages are known for all fish in catch vector. Computes estimate of survival rate, variance of survival rate, standard error of survival rate, 95% confidence interval for survival rate, instantaneous mortality rate, variance of instantaneous mortality rate, standard error of Z (total mortality), 95% confidence interval for Z, and Z interval obtained from S interval.

Option 2 tests the hypothesis that the relative frequency in the 0-age group as compared to the older ages does not deviate significantly from the expected frequency under option 1 assumptions and computes a chi-square statistic associated with the difference between the best estimate and Heinke's estimate. If this statistic exceeds CHI (a chi-square value for desired confidence level) the catch numbers are recorded as follows: N_1---> N_0; N_2---> N_1; N_3---> N_2;...;N_I---> N_{I-1} and the above computations are made for the new vector N_0,...N_{I-1}. This test is repeated until the statistics are less than CHI, a theoretical chi-square value with one degree of freedom which specifies the significance level of the test. CHI is entered on a control card. If the statistic is less than CHI, the output is the same as in option 1.

Option 3 is to be used when assumptions (a) and (b) of option 1 hold but it is not possible to age fish whose coded age is greater than "K." Option 3 assumes that the recorded relative frequencies are not reliable for fish of ages K+1, K+2,...,I in the vector of catch numbers; it sums the catch for ages K+1 to I and computes the same output as in option 1 using the catch vector N_0, N_1,...,N_K, m where m= N_{K+1}+...+N_I.

Option 4 permits the user to subdivide the catch curve into a number of segments. The assumptions listed under option 1 may be satisfied for the consecutive age groups in one segment but not for age groups in different segments of a catch curve. Because segmentation of a catch curve may be exploratory, the program allows the use of overlapping segments, i.e., one age group may appear in more than one segment. Option 4 computes the same output as option 1.

"The analysis of a catch curve," by D.C. Chapman and D.S. Robson, Biometrics 16:354-368, 1960. "Catch curves and mortality rates," by D.S. Robson and D.G. Chapman, Trans.Am.Fish. Soc. 90:1810189, 1961. Author - Lawrence E. Gales.

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Fishing Mortalities Estimation — Language - FORTRAN
TCPE2 — Hardware - Burroughs 6700

Uses the method of Murphy (1965) and Tomlinson (1970) to estimate the population (P) of a cohort of fish at the beginning of each of several consecutive time intervals (i) and the coefficients of catchability (q) and of fishing mortality (F) for each interval when the catches (C), effort (f), and the coefficients of natural mortality (M) for each interval and F for either the first or last interval are known. When estimates of F and M are not available, various trial values can be used to obtain estimates which appear to be reasonable. "A solution of the catch equation, "by G.I. Murphy, J.Fish.Res.Bd.Can. 22(1):191-202, 1965. "A generalization of the Murphy catch equation," by P.K. Tomlinson, J.Fish.Res.Bd.Can. 27(4): 821-825, 1970. Author - Patrick K. Tomlinson; modified by Jo Anne Levatin.

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Relative Yield per Recruit at Various Fishing Intensities — Language - FORTRAN
TCPF1 — Hardware - Burroughs 6700

Calculates the relative yield in weight per recruit at various fishing intensities by the method of Beverton (1963: Formula 1)). With option 1, the program calculates the ratios of the yields per recruit at selected values of E = (F/(F+M)) to the yield per recruit at E = 1. M is the coefficient of natural mortality; F is the coefficient of fishing mortality. With option 2, it calculates the relative yield per recruit at selected levels of F. Limitations: No more than ten values of M, nor more than 1,000 values of E or F, can be used for a single problem; in option 1, M cannot equal 0. "Maturation, growth and mortality of clupeid and engraulid stocks in relation to fishing," by R.J.H. Beverton, Rapp.Proc.-Verb. 154:44-67, 1963. Author - Christopher T. Psaropulos.

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Yield Cu[illegible] with Constant Rates — Language - FORTRAN
TCPF2 — Hardware - Burroughs 6700

Using the incomplete beta-function, evalu[illegible] Beverton and Holt yield equation and produces an array of coordinates for plotting yiel[illegible]ths. "Allometric growth and the Beverton and Holt yield equation." by G.J. Paulik and [illegible] Gales, Amer.Fish.Soc., Trans. 93(4):369-381, 1964. Author - Lawrence E. Gales.

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Eumetric Yield — Language - FORTRAN
TCPF3 — Hardware - Burroughs 6700

Uses Beverton and Holt's (1957: 36:4.4) equation to compute the population in numbers, the biomass, the yield in numbers, and the yield in weight theoretically obtainable from one recruit with various combinations of growth, mortality, and age of entry into the fishery. "On the dynamics of exploited fish populations," by R.J.H. Beverton and S.J. Holt, Fish.Inves., Minis. Agr.Fish.Food, Ser.2, 19:533 p., 1957. Author - Lawrence E. Gales; modified by Christopher T. Psaropulos.

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Piecewise Integration of Yield Curves — Language - FORTRAN
TCPF4 — Hardware - Burroughs 6700

Computes an approximate yield isopleth for a given number of recruits to a fishery when both growth and natural mortality are estimated empirically. The calculations are carried out using a modified form of Ricker's method for estimating equilibrium yield. The program is extremely general in that growth, natural mortality and fishing mortality rates need not be measured using the same time intervals. Fishing mortality rates can be age specific (up to 400 different rates can be applied during the life of the fish) but the over-all level of fishing mortality can be varied by means of multipliers which apply to all of the individual age specific rates. The range and the intervals between ages at first capture can also be varied by the user.

The program has two approximation options: (1) an exponential mode which assumes that the biomass of the stock changes in a strictly exponential manner during any interval when growth, natural mortality, and fishing rates are all constant (Ricker, 1958: Equation 10.4); (2) an arithmetic mode which uses the arithmetic mean of the stock biomass at the start and at the end of any interval during which all three rates are constant as an estimate of the average biomass present during the interval (Ricker, 1958: Equation 10.3).

The program will compute and print out at specified times the biomass of the stock when only natural mortality and growth are present. This biomass vector is useful for determining the optimum harvest times for stocks that may be completely harvested at one time. "A generalized computer program for the Ricker model of equilibrium yield per recruitment," by C.J. Paulik and W.F. Bayliff, J.Fish.Res.Bd.Canada 24:249-252, 1967. "Handbook of computations for biological statistics of fish populations," by W.E. Ricker, Fish.Res.Bd.Canada Bull. (119):300 pp. Author - Lawrence E. Gales.

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Piecewise Integration of Yield Curves When Age is Unknown — Language - FORTRAN
TCPF5 — Hardware - Burroughs 6700

Performs piecewise integration of yield curves when age is unknown. Different mortality rates may be associated with intervals in the lifespan and growth is calculated as a function of length from a transformed von Bertalanffy growth curve. Yield isopleths are given as functions of length-at-entry and fishing mortality. Note that program TCPC4 provides von Bertalanffy growth parameters from unaged fish which can be used with this program. The amount of growth a fish will put on during an interval of time is a function of the size at the beginning of the interval, not age. Similarly, survival is usually given as a function of time elapsed, not age. Therefore, growth during an interval and survival during the interval can be combined to produce yield, even though age is unknown. Author - Patrick K. Tomlinson.

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Constants in Schaefer's Model — Language - FORTRAN
TCPF6 — Hardware - Burroughs 6700

Uses three simultaneous equations to solve for the constants, a, M, and k_2, in Schaefer's (1957) model for determining the status of a stock of fish in regard to fishing. Schaefer (1957) used an iterative procedure to evaluate these constants, but in another publication (Schaefer and Beverton, 1963), it was indicated that evaluation of the constants by the solution of three simultaneous equations would be acceptable. "A study of the dynamics of the fishery for yellow-fin tuna in the eastern tropical Pacific Ocean" by M.B. Schaefer, Bull., Inter-Amer.Trop.Tuna Comm. 2(6):245-285, 1957. "Fishery dynamics - their analysis and interpretation," by M.B. Schaefer and R.J.H. Beverton, pp. 464-483 in, M.N. Hill, The Sea, Vol. 2, Interscience Publishers, New York, 1963. Author - Christopher T. Psaropulos.

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Schaefer Logistics Model of Fish Production — Language - FORTRAN
TCPF7 — Hardware - Burroughs 6700

Pella and Tomlinson (1969) discussed a generalization of Schaefer's (1954) logistic model to explain changes in catch as related to effort upon a given population and they presented a computer program useful in estimating the parameters of the model when observed catch-effort data are available. However, in their scheme, it is necessary to use numerical methods for approximating the expected catch. Also, the user is required to provide guesses of the parameters and limits to control searching. In general, this program TCPF7 uses the same procedure for estimating the parameters as that described in Pella and Tomlinson. Exceptions: The user only needs to supply catch, observed effort, and elapsed time for each of n time intervals; the program will make the guesses and set the values used in the search. "A generalized stock production model," by J.J. Pella and P.K. Tomlinson, Inter-Amer.Trop.Tuna Comm., Bull. 13(3):421-496, 1969. "Some aspects of the dynamics of populations important to the management of the commercial marine fisheries," by M.B. Schaefer, Inter-Amer.Trop.Tuna Comm., Bull. 1(2):25-56. Author - Patrick K. Tomlinson.

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Fits Generalized Stock Production Model — Language - FORTRAN
TCPF8 — Hardware - Burroughs 6700

Fits the generalized stock production model described by Pella and Tomlinson (1969) to catch and effort data. This model estimates equilibrium yield as a function of effort or population size. The production curve is allowed to be skewed. "A generalized stock production model," by Jerome J. Pella and Patrick K. Tomlinson, Inter-Amer.Trop.Tuna Comm., Bull. 13(3):419-496. Authors - Pella and Tomlinson; modified by Catherine L. Berude.

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Biometry - Linear Regression Analysis — Language - FORTRAN
TCSA1 — Hardware - Burroughs 6700

Performs an analysis of regression with one or more Y-values corresponding to each X-value. The Model I Regression is based on the following assumptions: (a) that the independent variable X is measured without error, where the X's are "fixed"; (b) that the expected value for the variable Y for any given value X is described by the linear function $\mu_Y = \alpha + \beta X$; (c) that for any given value of X the Y's are independently and normally distributed. $Y = \alpha + \beta X + \epsilon$, where ϵ is assumed to be normally distributed error term with a mean of zero; (d) that the samples along the regression line have a common variance, σ^2, constant and independent of the magnitude of X or Y. In Model II Regression, the independent variable and the dependent variable are both subject to error. Biometry, by Robert R. Sokal and F. James Rohlf, W.H. Freeman and Company, San Francisco, 1969. Modified by Walter Ritter O.

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Generalized Weighted Linear Regression for Two Variables, TCSA2 — Language - FORTRAN; Hardware - Burroughs 6700

Computes the regression line $Y_i = b_0 + b_1 x_i$ where the Y_i may have different weights. The user may transform the data by any of three transformations, natural logarithms of X, Y, and/or W (weight), common logarithms of X, Y, and/or W, and/or powers of X, Y, and/or W. The two variables and the weights may be transformed independently. The program normalizes the weights (or the transformations of the weights) by dividing each weight by the mean weight. Produces printer plots of the data and deviations. Author - Lawrence E. Gales; modified by Patrick E. Tomlinson and Christopher T. Psaropulos.

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Linear Regression, Both Variables Subject to Error, TCSA3 — Language - FORTRAN; Hardware - Burroughs 6700

Computes a regression in which both the dependent and the independent variable are subject to error. There are several methods for obtaining solution to the equation in a Model II case, depending upon one's knowledge of the error variances or their ratios. Since this situation is not too likely to arise in the biological sciences, the authors adapted a relatively simple approach in which no knowledge of these variances is assumed -- the Bartlett's three-group method. This method does not yield a conventional least squares regression line and consequently special techniques must be used for significance testing (Sokal and Rohlf, 1969). The user may transform the data by any of three transformations: natural logarithms of X and/or Y; common logarithms of X and/or Y; powers of X and/or Y. The program produces printer plots of the data and deriviations. Biometry, by Robert R. Sokal and F. James Rohlf, W.H. Freeman and Company. San Francisco, 1969. Author - Walter Ritter O.; modified by Christopher T. Psaropulos.

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Biometry - Product-Moment Correlation Coefficient, TCSB1 — Language - FORTRAN; Hardware - Burroughs 6700

Computes the Pearson product-moment correlation coefficient for a pair of variables and its confidence limits. In addition, the program computes and prints the means, standard deviations, standard errors, and covariances for the variable, as well as the equation of the principal and minor axes. The confidence limits for the slope of the principal axis are also computed and the coordinates of eight points are given for plotting confidence ellipses for bivariate means. Biometry, by Robert R. and F. James Rohlf, W.H. Freeman and Company, San Francisco, 1969.

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Cooley-Lonnes Multiple-Regression Analysis — Language - FORTRAN
TCSB2 — Hardware - Burroughs 6700

Computes a multiple-regression analysis for a single criterion and a maximum of 49 predictor variables. The Gauss-Jordan method is used in the solution of the normal equations. There is no restriction in the number of subjects for which score vectors may be presented. Output: Basic accumulations, means, standard deviations, dispersion matrix, and correlation matrix are printed and/or punched as required. Additional printed output, appropriately labeled, includes: The multiple-correlation coefficient; the F test criterion for multiple R, with its degrees of freedom; the beta weights; the squared beta weights; the B weights; and the intercept constant. Additional punched output includes: The beta weights; the B weights, and the intercept constant. Multivariate Procedures for Behavorial Sciences, by William W. Cooley and Paul R. Lonnes, John Wiley and Sons, Inc., New York. Modified by Walter Ritter O.

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Biometry - Goodness of Fit to Discrete Frequency Distribution, TCSC1 — Language - FORTRAN
Hardware - Burroughs 6700

Provides several options for the following operations: (1) Computes a binomial or Poisson distribution with specified parameters; (2) computes the deviations of an observed frequency distribution from a binomial or Poisson distribution of specified parameters or based on appropriate parameters estimated from the observed data; AG-test for goodness of fit is carried out; (3) A series of up to 10 observed frequency distributions may be read in and individually tested for goodness of fit to a specific distribution, followed by a test of homogeneity of the series of observed distributions; (4) A specified expected frequency distribution (other than binomial or Poisson) may be read in and used as the expected distributions; this may be entered in the form of relative frequencies or simply as ratios; the maximum number of classes for all cases is thirty in the case of binomial and Poisson, the class marks cannot exceed 29. Biometry, by Robert R. Sokal and F. James Rohlf, W.H. Freeman and Company, San Francisco, 1969. Modified by Walter Ritter O.

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Biometry - Basic Statistic for Ungrouped Data — Language - FORTRAN
TCSC2 — Hardware - Burroughs 6700

Reads in samples of ungrouped continuous or meristic variates, then ranks and optimally performs transformations on these data. Output consists of a table of the various statistics computed: mean, median, variance, standard deviation, coefficient of variation, g_1, g_2, and the Kalmogorov Smirnov statistic D_{max} resulting from a comparison of the observed sample with a normal distribution based on the sample mean and variance; these are followed by their standard errors and 100 (1 - a)% confidence intervals where applicable. Biometry, by Robert R. Sokal and F. James Rohlf, W.H. Freeman and Company, San Francisco, 1969. Modified by Walter Ritter O.

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Biometry - Basic Statistic for Data Grouped into a Frequency Distribution, TCSC3 — Language - FORTRAN; Hardware - Burroughs 6700

Similar to TCSC2, but intended for data grouped into a frequency distribution.

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Biometry - Single Classification and Nested Anova, TCSD1 — Language - FORTRAN; Hardware - Burroughs 6700

Performs either a single classification or a k-level nested analysis of variance following the techniques presented in Sokal and Rohlf (1969). The basic anova table as well as the variance components are computed. The program allows for unequal sample sizes at any level. The input parameters are reproduced in the output, followed by a standard anova table giving SS, df, MS, and F_s. For nested anovas with unequal sample sizes, synthetic mean squares and their approximate degrees of freedom (using Satterthwaite's approximation) are given below each MS and df. Each F_s is the result of dividing the MS on its line by the synthetic MS from the level above it. When sample sizes are equal, the synthetic mean squares and their degrees of freedom are the same as their ordinary counterparts, but are printed out nevertheless by the program. No pooling is performed. The anova table is followed by a list of the estimated variance components expressed both in the original units and as percentages; these in turn are followed by a table of the coefficients of the expected mean squares. Biometry, by Robert R. Sokal and F. James Rohlf, W.H. Freeman and Company, San Francisco, 1969. Modified by Walter Ritter O.

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Biometry - Factorial Anova TCSD2 — Language - FORTRAN; Hardware - Burroughs 6700

Reads in data for a complete factorial analysis of variance with no replications. Using the technique described in Sokal and Rohlf (1969, Section 12.5), it is possible to use this program for single classification anova with equal sample sizes, multi-way analysis of variance with equal replications, and other completely balanced designs. Produces the standard anova table and provides as well an optional output of a table of deviations for all possible one-, two-, three-, four-way (and more) tables. The output is especially useful as input to various programs for testing differences among means and can be inspected for homogeneity of interaction terms. Biometry, by Robert R. Sokal and F. James Rohlf, W.H. Freeman and Company, San Francisco, 1969. Modified by Walter Ritter O.

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Biometry - Sum of Squares STP — Language - FORTRAN
TCSD3 — Hardware - Burroughs 6700

Tests the homogeneity of all subsets of means in anova, using the sums of squares simultaneous test procedure of Sokal and Rohlf (1969, Section 9.7). Biometry, by Robert R. Sokal and F. James Rohlf, W.H. Freeman and Company, San Francisco, 1969. Modified by Walter Ritter O.

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Biometry - Student-Newman-Keuls Test — Language - FORTRAN
TCSD4 — Hardware - Burroughs 6700

Performs a Student-Newman-Keuls a posteriori multiple range test. The SNK procedure is an example of a stepwise method using the range as the statistic to measure differences among means. Biometry, by Robert R. Sokal and F. James Rohlf, W.H. Freeman and Company, San Francisco, 1969. Modified by Walter Ritter O.

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Biometry - Test of Homogeneity of Variances — Language - FORTRAN
TSCE1 — Hardware - Burroughs 6700

Performs Bartlett's test of homogeneity of variances and the F_{max} test. Biometry, by Robert R. Sokal and F. James Rohlf, W.H. Freeman and Company, San Francisco, 1969. Modified by Walter Ritter O.

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Biometry - Test of Equality of Means with Heterogeneous Variances, TCSE2 — Language - FORTRAN
Hardware - Burroughs 6700

Performs an approximate test of the equality of means when the variances are assumed to be heterogenous. The method differs from an ordinary single classification anova in that the means are weighted according to the reciprocal of the variance of the sample from which they were taken, and a special error MS must be used to take the weighting into account. The input parameters are reproduced in the output along with a listing of the means and variances for each sample. These are followed by the sample variance ratio F_s' and the degrees of freedom required for looking up the critical F-value. Biometry, by Robert R. Sokal and F. James Rohlf, W.H. Freeman and Company, San Francisco, 1969. Modified by Walter Ritter O.

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Biometry - Tukey's Test for Nonadditivity — Language - FORTRAN
TCSE3 — Hardware - Burroughs 6700

Performs Tukey's test for nonadditivity to ascertain whether the interaction found in a given set of data could be explained in terms of multiplicative main effects. This test is also useful when testing for nonadditivity in a two-way Model I anova without replication in experiments where it is reasonable to assume that interaction, if present at all, could only be due to multiplicative main effects. It partitions the interaction sum of squares into one degree of freedom due to multiplicative effects of the main effects on a residual sum of squares to represent the other possible interactions or to serve as error in case the anova has no replication. Biometry, by Robert R. Sokal and F. James Rohlf, W.H. Freeman and Company, San Francisco, 1969. Modified by Walter Ritter O.

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Biometry - Kruskal-Wallis Test — Language - FORTRAN
TSCE4 — Hardware - Burroughs 6700

The Kruskal-Wallis test is a non-parametric method of single classification anova. It is called non-parametric because their null hypothesis is not concerned with specific parameters (such as the mean in analysis of variance) but only with distribution of the variates. This is based on the idea of "ranking" the variates in an example after pooling all groups and considering them as a single sample for purposes of ranking. This program performs the Kruskal-Wallis test for equality in the "location" of several samples. The input parameters and sample sizes are reproduced in the output, followed by the Kruskal-Wallis statistic H (adjusted, if necessary), which is to be compared with a chi-square distribution for degrees of freedom equal to a-1. Biometry, by Robert R. Sokal and F. James Rohlf, W.H. Freeman and Company, San Francisco, 1969. Modified by Walter Ritter O.

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Biometry - Fisher's Exact Test — Language - FORTRAN
TCSE5 — Hardware - Burroughs 6700

Performs Fisher's exact test for independence in a 2 x 2 contingency table. The computation is based on the hypergeometric distribution with four classes. These probabilities are computed assuming that the row and column classifications are independent (the null hypothesis) and that the row and column totals are fixed. Biometry, by Robert R. Sokal and F. James Rohlf, W.H. Freeman and Company, San Francisco, 1969. Modified by Walter Ritter O.

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Biometry - R x C Test of Independence in Contingency Tables, TCSE6

Language - FORTRAN
Hardware - Burroughs 6700

Performs a test of independence in an R x C contingency table by means of the G test. Optionally it carries out an a posteriori test of all subsets of rows and columns in the R x C contingency table by the simultaneous test procedure. Biometry by Robert R. Sokal and F. James Rohlf, W.H. Freeman and Company, San Francisco, 1969. Modified by Walter Ritter O.

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Monte Carlo Spill Tracker

Language - PL/1 Optimizer
Hardware - IBM 370-168/216 K bytes (characters)

Provides insight on likely oil spill trajectories in a given region by season, using Monte Carlo sampling of Markov wind model at one- or three-hourly intervals; spill movement assumed to be linear combination of momentary wind and current vectors. Input: Map of area, output files from analysis of TDF-14 data, current hypothesis, postulated spill launch points. Output: Estimates of the likelihood of spill reaching various areas; estimates of the statistics of the time to reach such areas. See publications MITSG 74-20, "Primary, Physical Impacts of Offshore Petroleum Developments," by Stewart and Devanney, MIT Sea Grant Project Office, April 1974.

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Thermal Pollution Model

Language - FORTRAN IV
Hardware - CDC 6500/CDC 1604/20K 60 bit words

Simulates the dispersion of heat from a source. Output is a printout of current and heat fields.

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Substance Advection/Diffusion Routine

Language - FORTRAN
Hardware - CDC 6500

Simulates the advection and diffusion of pollutants. The program uses a Lagrangian approach with a Fickian diffusion equation. Input: Current data, pollutant release location, concentration and time of release. Output: Pollutant spread fields. EPRF Tech. Note 1-74, "A Vertically Integrated Hydrodynamical-Numerical Model."

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Danish Advection Program

Language - FORTRAN
Hardware - CDC 3100/CDC 6500

Computes advection of pollutants (or mass) in a fluid in two dimensions. Input: Velocities in X and Y, mass and grid spacing in X and Y, all for each grid point; timestep and total time of advection. Output: Initial gridpoint of field advected and final field after total advection. Quasi-Lagrangian method used, utilizing mass, center of mass, and width of mass distribution, all for each grid point. Storage requirement is grid-size dependent: for NX by NY grid, (NX*NY*7) + (NX+1)*28 words. "A Method for Numerical Solution of the Advection Equation," by L.S. Pederson and L.P. Prahm, Meteorological Institute, Denmark, Aug. 1973, 36 pp.

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Ecological Statistical Computer Programs
ECOSTAT

Language - ANS FORTRAN*
Hardware - IBM 360/370**

The system was developed as part of an extensive study undertaken by the County Sanitation Districts of Los Angeles and the Southern California Coastal Water Research Project to provide insight into the ecological effects of ocean discharge of treated wastewaters. Biological and physical data for analysis were available from semi-annual benthic surveys on the Palos Verdes Shelf. Due to the nature of the analysis and the probability that the system would be used by other agencies, it was decided that the programs would be made general and easily implemented and used in other computing environments and sampling studies. The system differs from other statistics packages in that it allows the user to define a taxonomic structure on encountered species and employ the resultant groupings in the calculation of diversity indices, T and F statistics, linear correlation coefficients, one-way analysis of variance, dissimilarity coefficients, and abiotic-biotic relationship tables. The user can also specify station groupings to be used in computing statistics.

Output: (1) Summary information: (a) raw data, (b) species distrubution, (c) dominant species; (2) Univariate statistics: (a) means, standard deviations by parameter for each station, (b) community diversity (8 measures - Brillouin's, Gleason's, Margalef's, Shannon-Weaver's, Simpson's, scaled Shannon-Weaver's, scaled Simpson's, scaled standard deviation), (c) T and F statistics between regions by parameter, (d) dissimilarity coefficients by taxon between regions, between samples for each station, between surveys by region, (e) ANOVA tables among surveys by region; (3) Multivariate statistics: (a) linear correlation coefficients by region between parameters; (4) Abiotic-biotic relationships: (a) means, standard deviations, ranges of physical parameters for each partition of relative abundance, (b) dominant species occurring at physical parameter class interval pairs.

(*With the following IBM extensions: Object-time dimensions transmitted in COMMON, INTEGER*2, END parameter in a READ, literal enclosed in apostrophes, mixed-mode expressions, NAMELIST, T format code.)

(**For all programs except BIOMASS, ABUNDANCE, and DIVERSITY, a direct access storage device is required. Since all data sets are accessed sequentially a tape system is possible, however, and with as few as three drives all analyses with the exceptions of those between surveys may be accomplished. The generation of Table VO (ANOVA among surveys) using five surveys, for example, requires a minimum of ten files to be open simultaneously, and, unless there are ten tape drives available, this would be impossible without using disk storage.)

"Ecological Statistical Computer Programs, User Guide," by Bruce Weinstein, Los Angeles County Sanitation Districts, August 1975.

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CURRENTS AND TRANSFER PROCESSES

Drift Bottle Statistics

Language - PL/1 Optimizer
Hardware - IBM 360-168/2[illegible]

Used for determination of spatial and temporal conditions in drift bottle trajectories. Input: Standard NODC 80 character drift bottle records, formatted according to NODC Pub. M-6 in either card or tape form. Bottle records must be roughly sorted by launch point location to facilitate identification of recoveries occurring from a common launch event. Output: Launch and recovery group size distributions; pairwise correlations in recovery location and date. Recovery group size vs. launch group size; Chi-square tests of independent trajectory, hypothesis, etc. Brief discussion of results for U.S. Atlantic Coast available in publication MITSG 74-20, "Primary, Physical Impacts of Offshore Petroleum Developments," by Stewart and Devanney, MIT Sea Grant Project Office, April 1974.

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Drift Bottle Plots

Language - PL/1
Hardware - IBM 370-168/SC4020 CRT

Plots launch and recovery locations of drift bottles. Input: Data files screened and formatted by CNDNSDTA. Output: CRT plots of launch and recovery positions. See publication MITSG 74-20, "Primary, Physical Impacts of Offshore Petroleum Developments," by Stewart and Devanney, MIT Sea Grant Project Office, April 1974.

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Reformat and Sort Drift Bottle Data
CNDNSDTA

Language - PL/1
Hardware - IBM 370-168/250K/Disk

Reformats into condensed record format (28 characters), screens for bottle configuration, and sorts by launch point, filing into on-line (disk) storage. Input: Standard NODC 80 character drift bottle records per NODC publication M-6. Output: All drift bottles launched within "r" miles of "N" launch points are reformatted and filed in "N" separate data file.

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Current Profiles from Tilt Data

Language -
Hardware -

Calculates current profiles generated from tilt data obtained from Niskin current array. Current magnitude and direction are computed at each sensor from tilt and azimuth data by means of numerical algorithms developed from analysis of the three-dimensional cable equations. Input: Physical parameters to be modeled. Output: Profiles can be generated at a given time using one method. Profiles can also be generated for one-hour increments from the averaged data which have been curve fitted between sensor stations.

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Current Meter Data

Language - FORTRAN
Hardware - CDC 3300/Disk/UCC Plotter

CREATE-C	20K words
CURRENT	20K words
CURRPLOT	28K words

CREATE-C creates a disk file of raw data digitized from Braincon current meter film and consisting of arc endpoints and angles; listing also produced. CURRENT converts raw data to current speed, direction, etc., according to particular calibration and gives basic statistics: minimum and maximum speed, means, standard deviations, etc. Input: disk file from CREATE-C and a data card giving information about the data (e.g., format) and about the current meter used (type, observation time, etc.). Output: Listing of converted data and statistics and a new disk file of converted data. Using this data file and a plot data card, CURRPLOT prepares a tape for the UCC Plotter to give plots of speed vs. time, direction vs. time, and progressive vector plot. Plots are broken up into one-week units.

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Current data
SPECTRUM

Language - FORTRAN
Hardware - CDC 3300

Using processed data file from CURRENT and a preprocessing data card, gives autocorrelation and auto power spectrum for current speed and velocity components with preprocessing options for filtering, condensing, etc.

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Optimized Multi-layer HN Model

Language - CDC FORTRAN EXTENDED
Hardware - CDC 7600 or 6500 w/CDC 3100/157K octal (60 bit) words on 7600

Computes surface deviations and integrated current velocities based on hydrodynamic equations for small-scale coastal and open ocean areas for up to three selected layers. The finite difference scheme proposed by Hansen (1938) is extended to multiple layer cases optimized for ease in practical application and for computer computation. Intermediate data tape prepared on CDC 3100. EPRF Tech. Paper 15-74, by R.A. Bauer.

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Monterey, CA 93940

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Telephone (408) 646-2937

Mean Drift Routine

Language - FORTRAN
Hardware - CDC 6500/CDC 1604

Generalized routine to simulate the drift of an object, given the current structure, wind fields, and object leeway. EPRF Tech. Note 1-74, "A Vertically Integrated Hydrodynamical-Numerical Model."

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Search and Rescue Planning
NSAR

Language - FORTRAN Extended
Hardware - CDC 6500/54K words

Provides an estimate of an object's position in the ocean at the time a search is initiated. Computes drift as a resultant of two components. In all cases 100 percent of the surface current is applied. Wind effects are handled through a series of leeway codes options. Input: FNWC surface wind and current field analysis and prognosis; object starting time and position, datum time, last known position, navigation error factors, leeway factors. Output: Datum points (latitude, longitude) for each datum time. OPNAV INST 3130.5A, 7 Dec. 1972, FNWC Tech. Note 60, August 1970.

LCDR John Cossner
Fleet Numerical Weather Central
Monterey, CA 93940

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Telephone (408) 646-2010

Current Meter Turbulence

Language - FORTRAN
Hardware - IBM 7074

Gives an indication of turbulence in the ocean by computing measures of the deviations from means over various lengths of time. OS No. 572-2. Author - Robert R. Gleason.

Data Systems Office
U.S. Naval Oceanographic Office
Washington, DC 20373

Available from originator only

Telephone (301) 763-1449

In-Situ Current

Language - FORTRAN V
Hardware - UNIVAC 1108/1K words/Drum

Converts one-minute averages of Interocean Type II current meter to standard vectorial values. Produces vectorial angle and velocity for each data point and then combines vectorially to yield a mean value for entire period. Input: Card images of data points taken from Rustrak recorders. Output: Printout of vectorial and five-minute average values, current speed and direction in knots, and degrees true.

Philip Vinson
U.S. Naval Oceanographic Office
Washington, DC 20373

Available from originator only

Telephone (202) 433-3678

Water Displacement
DISPLA

Language - FORTRAN
Hardware - UNIVAC 1108/1,200 36 bit words/
3 tape units

Computes water displacement resulting from ocean current action. Input: Current speed and direction values on tape produced by current meter print program. Output: Individual and cumulative displacements per selected unit time in nautical miles; tabular printout, tape, or both.

Gerald Williams
U.S. Naval Oceanographic Office
Washington, DC 20373

Available from originator only

Telephone (202) 433-4187

Current Meter Print

Language - FORTRAN
Hardware - UNIVAC 1108/10K 36 bit words/Drum/ 3 tape units

Calculates ocean current speeds and directions from Geodyne A101 optical current meters. Values are converted to knots and degrees and are vectorially averaged over one-minute data frames, ten scans per frame. Input: Observed current parameters from meter converted from optical film to magnetic tape; parameters are in arbitrary units dependent on meter design. Output: Current speed and direction data; tabulated printout and tape. Tape output drives plotter program.

Gerald Williams
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Available from originator only

Telephone (202) 433-4187

Current Meter Plot

Language - FORTRAN
Hardware - UNIVAC 1108/9K 36 bit words/3 tape units/CalComp Plotter

Produces plotter tape to plot ocean current speed and direction information. Program calls CalComp subroutines. Input: Current speed and direction data on tape produced by Current Meter Print Program. Output: Histograms, polar plots, and point plots.

Gerald Williams
U.S. Naval Oceanographic Office
Washington, DC 20373

Available from originator only

Telephone (202) 433-4187

Convert Current Meter Tape
MAGPACK

Language - FORTRAN V
Hardware - UNIVAC 1108/EXEC 8/Instructions 647 words/Data 707 words/2 tape units

Converts binary data on tape from Geodyne MK III current meter to BCD tape, formatted and blocked for further processing, with edited time, compass, vane, tilt, and speed rotor counts. Binary data decoded with FORTRAN field functions and output blocked and formatted with subroutine NAVIO. Author - Peter J. Topoly.

Data Systems Office
U.S. Naval Oceanographic Office
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Available from originator only

Telephone (301) 763-1449

Current Meter Data
MPRINTO

Language - FORTRAN V
Hardware - UNIVAC 1108/EXEC 8/Instructions 2 tape units

Computes frame and scan values of current meters (Geodyne A101 optical and MK III magnetic); calculates normalized unit vectors for vectorial speed, lists data, and produces packed BCD tape. Input: BCD tape with rotor counts of compass, vane, speed, and tilt. Output: Packed BCD tape of frame data and averaged frame data (pack rate and averaging rate optional). Author - Peter J. Topoly.

Data Systems Office
U.S. Naval Oceanographic Office
Washington, DC 20373

Available from originator only

Telephone (301) 763-1449

Current Meter Clock Sequence
XTAL

Language - FORTRAN IV Extended
Hardware - XDS Sigma 7/48K words (192K bytes)

Verifies sequence of crystal clock count values from VACM or Geodyne 850 current meters. Bad clock values are identified by use of differencing techniques. Input: Clock values on tape in CARP format. Output: Statistics of clock performance with catalog of erroneous values.

John A. Maltais
Woods Hole Oceanographic Institution
Woods Hole, MA 02543

Available from originator only

Telephone (617) 548-1400

Current Meter Calibration
CASDEC

Language - FORTRAN IV Extended
Hardware - XDS Sigma 7/48K words (192K bytes)

Applies calibration parameters to raw VACM current meter data on tape in CARP format, identifies and removes bad values, and stores the output on tape in standard buoy format.

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Woods Hole, MA 02543

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Current Meter Data Reduction and Editing
CARP

Language - HP Assembly Language
Hardware - HP 2100/8K locations/Cassette reader/Keyboard device

Transfers current meter data from VACM cassette or Geodyne 850 cartridge magnetic tape to nine-track computer compatible tape and flags data cycles which have errors.

Mary Hunt
Woods Hole Oceanographic Institution
Woods Hole, MA 02543

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Telephone (617) 548-1400

Surface Current Summary
SUFCUR

Language - Assembler
Hardware - IBM 360-65

Produces a statistical summary of surface current observations for each Marsden (ten-degree) square, one-degree square, or five-degree square and month for a given area. Author - Jeffrey Gordon.

Oceanographic Services Branch
National Oceanographic Data Center
NOAA/EDS
Washington, DC 20235

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Telephone (202) 634-7439

Vector Time Series
CURPLT6

Language - FORTRAN IV
Hardware - CDC 6400 (SCOPE 3.4)/115K (octal) 10-character words/CalComp 936/905 Plotting System

Computes and plots statistics, histograms, time series, progressive vector diagram and spectra for time series of current meter data. Input: Current meter time series on tape in CDC 6400 binary format; maximum number of data points is 5326. Output: Listing and tape for off-line plotter. Perfect Daniel frequency window used to compute spectral estimate from FFT-generated periodogram values.

James R. Holbrook
Pacific Marine Environmental Laboratory, NOAA
3711 Fifteenth Avenue, N.E.
Seattle, WA 98105

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Telephone (206) 442-0199

Processes Current Instrument Observations Language - FORTRAN II
Hardware - IBM 1620 II

Several programs and subroutines for processing Michelsens Container data (automatic current and temperature measurements), for processing Ekman current meter data, and for harmonic analysis and power spectrum analysis. NATO Subcommittee on Oceanographic Rese[illegible] Technical Report No. 37 (Irminger Sea Project), "Some FORTRAN II Programs for Computer Pro[illegible]ing of Oceanographic Observations," by H.E. Sweers, Feb. 1967.

Geophysical Institute
University of Bergen
Bergen, Norway

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Current Meter Data Processing System Language - MS FORTRAN
Hardware - CDC 3150/20K words/2 tape units/ CalComp Plotter

Processes data primarily from Braincon or Aanderaa moored current meters; performs automatic editing, tidal analysis residuals, tide prediction, filtering, plotting; power spectra and statistical means and histograms are generated. Also performs file management.

Doug Gregory
Bedford Institute of Oceanography
P. O. Box 1006
Dartmouth, N. S. B2Y 4A2

Available from originator only

Telephone (902) 426-2390

TIDES

Astronomical Tide Prediction

Language - FORTRAN IV
Hardware - IBM 360-195/80K bytes

Computes hourly values and time and heights of high and low astronomical tides by harmonic method. Input: Tidal constituent constants. Technical Memorandum WBTM TDL-6.

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Techniques Development Laboratory
National Weather Service, NOAA
8060 Thirteenth Street
Silver Spring, MD 20910

Available from originator only

Telephone (301) 427-7614

Tides in the Open Sea

Language - FORTRAN 60
Hardware -

Predicts tides in the open sea, utilizing the basic hydrodynamic equations, for the principal lunar semidiurnal constituent M2. Application is made to the analysis of the tidal regime in the Gulf of Mexico. Thesis by Thomas H. Gainer, Jr., May 1966.

Naval Postgraduate School
Monterey, CA 93940

Available from NTIS, Order No. AD 489 096/LK, $4.75 paper, $2.25 microfiche.

Harmonic Analysis of Data at Tidal Frequencies

Language - FORTRAN IV
Hardware - CDC 6600*/140K

For analyzing equally spaced short-period data (15 days or 29 days), this program utilizes the standard Fourier analysis and traditional methods of the former Coast and Geodetic Survey. Either a vector (polar form) or scalar variable may be analyzed; for vector series, the program allows either a major-minor axis analysis or a north-east component approach. No data series may exceed 7,000 terms without redimensioning in the program, and no series of other than 15 or 29 days of uniformly spaced data can be analyzed. The program accepts input via magnetic tape or punched cards in any format with the restriction that, for vectors with magnitude and direction in the same record, the angles must precede the amplitudes in the record. For vectors specified by one file of amplitudes and one file of directions, the amplitude file must be read first. Output: mean amplitudes and phases of 26 tidal constituents. NOAA Technical Report NOS 41, "A User's Guide to a Computer Program for Harmonic Analysis of Data at Tidal Frequencies," by R. E. Dennis and E. E. Long, July 1971.

(*The program is executable with minor adjustments on any compatible machine having a 140K memory and access to arcsine and arccosine systems functions. Computing time is approximately 1.5 seconds per station on the CDC 6600.)

Charles R. Muirhead
Chief, Oceanographic Surveys Branch
National Ocean Survey, NOAA
6001 Executive Boulevard
Rockville, MD 20852

Deck available from originator only; for above report (including program listing), contact Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20402. Price: $.70, stock number 0317-0022.
Telephone (301) 443-8501

Theoretical Radial Tidal Force

Language - MAD
Hardware - IBM 7090

Input: (1) astronomical data from the nautical almanac; (2) the solar ephemeris obtained from the same source (only the earth-sun radius vector is needed); (3) list of local constants, atitude and longitude in degrees of arc and minutes, elevation in centimeters. Output: Lunar, olar, and total tidal forces and the vector date. Program accomodates maximum of 725 hours 30 days) of data in core storage. Author - Henry L. Pollak.

Dept. of Earth and Planetary Sciences
414 Space Research Coordination Center
University of Pittsburg
Pittsburg, PA 15213

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WAVES

Hurricane Storm Surge Forecasts
SPLASH I

Language - FORTRAN IV
Hardware - CDC 6600/77K words

Predicts hurricane storm surges for landfalling storms, using numerical solutions of linearized transport equations with surface wind forcing and time history bottom stress. Input: Basin data and storm variables, such as intensity, size, and vector storm motion. Output: Storm surge envelopes, storm definitions, and astronomical tides.

Celso S. Barrientos
Techniques Development Laboratory
National Weather Service, NOAA
8060 Thirteenth Street
Silver Spring, MD 20910

Available from NTIS: Magnetic tape, Order. No. COM-75-10180/AS, $250 domestic, $312 foreign; User's Guide, Order No. COM-75-10181/AS, $3.25 domestic, $5.25 foreign
Telephone (301) 427-7613

Hurricane Storm Surge Forecasts
SPLASH II

Language - FORTRAN IV
Hardware - CDC 6600/77K octal words

Predicts storm surges for storms with general track and variant storm conditions, using numerical solutions of linearized transport equations with surface wind forcing and time history bottom stress. Input: Basin data, storm variables, and geographical description of storm track. Output: Storm surge envelopes, space-time history of surges, storm characteristics, and astronomical tides.

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Techniques Development Laboratory
National Weather Service, NOAA
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Available from NTIS: See SPLASH I
Telephone (301) 427-7613

East Coast Storm Surge

Language - FORTRAN IV
Hardware - IBM 360-195/165K bytes

Predicts storm surges generated by extratropical storms for eleven stations along the U.S. East Coast. Forecast equations derived by statistical screening regression. Input: National Meteorological Center PE model sea-level pressure forecasts. Output: Storm surge forecasts to 48 hours at 6-hour intervals, for 11 locations. NOAA Technical Memorandum NWS TDL-50.

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Techniques Development Laboratory
National Weather Service
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Silver Spring, MD 20910

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Telephone (301) 427-7614

Wave Forecasts

Language - FORTRAN IV
Hardware - IBM 360-195/410K bytes

Forecasts wind waves and swells for the Atlantic and Pacific Oceans, using singular method based on the Sverdrup-Munk forecasting system. Input: National Meteorological Center 1000-mb PE model wind forecasts; Output: Wind wave and swell grid printed charts to +48 hours. Technical Memoranda WBTM TDL-13 and TDL-17.

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Wave Bottom Velocity

Language - FORTRAN IV G Level 21
Hardware - IBM 360-75/96K

Computes and plots maximum bottom (horizontal) orbital velocity versus still water depth for Airy waves of given height and period. Output: log-log graph of u(max) at sea floor vs. water depth for each wave; also, a listing of the wave's steepness, u(max) at bottom, wave length, and celerity is produced.

John McHone
Geology Department
University of Illinois
Urbana, IL 61801

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Telephone (217) 333-3542

French Spectro-Angular Wave Model

Language - FORTRAN IV/COMPASS
Hardware - CDC 6500/CDC 7600

Computes sea-state, using a spectral approach involving sixteen directions and six periods, devised by Gelei et al. Input: Wind speed and direction. Output: Significant wave height period of highest energy and direction of aximum energy fields. Detailed spectral breakdown for up to twelve points.

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Surf Prediction Model

Language - FORTRAN IV
Hardware - CDC 3100/16K 48 bit words

Produces calculated wave ray paths, including the wave information and refraction and shoaling coefficients, using a modified Dobson approach to the ution of the general wave refraction. Technical Report No. 16, by B.S.L. Smith and F.E. Cam ad, College of Marine Studies, University of Delaware.

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Singular Wave Prediction Model

Language - FORTRAN
Hardware - CDC 3100/CDC 3200/32K 24 bit words

Produces a wave height analysis for semi-enclosed seas. Uses a modified geostrophic wind derived from a local pressure analysis to generate an analysis of the sea state. Output: Wave height (ft), wave period (sec), wind speed (m sec^{-1}) and wind direction (degrees). EPRF Program Note 8, "The Wave 32 Program," by S. Larson and A.E. Anderson, Jr.

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Monterey, CA 93940 | Telephone (408) 646-2868

Wave Interaction with Current — Language - FORTRAN IV
CAPGRAY — Hardware - IBM 370-165/2000K Region

Calculates wave length, wave number, wave slope, and wave energy changes for waves in the capillary-gravity subrange as they interact with non-uniform current. A perturbation scheme using the gravity contribution of the capillary-gravity wave as the perturbation parameter was used to integrate the energy equation exactly. Input: Wave number K for waves with no current.

Steven R. Long | Available from originator only
Center for Marine and Coastal Studies
North Carolina State University
Raleigh, NC 27607 | Telephone (919) 737-2212

Shipborne Wave Recorder Analysis — Language - FORTRAN IV
SBWRO — Hardware - IBM 1800

Given values of the highest and second highest crests, the lowest and second lowest troughs, the number of zero crossings, and the number of crests in a short record from the NIO shipborne wave recorder, computes the spectral width parameters and the significant wave height and also the predicted maximum height in a period of three hours; outputs the results on lineprinter and on disk. NIO Program No. 89. Author - Eileen Page.

National Institute of Oceanography | Copy on file at NODC (listing, documentation)
Wormley, Godalming, Surrey, England

Storm Surge — Language - FORTRAN IV
Hardware - UNIVAC 1108/10K words

Numerical models, based on the hydrodynamic equation and local depth fields, are used to determine the flood levels expected from specific hypothetical storms. Publication TM-35, "Storm Surge on the Open Coast; Fundamentals and Simplified Prediction," May 1971.

(1) For program release: | Available from originator only
Colonel James L. Trayers
Commander and Director
Coastal Engineering Research Center
Kingman Building
Fort Belvoir, VA 22060

(2) For program information:
D. Lee Harris
Chief, Oceanography Branch
Coastal Engineering Research Center

Wave Refraction — Language - FORTRAN IV
Hardware - UNIVAC 1108/15K words/Plotter

Calculates and plots surface wave rays. Input: Depth grid; xy and angle starting point of rays. Output: Plotted output of shoreline and wave rays; listing of wave ray x, y, angle, time and depth. Publication TM-17, "A Method for Calculating and Plotting Surface Wave Rays," Feb. 1966.

(1) For program release:
Colonel James L. Trayers
Commander and Director
Coastal Engineering Research Center
Kingman Building
Fort Belvoir, VA 22060

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(2) For program information
D. Lee Harris
Chief, Oceanography Branch
Coastal Engineering Research Center

Water-Wave Teaching Aids

Language - FORTRAN
Hardware - IBM 360-40

In teaching the engineering applications of water-wave theory, it is often desirable to have students make numerical calculations based on the various wave theories. This is practical, however, only for the simplest of the water-wave theories, as the computations involved with higher order theories are quite tedious and time-consuming. This collection of programs and subroutines represents an attempt to relieve students of these lengthy and detailed computations, so that they can use the theoretical results in solving realistic problems. At the same time, there are dangers inherent in developing and using computer programs for teaching purposes. The principal difficulty is the "black box" syndrome, where the students merely punch some numbers into a card and, later, get more numbers back from the machine, without the vaguest idea of what happened in between. In order to avoid this difficulty, and, in addition, to provide wide flexibility, it was decided that the best format for this collection would be many short, single-function subroutines, which compute some of the more tedious intermediate results for a given problem, and which can be easily modified or added to by the user. The disadvantage of this approach is that it requires some knowledge of FORTRAN on the part of the student. It is believed, that this disadvantage is outweighed by the advantage of making the computational processes both clear and flexible.

LENG1 computes wave length and speed, given the water depth and wave period, using small-amplitude (and Stokes' second-order) wave theory. Values are returned to the calling program through the CALL statement and are also printed out during execution. LENG3 uses Stokes' third-order wave theory.

PROF1 computes water surface elevations, eta(x) or eta(t), over a wave period, using linear wave theory; returns arrays of x, t, and eta through the CALL statement; prints input data and the three arrays. Alternate subroutines PROF2 and PROF3 accomplish the same purpose using Stokes' second- and third-order wave equations.

Subroutines UMAX1, WMAX1, UTMAX1, and WTMAX1 compute u(max), w(max), the partial derivative of u with respect to t(max), or the partial derivative of w with respect to t(max), i.e., the maximum flow velocities in the x and z directions and their corresponding temporal accelerations, as a function of z, from z = -h to z = eta(max), using linear wave theory. Returns arrays of z and u(max) etc., for z = -h, -(29/30)h, -(28/30)h,...for z less than eta(max), through the CALL statement; prints the input data and the two arrays. Alternative sets of routines carry out the same purpose using Stokes' second- and third-order equations.

Subroutines UOFT1, WOFT1, UTOFT1, and WTOFT1 compute values of u(t), w(t), the partial derivative of u with respect to t, or the partial derivative of w with respect to t, i.e., the horizontal and vertical flow velocities and their accelerations, over a wave period (T) at a given depth (z) using linear wave theory. Returns arrays of t and u(t), etc., for t = 0, T/40, 2T/40,..., T, through the CALL statement; prints the input data and the two arrays. Alternative sets of routines carry out the same purpose using Stokes' second- and third-order equations.

The following four programs, dealing with spectra, were adapted (with permission) from the Share program G1 BE TISR, written at Bell Laboratories by M.J.R. Healy, 1962: DETRND removes the mean, or the mean and linear trend (slope) from a time series X(I), I = 1,N; AUTCOV computes the autocovariance, Y(K), K = 0,L, of the time series X(I), I = 1,N; CRSCOV computes the auto- and cross-covariances, ZXX(K), etc., of the two sequences X(I), Y(I), I = 1. N, for lags from 0 to L; FOURTR computes either the sine or cosine transform, Y(K), K = 1, M + 1, of the series X(K), K = 1, M + 1 (smoothing of either is optional, with coefficients .25, .50, .25).

PROFILE computes and plots the wave profile given a spectrum (in the form of the Fourier coefficients). Output: A printer plot (on a printer with a 132-character line) of eta vs. t.

REFL1 computes and prints water surface profiles for the partial (two-dimensional) reflection of a linear (small-amplitude) wave from a structure.

FORCE AND MOMENT computes the total force and moment (about the base, or "mud line") on a circular cylindrical pile as a function of time, using linear theory integrated to the actual water surface. A table of F and M_0 vs. t is printed out.

FDIST computes the force distribution on a pile, using linear theory. Prints out the data and the force distribution as a function of time.

Listed and documented in Hydrodynamics Laboratory Technical Note No. 13, "Water Wave Teaching Aids," by R.H. Cross, Sept. 19[illegible].

Department of Civil Engineering   Copy on file at NODC (above report)
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Cambridge, MA 02139

AIR-SEA INTERACTION AND HEAT BUDGET

Markovian Analysis of TDF-14 Wind Data

Language- PL/1 Optimizer
Hardware - IBM 370-180/260K bytes (characters)

Produces 9 x 9 and 33 x 33 matrices of wind transition probabilities for user-supplied interval. Assumes wind can be modeled as a Markov process, in which likelihood of wind speed and direction in next interval depends only on current wind speed and direction. Input: TDF-14 formatted tapes of hourly and three-hourly weather station data, available from National Climatic Center, Asheville, NC 28801. Output: Wind transition matrices by season, steady-state probabilities, distribution of wind speed by direction. See publication MITSG 74-20, "Primary, Physical Impacts of Offshore Petroleum Development," by Stewart and Devanney, MIT Sea Grant Project Office, April 1974.

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Massachusetts Institute of Technology
Room 5-207
Cambridge, MA 02139

Available from originator only

Telephone (617) 253-5941

Summarizes Weather Reports
SYNOP

Language - FORTRAN (ALGOL input routine)
Hardware - Burroughs 6700/Less than 20K words

Processes synoptic marine radio weather reports to produce summaries of various items, by month. The validity of the data is checked against long-term mean values. Input: Disk files prepared separately from punched cards. Output: Printed summaries by one-, two-, and five-degree quadrangles, of sea and air temperatures, heat budget information, and barometric pressure; also punched cards for selected summary items.

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National Marine Fisheries Service, NOAA
P.O. Box 271
La Jolla, CA 92037

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Telephone (714) 453-2820, ext. 325

Pyranometer and Radiometer Time Series
RAD

Language - FORTRAN
Hardware - CDC 6400/53K words

Converts pyranometer and new radiometer readings to radiant intensity. Input: Cards with punched values of time, voltage values from a net radiometer, pyranometer, humidity sensor, air thermistor, wind speed detecter, and values of sea-surface temperature. Output: Listing of the above values converted to proper units plus computed values of net solar radiation, evaporative and conductive fluxes, total flux, effective back radiation, transmittance, solar altitude, and albedo.

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Pacific Marine Environmental
Laboratory, NOAA
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Seattle, WA 98105

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Ocean Climatology Analysis Model
ANALYS

Language - FORTRAN
Hardware - CDC 1604/16K 48 bit words/Drum/
3 tape units

Produces monthly climatological data fields. Input: Synoptic fields, first-guess climatology field. Uses a Laplacian relaxation technique. Computer Applications, Inc., Tech. Report, "Documentation of Subroutine ANALYS," by J.N. Perdue.

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Hurricane Heat Potential Model

Language - FORTRAN IV
Hardware - CDC 6500/20K 60 bit words/Varian Plotter optional

Computes the hurricane heat potential using the station temperature profiles in the form of punched cards in 4-D format. *Output:* a profile plot, hurricane heat potential, final Varian plot of area with all heat potentials plotted. Thesis by LCDR Shuman.

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Mixed Layer Depth Analysis Model
MEDMLD

Language - FORTRAN/COMPASS
Hardware - CDC 3100/CDC 3200/32K 24 bit words/ Drum/3 tape units

Generates an analyzed mixed layer depth field using ship reports and a first-guess field in the form of an adjusted climatological MLD field. The program uses a Laplacian analysis and relaxation scheme to generate the final field. Output: An analyzed mixed layer depth field on a synoptic basis. EPRF Programming Note 7, "Mediterranean Mixed Layer Depth Analysis Program MEDMLD," by A.E. Anderson, Jr.

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Atmospheric Water Content Model

Language FORTRAN (CDC 3100 MSOS)
Hardware - CDC 3100/12K octal words (24 bit)/ 15K octal words with system (MSOS)

Computes total grams of water present in atmospheric column surrounding ascent of radiosonde. The method used is based on Smithsonian tables and formulae. Compressibility of moist air is assumed equal to one. *Output:* Various intermediate values plus geometric height and total quantity of water in grams.

T. Laevastu or A. Stroud
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Ocean-Atmospheric Feedback Model

Language - FORTRAN IV
Hardware - CDC 6500/70K 60 bit words

Simulates the response of the surface air to sea-surface properties and also the processes of mesoscale feedback mechanisms. EPRF Tech. Paper 2-72, "The Effects of Oceanic Fronts on Properties of the Atmospheric Boundary Layer," by T. Laevastu, K. Rabe, and G.D. Hamilton.

Kevin M. Rabe Environmental Prediction Research Facility Naval Postgraduate School Monterey, CA 93940	Available from originator only Telephone (408) 646-2842

Wind Computation from Ship Observations — Language - FORTRAN
TRUWIND — Hardware - CDC 1604/16K 48 bit words

Calculates the true wind direction in degrees and speed in knots, given the direction and speed of the ship and the observed wind direction and speed. EPRF Program Note 16, "Program TRUWIND," by Baldwin van der Bijl.

Taivo Laevastu Environmental Prediction Research Facility Naval Postgraduate School Monterey, CA 93940	Available from originator only Telephone (408) 646-2937

Mie Scattering Computations — Language - FORTRAN
Hardware - CDC 3800/CDC 6600/32K

Uses Mie scattering theory to compute the angular distribution of scattered radiation from spherical particles, for a range of values of index of refraction and size parameter $\alpha=2\pi r/\lambda$ (where r = particle radius and λ = wavelength of incident radiation).

James W. Fitzgerald Naval Research Laboratory Washington, DC 20375	Available from originator only Telephone (202) 767-2362

Solar Radiation Conversion — Language - FORTRAN
Hardware - IBM 7074

Averages the radiation readings from the Eppley pyrheliometer and Beckman-Whitley radiometer for every 15 minutes. Converts from MV to Langleys/min. and calculates net radiation from both instruments. A modification of this program was made to include a Thornthwaite net radiometer. Authors - S.M. Lazanoff; modified by Mary E. Myers.

Data Systems Office U.S. Naval Oceanographic Office Washington, DC 20373	Available from originator only Telephone (301) 763-1449

Wind Stress — Language - FORTRAN
Hardware - IBM 7074

Determines wind stress on the ocean surface. OS No. 53462. Author - W.H. Gemmill.

Data Systems Office U.S. Naval Oceanographic Office Washington, DC 20373	Available from originator only Telephone (301) 763-1449

Two-Dimensional Power Spectrum for SWOP II — Language - FORTRAN
Hardware - IBM 7074

Determination of spectrum associated with the spatial distribution of energy as obtained from an instantaneous picture of the ocean taken from aircraft (SWOP II). OS NO. :3484. Author - C.M. Winger.

Data Systems Office U.S. Naval Oceanographic Office Washington, DC 20373	Available from originator only Telephone (301) 763-1449

Prediction of Vertical Temperature Change — Language - FORTRAN; Hardware - IBM 7074/Benson-Lehner Plotter

A technique based primarily on heat budget and wind mixing calculations has been developed for predicting the vertical thermal structure of the ocean; the technique essentially modifies the initial thermal structure through incident solar radiation, back radiation, sensible and evaporative heat exchange, convective heat transfer in the water mass, and wind mixing. Predictions are made at six-hour intervals until 1200Z on the date of forecast. The predicted BT is printed out, and also can be plotted with a Benson-Lehner Model J plotter. Authors - W.H. Gemmill and D.B. Nix. Informal manuscript report IMR No. 0-42-65, Oct. 1965. (See also IMR No. 0-45-65 by B. Thompson and IMR No. 0-13-66 by Barnett and Amstutz.) Program listings separate from reports.

Data Systems Office U.S. Naval Oceanographic Office Washington, DC 20373	Copy on file at NODC (Above reports 0-42-65 and 0-45-65; also listings) Telephone (301) 763-1449

Cloud Cover and Daily Sea Temperature — Language - FORTRAN; Hardware - IBM 7074

Divides cloud cover into three groups and computes mean temperature by hour of day and by day for each depth. OS No. 53414. Author - D.B. Nix.

Data Systems Office U.S. Naval Oceanographic Office Washington, DC 20373	Available from originator only Telephone (301) 763-1449

ICE

Sea Ice Studies
YARIT, FLIP, SALPR, RITE

Language - FORTRAN IV
Hardware - IBM 7090-94

A generalized program with several options that allow considerable latitude in the specification of input and output data. A main program reads in the input data and summarizes the results of each year's integration. Subroutine YARIT calculates the temperature and thickness changes of the ice and snow for each time step during the year. Subroutine FLIP takes the monthly values of the independent energy fluxes at the upper boundary and produces smoothed values for each time step. Subroutine SALPR calculates the salinity profile for each time step. Finally, subroutine RITE writes the temperature profile, ice thickness and mass changes for each ten-day period throughout the year. Memorandum RM-6093-PR, "Numerical Prediction of the Thermodynamic Response of Arctic Sea Ice to Environmental Changes," by G.A. Maykut and N. Untersteiner, Nov. 1969. Prepared for U.S. Air Force Project Rand.

The Rand Corporation
1700 Main Street
Santa Monica, CA 90406

Available from NTIS, Order No. Ad 698 733/LK, $7.00 paper, $2.25 microfiche.

Wind Drift and Concentration of Sea Ice
ICEGRID MODIFIED

Language - FORTRAN 60
Hardware - IBM 1604

Takes into consideration the effects of melting on the production of five-day forecasts of the wind drift and concentration of sea ice, using equations after Zubov and an earlier program of Knodle. Uses a 26x21 grid-point array with variable scale. Output fields are concentration, direction, and distance of movement. Incorporates programs ICEMELT and ICEGRID. Thesis by Kenneth M. Irvine, 1965.

Naval Postgraduate School
Monterey, CA 93940

Available from NTIS, Order. No. AD 475 252/LK, $4.25 paper, $2.25 microfiche.

Iceberg Drift
ICE-PLOT

Language - FORTRAN IV
Hardware - CDC 3300/31K words

Provides twelve hours of iceberg drift, iceberg input for Ice Bulletin, and map outline for FAX broadcast. Input: Twelve-hour average wind field, monthly surface current, and initial iceberg position (or previous, updated position if not a new berg). Output: Listing of new iceberg positions, Ice Bulletin message form, and map of approximate new iceberg positions. Vector addition of average winds and currents using four geographical "courses," twenty minutes (lat./long.) apart.

CDR A.D. Super
International Ice Patrol
U.S. Coast Guard
Bldg. 110, Coast Guard Support Center
Governors Island, NY 10004

Available from originator only

Telephone (212) 264-4798

Ice Drift Analysis/Forecast

Language - FORTRAN II
Hardware - CDC 160A/8K 12 bit words/3 tape units

Forecast or analyzed geostrophic winds and average sea-surface currents on magnetic tape are required input. The geostrophic winds are averaged over the time period specified by typewriter input. The ice drift equations are applied to the resultant wind, and sea surface currents are added. Output is in the form of forecast or analyzed ice drift (movement) at predetermined locations (points) to a maximum of 207.

Lt. Roland A. Garcia, USN
Fleet Weather Facility Suitland
Suitland, MD 20373

Copy on file at NODC (listing, documentation)

Telephone (301) 763-5972

SOUND

Normal Mode Calculations
NORMOD3

Language - FORTRAN IV
Hardware - CDC 6500/60K octal words/CalComp or other plotter

Calculates discrete normal modes and resulting propagation loss for depths and ranges of interest. This is a deep water version of a program originally written by Newman and Ingenito (NRL Report No. 2381, 1972). Appropriate for deep profiles and moderate frequencies (~100 Hz), the program uses a finite difference technique to generate mode shapes from the bottom up to the surface. It searches for appropriate eigenvalues yielding proper number of zero crossings and zero pressure at the surface. NOL Tech. Report 74-95.

Ira M. Blatstein
Naval Surface Weapons Center
White Oak
Silver Spring, MD 20910

Available from originator only

Telephone (202) 394-2583

Horizontal Range
RANGE

Language - FORTRAN
Hardware - CDC 6400

Computes horizontal range from a receiver to a sound source as a function of the D/E angle, the sound speed profile, the source and receiver depths, and the water depth and bottom slope at the point of bottom reflection. Assumes that the surface is flat, no horizontal variations in sound speed profile, and a flat earth. Only the two-dimensional case is considered. NOL Tech. Note 9856.

M. M. Coate
Naval Surface Weapons Center
Code 221
White Oak
Silver Spring, MD 20910

Available from originator only

Telephone (202) 394-2334

Sound Scattering by Organisms
SKAT

Language - FORTRAN IV
Hardware - CDC 1604/16K 48 bit words

Simulates the scattering of sound by organisms of various shapes and dimensions.

Taivo Laevastu
Environmental Prediction
Research Facility
Naval Postgraduate School
Monterey, CA 93940

Available from originator only

Telephone (408) 646-2937

Normal Mode Propagation Model

Language - FORTRAN V
Hardware - UNIVAC 1108/Drum

Produces propagation loss as a function of range and depth, time history of received pulses, mode enhancement information, ray equivalents, group velocity, phase velocity of modes, using as input sound velocity profiles, frequency, source and receiver depths, bottom topography and composition, and selection of modes. For certain plots, plotting programs are required. NUSC Report 4887-II.

William G. Kanabis
Naval Underwater Systems Center
New London, CT 06320

Available from originator only

Telephone (203) 442-0771, ext. 2353

Sound Refraction Corrections
FITIT

Language - FORTRAN
Hardware - CDC 3300

Computes data and fits polynomial functions to variable used to correct for bending of non-reflecting, nonvertexing sound rays. Least-squared-error type fitting (stepwise regression not used, but would improve program). Input: Sound velocity profile, limits of integration, domain of polynomial. Output: First to fifth degree polynomials, accuracy of FIT.

A.E. Vaas
Naval Underwater Systems Center
Newport, RI 02840

Available from originator only

Telephone (401) 841-3435

Beam Patterns and Widths
GBEAM

Language - FORTRAN V
Hardware - UNIVAC 1108/18K words/IGS Plotting System

Computes beam patterns and their beam widths for three-dimensional array with arbitrary element spacings, taking into consideration individual element's directionality, selectable delay, and shading. Also calculates directivity index and/or reverberation index. Formulation based on three-dimensional spherical and solid geometry. Directivity index and reverberation index calculations are carried out by two-dimensional parabolic numerical integration. NUSC Technical Report 4687.

Ding Lee or Gustave A. Leibiger
Naval Underwater Systems Center
New London, CT 06320

Available from originator only

Telephone (203) 442-0771

Statistics of Acoustic Measurements and Predictions - STAMP

Language - FORTRAN V
Hardware - UNIVAC 1108/60K variable

A general purpose processing program which includes a module for performing statistics of acoustic measurements and predictions. Storage requirement is variable; program is segmented. 60K is the maximum. User's Guide in preparation.

Richard B. Lauer
Naval Underwater Systems Center
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Available from originator only

Telephone (203) 442-0771, ext. 2827

Propagation Loss
FAST FIELD PROGRAM

Language - FORTRAN IV
Hardware - UNIVAC 1108

Calculates underwater acoustic propagation loss as a function of range for a point monochromatic source in a medium with an arbitrary sound speed profile versus depth. Special input-output requirement: Sound speed profile fitting program. NUSC Report Nos. 1046 and 4103.

Frederick R. DiNapoli
Naval Underwater Systems Center
New London, CT 06320

Available from originator only

Telephone (203) 442-0771, ext. 2647

Bottom Reflectivity

Language - FORTRAN II
Hardware - UNIVAC 1108

Computes three acoustic reflection coefficients as a function of incident angle and frequency. The program accounts for differences in path length, depth of source and receivers, water bottom slope, velocity gradient, and recorded travel time. USL Tech. Memo. Nos. 913-4-5 and 907-144-65. The later report also serves to document a supplemental program (USL No. 0429, in FORTRAN) for computing means and standard deviations of the three reflection coefficients. Program No. 0289.

R. Whittaker | Copy on file at NODC (listing, documentation)
Naval Underwater Systems Center
New London, CT 06320 | Telephone (203) 442-0771, ext. 2316

Pattern Function Calculations — Language - FORTRAN IV; Hardware - UNIVAC 1108

Computes transducer pattern functions needed in the sonar equations when estimating search performance of acoustic torpedoes. The desired parameters include the transmit and receive directivity indexes and the volume and boundary reverberation indexes. In a vehicle employed in circular search, the reverberation indexes are functions of turn rate and elapsed time in the ping cycle. The output is used by the "Sonar in Refractive Water" program. Report AP-PROG-C-7035, "Pattern Function Calculations," by Herbert S. Kaplan, Associated Aero Science Laboratories, Inc., Pasadena, for NUSC, Apr. 1967.

Naval Undersea Center | Copy on file at NODC (above report)
Pasadena Laboratory
3202 E. Foothill Blvd.
Pasadena, CA 91107

Rayleigh-Morse Bottom Reflection Coefficients — Language - FORTRAN V
RAYMOR — Hardware - UNIVAC 1108

Computes Rayleigh-Morse bottom reflection coefficients, also phase changes of the reflected and transmitted acoustic wave. Author - J.C. Reeves.

Naval Undersea Center | Copy on file at NODC (listing, documentation)
Pasadena Laboratory
3202 E. Foothill Blvd.
Pasadena, CA 91107

Light and Sound Instruction D — Language - FORTRAN; Hardware - IBM 7074

Computes the convergence zone parameters using the V_x method (equations of Donald Cole), by one-degree quadrangle, by month, and by season. OS No. 20112. Author - M.C. Church.

Data Systems Office | Available from originator only
U.S. Naval Oceanographic Office
Washington, DC 20373 | Telephone (301) 763-1449

Propagation Loss — Language - FORTRAN V
S1587 — Hardware - UNIVAC 1108/CalComp or Stromberg-Carlson 4060 plotter

Produces printed tables and plotted contours of single-frequency near-surface propagation loss. NUSC/NL Technical Memorandum No. 2070-356-70 and memo serial PA4-101, 2 May 1973.

T.A. Garrett | Available from originator only
Naval Underwater Systems Center
New London, CT 06320 | Telephone (203) 442-0771, ext. 2991

AMOS Propagation Loss — Language - FORTRAN V
S1797 — Hardware - UNIVAC 1108/Stromberg-Carlson 4060 plotter

Computes and plots AMOS and modified AMOS propagation loss as a function of range, frequency, or depth. NUSC Technical Memorandum PA4-225-71 and memo serial PA4-101, 2 May 1973.

T.A. Garrett
Naval Underwater Systems Center
New London, CT 06320

Available from originator only

Telephone (203) 442-0771, ext. 2991

SOUND VELOCITY

Sound Speed Computation Model — Language - FORTRAN
SOVEL — Hardware - CDC 3100/CDC 3200/CDC 1604/32K 14 bit words/1 tape unit

Computes sound speed from salinity-temperature-depth data. EPRF Program Note 10, "Program SOVEL," by T. Laevastu.

Taivo Laevastu
Environmental Prediction Research Facility
Naval Postgraduate School
Monterey, CA 93940

Available from originator only
Telephone (408) 646-2937

Sound Velocity — Language - FORTRAN IV-H
SONVEL — Hardware - XDS Sigma 7

Subroutine computes the speed of sound in seawater from the temperature, salinity, and pressure, according to W.D. Wilson's formulas.

Mary Hunt
Woods Hole Oceanographic Institution
Woods Hole, MA 02543

Available from originator only
Telephone (617) 548-1400

Sound Velocity: Wilson's Formula — Language - FORTRAN
WLSND, SVELFS, VELPRS — Hardware - IBM 360-65/2218 bytes (object form)

Computes sound velocity using Wilson's equations. WLSND is used when pressure is computed from depth and FS is computed from salinity. SVELFS is used when pressure is computed from depth and FS is the entering argument; in this case, FS is usually computed in SIGMAT. VELPRS is used when pressure is not computed but is an entering argument; atmospheric pressure is included; successive computation starting at the ocean is not necessary here. Author - Robert Van Wie.

Oceanographic Services Branch
National Oceanographic Data Center
NOAA/EDS
Washington, DC 20235

Copy on file at NODC
Telephone (202) 634-7439

Depth Correction — Language - FORTRAN IV
MTCOR — Hardware - XDS Sigma 7/1419 32 bit words

Calculates depth correction for sound velocity using Matthews' tables. Established coefficients are used to approximate Matthews' tables. The Matthews' table number 1-52 must be specified.

Robert C. Groman
Woods Hole Oceanographic Institution
Woods Hole, MA 02543

Available from originator only
Telephone (617) 548-1400

Sound Velocity — Language - FORTRAN
Hardware - UNIVAC 1108/6,100 36 bit words

Adjusts sound velocity values for marine sediments, as recovered from laboratory velocimeter, to in situ conditions of temperature, pressure, and salinity. Wilson's formula for sound speed in water is used to apply corrections.

Joseph Kravitz
U.S. Naval Oceanographic Office
Washington, DC 20373

Copy on file at NODC (deck with documentation)

Telephone (202) 433-2490

Sonic Velocities through Solid Samples
DSDP/SONHAM

Language - ALGOL
Hardware - Burroughs 6700/7K words

Computes sonic velocities through solid samples from technicians' data taken from a Hamilton frame device (Dr. Edwin R. Hamilton, Naval Undersea Center, San Diego, CA 92132), and interprets a key associated with each sample which defines its origin. Input: One card file for the velocity data and key, and another card file for interpreting the key. Output: Listing with option for punched cards; listing includes five superimposed histograms of velocities at different levels of refinement.

Peter B. Woodbury
Deep Sea Drilling Project
Box 1529
La Jolla, CA 92037

Available from originator only

Telephone (714) 452-3256

Light and Sound Instruction B

Language - FORTRAN
Hardware - IBM 7074

Computes the harmonic mean sound velocity, travel time, and correction ratio at 100-fathom depth intervals by one-degree square. OS No. 20111. Author - M.C. Church.

Data Systems Office
U.S. Naval Oceanographic Office
Washington, DC 20373

Available from originator only

Telephone (301) 763-1449

SOUND — RAY PATH

Continuous Gradient Ray Tracing System
CONGRATS

Language - FORTAN V
Hardware - UNIVAC 1108/50K 36 bit words/Disk drum with 250K words/2 tape units/CalComp Plotter

Draws ray diagrams, computes eigenrays, and calculates propagation loss and reverberation. Uses ray tracing method in which sound speed is represented as a function of depth with a continuous gradient, and the ray equations can be integrated in closed form. Input: Sound speed profile, bottom profile, sonar and target geometry, frequency, beam patterns, pulse length (number of these required depends on output desired). Output: Ray diagrams, propagation loss vs. range, pulse shape at a point, reverberation vs. time. NUSL Report No. 1052, "CONGRATS I: Ray Plotting and Eigenray Generation" by H. Weinberg, Oct. 1969; NUSL Report No. 1069, "Continuous Gradient Ray Tracing System (CONGRATS) II: Eigenray Processing Programs," by J.S. Cohen and L.T. Einstein, Feb. 1970; NUSC Report No. 4071, "Coutinous Gradient Ray Tracing System (CONGRATS) III: Boundary and Volume Reverberation," by J.S. Cohen and H. Weinberg, April 1971; and other reports.

Henry Weinberg or Jeffrey S. Cohen
Naval Underwater Systems Center
New London, CT 06320

Available from originator only

Telephone (203) 442-0771, ext. 2589 or 2989

Acoustic Performance and Evaluation - Digigraphics, APE-DIGI

Language - FORTRAN
Hardware - CDC 3300/64K/CDC 274 Digigraphics console, controller, software

The model simulates and displays, *on a real time* basis, the acoustic propagation characteristics of any given ocean medium including ray paths, intensity loss vs. range curves, and iso-loss contours. Includes provisions for transducer patterns, target characteristics, and certain receiving circuit characteristics. Input: Ocean profile (SUP, BT), operating frequency, db levels for iso-loss contours. Graphic and tabular output. The math model employed is a substantial extension of an ORL program and is based on the theory of ray-path acoustics as presented in "Physics of Sound in the Sea" and a work by Officer; also included are the works of Schulkin and Marsh for adsorption coefficients, Wilson for sound velocity calculations, and two Vitro Laboratory studies of Torpedo MK48 acoustic performance. NUSC TD 130, "Operation Procedures for Exercising the Acoustic Performance and Evaluation-Digigraphics Simulation Model (APE-DIGI)," July 1971.

Ronald P. Kasik
Naval Underwater Systems Center
Newport, RI 02840

Available from originator only

Telephone (401) 841-3435

Ray Path
S0434B

Language - FORTRAN
Hardware - UNIVAC 1108/30K/CalComp Plotter

Produces plots of travel vs. range for D, SR, BR, SRB, BRS, SBSR, BSBR paths, grazing angles for first three bottom bounce paths. Estimates ray paths and travel times by approximating true profile with linear segmented profile. Input: Source, receiver configuration, velocity profile, and plot requirements.

Peter D. Herstein
Naval Underwater Systems Center
New London, CT 06320

Available from originator only

Telephone (203) 442-0771, ext. 2305

Critical Acoustic Ratio

Language - FORTRAN
Hardware - IBM 7074

Determination of critical ratio of trigonometric functions of acoustic angles involved in connection with the convergence interval for a 3-layer model of the ocean. OS No. 53483. Author - C.M. Winger.

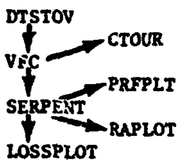
Data Systems Office
U.S. Naval Oceanographic Office
Washington, DC 20373

Available from originator only

Telephone (301) 763-1449

GRASS Underwater Acoustics Prediction System

Language - FORTRAN 63
Hardware - CDC 3800/Drum Scope 2.1 CalComp Plotter



DTSTOV	7,679 48 bit words
VFC	20,832 48 bit words
CTOUR	27,452 48 bit words
PRFPLT	11,622 48 bit words
SERPENT	36,784 48 bit words
RAPLOT	12,118 48 bit words
LOSSPLOT	19,543 48 bit words

DTSTOV converts salinity, temperature, and depth (STD) data to sound speed profiles, using Leroy's second equation (Eq. [7] in J. Acoust. Soc. Am. 46: 216-226, [1969]). Input: cards and data-identifying parameters. Output: Profile ranges, latitudes, longitudes, depths, temperatures, salinities, and sound speeds punched and/or printed. Pressures may be printed as an option.

VFC is used: To examine input bottom-topography and sound speed data for consistence and physical meaningfulness; to extend all input sound speed profiles to the ocean bottom; to perform earth curvature corrections; to determine derivatives of sound speed data. Two-dimensional sound speed field is modeled using a combination of cubic spline and linear interpolation schemes. Input: Bottom topography in the form of non-uniformly spaced range-depth pairs; sound speed profiles (possibly generated by DTSTOV); program control parameters and data identification numbers. Output: A magnetic tape (coefficient tape) containing corrected and extended sound speed profiles and their first and second derivatives and bottom topography; a printer listing and printer plots of input and output profiles.

CTOUR generates three-dimensional isometric and contour plots of the sound speed fields. The program interpolates value of sound speed at each point using a combination of cubic spline and linear interpolation schemes, then calls contouring and isometric plotting routines. Input: Magnetic (coefficient) tape generated by VFC; contour levels, control parameters, and grid specifications. Output: A CalComp contour and three-dimensional isometric plot of the sound speed field; a printer listing of contour levels and values of sound speed at grid intersections.

PRFPLT generates CalComp plots of sound speed profiles. The vertical gradients and curvatures corresponding to a profile are plotted on the same graph as its sound speeds. A cubic spline interpolation scheme is used. Input: Magnetic (coefficient) tape generated by VFC, program control and data identification numbers on cards. Output: CalComp plots showing input data points and effect of interpolation in depth.

SERPENT traces rays through a two-dimensional range and depth dependent sound speed field bounded by a flat surface and variable bottom topography; calculates random, coherent, and statistical intensities for multiple receivers at user-selected ranges and depths. An iterative ray tracing scheme is used based upon expansion of ray depth, range, and sine in terms of an increment of ray arc length. Iteration step size depends upon sound speed field in rays' vicinity. Input: Coefficient tape from VFC and cards containing source information, receiver information, surface information, output requests, parameters governing ray iteration, run identification information, and bottom loss data. Output: A magnetic tape containing ray statistics (optional), a magnetic tape containing transmission loss information (optional), a printer listing of ray information, transmission loss information, etc.

RAPLOT generates CalComp ray plots (ray depth vs. range from ray source). Input: The ray statistics plot generated by SERPENT, control parameters on cards which select the number of plots to be generated, the rays to be displayed on each plot, the plot size, scaling parameters, etc. Output: Labeled CalComp plots showing rays and bottom profile and a printer listing of input and control parameters.

LOSSPLOT generates CalComp plots of transmission loss vs. range. Calculated and experimental values of transmission loss may be displayed on the same plot. Input: Transmission loss tape generated by SERPENT; control parameters and graph titles on cards; experimental measurements or theoretical values of transmission loss on cards. Output: Labeled Calcomp plots of transmission loss vs. range. If requested, plots will display random, coherent, and statistical losses together with input experimental data or theoretical curves.

"GRASS: A Digital Computer Ray Tracing and Transmission Loss Prediction System, Vol. 1 - Over-all description," NRL Report 7 21, Dec. 1973;"...Vol. 2 - User's Manual," NRL Report 7642, Dec. 1973.

John J. Cornyn, Jr.	Available from originator only
Naval Research Laboratory	
Code 5493C	
Washington, DC 20375	Telephone (202) 767-3585

Sonar in Refractive Water — Language - FORTRAN IV; Hardware - UNIVAC 1108/30K words

Traces sound rays, computes reverberation, computes acquisition laminae (vertical plane), in a linear gradient or continuous gradient medium. Output: Tape to be used by program RAY SORT. NUC Technical Publication No. 164, "Digital Computer Programs for Analyzing Acoustic Search Performance in Refractive Waters," by Philip Marsh and A.B. Poynter, Dec. 1969, two volumes. NUC Programs 800000 and 800001. See also NEWFIT and Pattern Function Calculations which prepare input for this program.

Naval Undersea Center	Available from NTIS, Order No. AD 863 777 and
Pasadena Laboratory	AD 863 778, $6.00 each volume in paper,
3202 E. Foothill Blvd.	$2.25 each volume in microfiche.
Pasadena, CA 91107	

Sorts Sound Ray Data — Language - FORTRAN IV
RAY SORT — Hardware - UNIVAC 1108/31K (450 instructions)

Sorts certain sound ray data (from tape written by the "Sonar in Refractive Water" program) by depth, initial ray angle, and depth-intersection number. (See reference for above program)

Naval Undersea Center	Available from NTIS: See "Sonar in Refractive
Pasadena Laboratory	Water."
3202 E. Foothill Blvd.	
Pasadena, CA 91107	

Acoustic Ray Tracing — Language - FORTRAN II; Hardware - IBM 7090

Calculates underwater sound propagation. Program requires input which describes the source, the field, the surface, and the bottom. Output is a report on magnetic tape which gives ray path, slope, curvature, and length. Also given are reflection and extrema statistics, travel time, wave front curvature, and intensity. Technical Report No. 1470764.

Trident/ASW Library	Available from NTIS, Order No. AD 605 328,
Arthur D. Little, Inc.	$4.75 paper, $2.25 microfiche.
35 Acorn Park	
Cambridge, MA 02140	

Ray Tracing

Language - FORTRAN/Klerer-May USER language
Hardware -

A series of 19 programs for the calculation of the acoustical field in long-range (several hundred to several thousand miles), low-frequency underwater sound propagation in the deep ocean. Involves the calculation of ray trajectories, and intensity calculations that are based on the mapping of ray densities into the far-acoustical field. Input from NODC data tapes or from Fleet Numerical Weather Central cards. Technical Report 150, "The Hudson Laboratories Ray Tracing Program," by H. Davis, H. Fleming, W.A. Hardy, R. Miningham, and S. Rosenbaum, June 1968. "Reference Manual," by M. Klerer and J. May, Hudson Laboratories, Revised July 1965; manual reprinted in above report.

The Hudson Laboratories of Columbia University
145 Palisade Street
Dobbs Ferry, NY 10522

Available from NTIS: Order No. AD 678 759, $10.00 paper, $2.25 microfiche.

RAYTRACE

Language - FORTRAN IV
Hardware - XDS Sigma 7/CalComp plotter

RAYTRACE is a straightforward, easy-to-use acoustic ray tracing program which produces a plot and a listing. The user specifies a single-valued velocity profile, source depth, maximum range, a range increment at which points are computed and the length of the plot axes in inches. All axis scaling and labeling is done automatically. The discrete velocity profile supplied is smoothed by linear interpolation. Rays are constructed as arcs of circles between profile depths. At surface and bottom rays are reflected according to the equal angle law. Any number of rays with different initial angles measured from the horizontal may be plotted. In addition to the plot output, RAYTRACE produces the following printed output for each ray at integral multiples of the specified range increment: (1) range; (2) depth of ray at that range; (3) angle of the tangent to the ray at that range measured from the horizontal; (4) total travel time from the source to that range along the ray; (5) total distance from the source to that range along the ray path. Whenever a vertex occurs on a ray, the range is set to that of the vertex, an output point is computed, and incrementing of output range continues from that of the vertex. Originally written by C. Olmstead, the program has been modified by Bergstrom, Fink, M. Jones, and R.C. Spindel.

Woods Hole Oceanographic Institution
Woods Hole, MA 02543

Copy on file at NODC (listing, documentation)

NAVIGATION AND CHARTING

Plots Maps, Grids, Tracks
MAP

Language - FORTRAN IV
Hardware - IBM 360-65/CalComp, Houston Omnigraphic, or Gerber plotter/2 tape units

Generates a plot tape to draw a map according to the user's specifications of latitude and longitude, projection, kind of grid, and size of map. Projection options: Mercator, Miller, square, cylindrical stereographic, Lambert equal-area cylindrical, sinusoidal equal-area, flat-polar sinusoidal equal-area, Mollweide homolographic, and Lambert Conic Conformal. Grid lines and coastal lines are drawn at the user's option; if coastal lines are plotted, a land mass data tape is needed. There is an entry which returns (x, y) plotter coordinates for latitude and longitude of a point, enabling the user to plot station positions, ship's track, etc.

Ruth McMath
Department of Oceanography
Texas A&M University
College Station, TX 77843

Available from originator only

Telephone (713) 845-7432

Astronomic Position, Azimuth Method

Language - FORTRAN IV (H or G)
Hardware - IBM 360-65/38K bytes

Calculates the latitude and longitude of an astronomic observation station, given measured horizontal angles between stars and fixed mark along with observation times. A set of observation equations is solved by the method of least squares to obtain corrections to assumed values of latitude, longitude, and the azimuth of the reference mark, as well as probable errors for these three quantities. The adjustment is iterated five times or until the corrections become less than 0.005 seconds, either of which causes a program halt. Output: A table of input information and a record of the process of refinement for each set of station data read in. A previous version of this program was written in ALGOL for the Burroughs 220, in single precision. Author - Spencer Roedder.

Computer Center Division
U.S. Geological Survey
National Center
Reston, VA 22092

Copy on file at NODC (deck, documentation)

Telephone (703) 860-7106

Satellite Rise and Set Times
ALERT, ASORT

Language - FORTRAN IV
Hardware - IBM 1130/5836 words (ALERT), 12040 words (ASORT)

Calculates the rise and set times and time of closest approach of satellites. Output: Listing of ALERT information and punched cards for next program, ASORT sorts the output of rise times of satellites from program ALERT into chronological order. A listing is printed on the IBM 1132. FRB Manuscript Report No. 1071, by C.A. Collins, R.L.K. Tripe, and S.K. Wong, Dec. 1969.

Pacific Biological Station
Fisheries Research Board of Canada
P. O. Box 100
Nanaimo, B. C. V9R 5K6

Copy on file at NODC (listing, documentation)

Satellite Navigation

Language - FORTRAN/Assembler
Hardware - IBM 1800

A set of programs for various aspects of sattellite navigation. The programs fall naturally into two sections: those involved in the on-line reduction of data from the satellite, and those involved in the analysis, both on-line and off-line. NIO Report N. 20, Aug. 1969.

National Institute of Oceanography
Wormley, Godalming, Surrey, England

Copy on file at NODC (listing, documentation)

Loran/Decca Coordinates Calculation
HNAV

Language - FORTRAN IV
Hardware - IBM 1800

Given a Decca, Loran-A. or Loran-C fix, calculates the latitude and longitude. The method for a hyperbolic system with separate master is used for all cases. The constants for the hyperboloids are calculated in meters for both Loran and Decca, thus allowing a fix to be calculated if one Loran reading and one Decca reading are known. NIO Program No. 165. Uses SDANO and other subroutines. Author - M. Fasham.

National Institute of Oceanography
Wormley, Godalming, Surrey, England

Copy on file at NODC (listing, documentation)

Loran/Decca File Initialization
HNV1

Language - FORTRAN IV
Hardware - IBM 1800

Given input data on a master-slave pair, HNV1 calculates certain geodetic values and stores them on a tape file for later use by program HNAV. NIO Program No. 164. Author - M. Fasham.

National Institute of Oceanography
Wormley, Godalming, Surrey, England

Copy on file at NODC (listing, documentation)

Geodetic Distance and Azimuth
SDANO

Language - FORTRAN IV
Hardware - IBM 1800

Given the geographical coordinates of two points, this subroutine calculates the geodetic distance and azimuths between them. Based on the method of E.S. Sodano for a non-iterative solution of the inverse and direct geodetic problems. NIO Program No. 46. Author - M. Fasham.

National Institute of Oceanography
Wormley, Godalming, Surrey, England

Copy on file at NODC (listing, documentation)

General Map Projection

Language - MAD
Hardware - IBM 7090/CalComp 763 plotter

Conversion or generation of latitude and longitude values to map projection coordinates. Includes all commonly employed projections of sphere. Oblique cases may be automatically obtained. Author - W.R. Tobler.

Department of Geography
University of Michigan
Ann Arbor, MI 48104

Copy on file at NODC (listing, documentation)

Finite Map Projection Distortions

Language - MAD
Hardware - IBM 7090

Programs and subroutines to estimate the errors introduced by the substitution of map projection coordinates for spherical coordinates. Statistical computations of finite distortion are related to Tissot's indicatrix as a general contribution to the analysis of map projections. Technical Report No. 3, "Geographical Coordinate Computations, Part II," by W.R. Tobler, Dec. 1964.

Department of Geography
The University of Michigan
Ann Arbor, MI 48104

Copy on file at NODC (above report)

Plots Mercator Grid
CHART

Language - FORTRAN
Hardware - IBM 1800/16K words/Plotter

Produces Mercator grid on 30-inch drum or flatbed plotter, with various scale and tick mark options. Input: Card defining upper right coordinate of chart.

Michael Moore
Scripps Institution of Oceanography
P.O. Box 1529
La Jolla, CA 92037

Available from originator only

Telephone (714) 452-4194

Navigational Satellite Passes
ALRTX

Language - FORTRAN
Hardware - IBM 1800/16K words

Given satellite orbital parameters and station description cards, produces listing of satellite passes to occur for a given area and time.

Michael Moore
Scripps Institution of Oceanography
P.O. Box 1529
La Jolla, CA 92037

Available from originator only

Telephone (714) 452-4194

Loran or Omega Conversion
GEPOS

Language - FORTRAN IV
Hardware - HP 2100S/Keyboard/Paper tape reader

Converts Loran-C or Omega information from line-of-position reading to geographic coordinates or geographic coordinates to line-of-position, using method described in Naval Oceanographic Office Informal Report NO. N-3-64 by A.C. Campbell. Input: Line-of-position readings, time, date, initialization parameters; designed to process EPSCO 4010 data logger paper tapes. Output: Listings of converted geographic coordinates and magnetic tape with same data in a format compatible with plotting program TMERC.

Chris Polloni
Woods Hole Oceanographic Institution
Woods Hole, MA 02543

Available from originator only

Telephone (617) 548-1400

Cruise Track
TMERC

Language - FORTRAN IV
Hardware - HP 3100A/16K words/Keyboard/CalComp Plotter

Draws a Mercator chart and cruise track from navigation data. Data format is fixed, compatible with program GEPOS. Input: Geographic coordinates and time (normally GMT).

Chris Polloni
Woods Hole Oceanographic Institution
Woods Hole, MA 02543

Available from originator only

Telephone (617) 548-1400

Transformation of Spherical Coordinates
ROTCUT

Language - FORTRAN IV
Hardware - XDS Sigma 7/5,500 words

Performs various operations using transformation of spherical coordinates. Output: Rotation about a pole, transformation to the new coordinate system, weighted or unweighted mean pole computation using Fisher's distribution, rotation for closest approach and pole of best small-circle fit.

Christine Wooding	Available from originator only
Woods Hole Oceanographic Institution	
Woods Hole, MA 02543	Telephone (617) 548-1400

Sum of Finite Rotations on a Sphere — Language - FORTRAN IV
SUMROT — Hardware - XDS Sigma 7

Using coordinate transformation, calculates the sum of finite rotations on a sphere. Requires the latitude and longitude of the pole of rotation, and amount of rotation for each set. Output: Listing of the input rotations plus the resultant rotation and its tensor.

Christine Wooding	Available from originator only
Woods Hole Oceanographic Institution	
Woods Hole, MA 02543	Telephone (617) 548-1400

Loran Fix — Language - FORTRAN
LRFIX — Hardware - IBM 1800/16K words

Produces position fix from station position and reading pairs cards.

Michael Moore	Available from originator only
Scripps Institution of Oceanography	
P.O. Box 1529	
La Jolla, CA 92037	Telephone (714) 452-4194

Earth Spherical Subroutines — Language - FORTRAN
ESTCH, ESTC2, ESTPL — Hardware - IBM 1800

ESTCH converts earth spherical to plotter coordinates. Input: Decimal latitude and longitude. Output: Chart position for a call FPLOT (I, X, Y). ESTC2 converts earth spherical to plotter coordinates with inside check. Input and output: Same as ESTCH. ESTPL converts earth spherical to polar coordinates; not valid for over 200 miles, or over the poles. Input: Starting latitude and longitude, end latitude and longitude. Output: Distance (miles), angle (degrees) relative to true North (decimal units).

Michael Moore	Available from originator only
Scripps Institution of Oceanography	
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La Jolla, CA 92037	Telephone (714) 452-4194

Plan Course and Schedule — Language - FORTRAN
CRUIS and Subroutines — Hardware - IBM 1800/16K words

CRUIS is used to plan steaming and station time and fuel consumption. Subroutines: SAILB calculates the distance between two points by either great-circle sailing or Mercator sailing, whichever makes the most sense. SAILG calculates great-circle distance and courses: SAILM calculates rhumbline (Mercator) course and distance.

Michael Moore	Available from originator only
Scripps Institution of Oceanography	
P.O. Box 1529	
La Jolla, CA 92037	Telephone (714) 452-4194

Degree Conversions — Language - FORTRAN
DEGFR, DEMI — Hardware - IBM 1800

DEGFR converts integer degrees and real minutes to real degrees. DEMI converts decimal degrees to integer degrees and decimal minutes.

Michael Moore — Available from originator only
Scripps Institution of Oceanography
P.O. Box 1529
La Jolla, CA 92037 — Telephone (714) 452-4194

Mercator Degrees — Language - FORTRAN
DMRCT — Hardware - IBM 1800

From latitude in degrees, gives Mercator projected latitude in degrees. Expansion (continued fraction) ± 77 degrees.

Michael Moore — Available from originator only
Scripps Institution of Oceanograhy
P.O. Box 1529
La Jolla, CA 92037 — Telephone (714) 452-4194

Magnetic Field Components — Language - FORTRAN
MAGFI — Hardware - IBM 1800

Converts latitude (N+), Longitude (E+) to colatitude and east longitude. Input: Geoid latitude, longitude, date (years and decimals of a year). Output: Magnetic field (gammas), north component and east component of magnetic field, vertical component of magnetic field.

Michael Moore — Available from originator only
Scripps Institution of Oceanography
P.O. Box 1529
La Jolla, CA 92037 — Telephone (714) 452-4194

Annotated Track on Stereographic Projection — Language - FORTRAN
ANNOT — Hardware - CDC 3600/3800/CalComp Plotter

Plots an annotated track (bathymetry or magnetics data) along a track (navigation) on a stereographic projection.

James V. Massingill — Available from originator only
Environmental Sciences Section
Naval Research Laboratory
Washington, DC 20375 — Telephone (202) 767-2024

Annotates Chart — Language - HP FORTRAN IV under RTE
CORBT — Hardware - HP 2100S/15K words

Reads position and bathymetry information from a disk file and annotates the depth on a Mercator chart at the position given. This is a revision of the bathymetry processing section of program OCEANO written by the NRL Propagation Branch.

Robert A. O'Brien, Jr. — Available from originator only
Shipboard Computing Group, Code 8003
Naval Research Laboratory
Washington, DC 20375 — Telephone (202) 767-2387

Bathymetric or Magnetics Chart — Language - HP FORTRAN IV under RTE
PROFL — Hardware - HP 2100S/10K words

Plots bathymetric or magnetic data as a function of distance along track or distance on a Mercator chart. The data file (disk) is read, and the track length or chart distance is calculated. The dependent variable is then plotted against this value.

Robert A. O'Brien, Jr.
Shipboard Computing Group, Code 8003
Naval Research Laboratory
Washington, DC 20375

Available from originator only
Telephone (202) 767-2387

Mercator Chart Digitization — Language - HP FORTRAN under RTE
ANTRK — Hardware - HP 2100S/8K locations/Disk/ Summagraphic Digitizing Tablet

The operator digitizes the Mercator chart position, which the program converts to latitude and longitude; the annotated data value is then entered, and position and value are written on the disk. Input: Information to define chart and the output of a digitizing tablet.

Robert A. O'Brien, Jr.
Shipboard Computing Group, Code 8003
Naval Research Laboratory
Washington, DC 20375

Available from originator only
Telephone (202) 767-2387

Bathymetric Chart Digitization — Language - HP FORTRAN IV under RTE
DGBTH — Hardware - HP 2100S/7200 locations/Disk/ Summagraphics digitizing tablet

Produces a disk file containing the digitized bathymetry values as a function of time; also messages to the operator. The program has automatic procedures for redefining the origin when the chart is shifted and when the recording instrument changes phase. Input: Control information necessary to define a coordinate axis and values from a digitizing tablet.

Robert A. O'Brien, Jr.
Shipboard Computing Group, Code 8003
Naval Research Laboratory
Washington, DC 20375

Available from originator only
Telephone (202) 767-2387

Plots on Stereographic Chart — Language - HP FORTRAN IV under RTE
ANNØT — Hardware - HP 2100S

Reads a disk file containing bathymetry and position, then annotates the depth information on a stereographic projection chart at the position given. Modification of Woods Hole program.

Robert A. O'Brien, Jr.
Shipboard Computing Group, Code 8003
Naval Research Laboratory
Washington, DC 20375

Available from originator only
Telephone (202) 767-2387

Plots Navigation Data — Language - HP FORTRAN IV under RTE
OCEAN — Hardware - HP 2100S/15K background words

Reads disk file containing navigation data and plots positions on Mercator chart. This is a revision of the navigation processing in program OCEANO written by the NRL Propagation Branch.

Robert A. O'Brien, Jr.
Shipboard Computing Group, Code 8003
Naval Research Laboratory
Washington, DC 20375

Available from originator only

Telephone (202) 767-2387

Long Base Line Acoustic Tracking

Language - HP FORTRAN IV under RTE
Hardware - HP 2100S

Real-time local navigation using a bottom distributed acoustic transponder system. Will navigate the ship and a towed body. Input: Real-time data from the transponders giving ranges, depth of towed body; also requires a sound speed profile and location of the transponders. Output: Position of ship and/or towed body; information is logged on magnetic tape.

J. Dean Clamons
Shipboard Computing Group, Code 8003
Naval Research Laboratory
Washington, DC 20375

Available from originator only

Telephone (202) 767-2024

FAA Plot

Language - FORTRAN
Hardware - UNIVAC 1108/Concord Digital Plotter

Accepts three card images and a supplied set of FAA data cards as input. The output is a magnetic tape to drive the E-51, E-103, E-108 Concord Digital Plotters, using the echelon mode. The end product is a film positive with a plus symbol for the position of the FAA plots. The Mercator, transverse Mercator, and Lambert conic conformal projection with two standard parallels are the three projections which can be used to plot program outputs. O.S. No. 65652. Authors - Ronald M. Bolton and J. Parrinello.

Automated Cartography Office,
Code NA
Defense Mapping Agency
Hydrographic Center
Washington, DC 20390

Available from originator only

Distance and Azimuth
CIRAZD

Language - FORTRAN
Hardware - UNIVAC 1108

Finds the distance and azimuth between two points on the earth's surface when the earth is assumed to be a sphere. If either pole is used for the center point, the angle given is with respect to grid north. By use of trigonometric identities and absolute value functions, this program avoids many of the computational problems usually found in distance computations. O.S. No. 55690. Author - Barry Turrett.

Automated Cartography Office,
Code NA
Defense Mapping Agency
Hydrographic Center
Washington, DC 20390

Available from originator only

Parametric Map

Language - FORTRAN II
Hardware - UNIVAC 1108

Generates any hyperbolic navigation system by using parametric equations. Generates plotting coordinates for loran-A, loran-C, Omega, and Decca charts. Will process all lattice lines that fall within a specified geographic area. Can be displayed on any of the following map projections: Mercator, transverse Mercator, Lambert conformal conic, oblique Mercator, polyconic. O.S. No. 53012. Authors - R.A. Bolton, R.M. Bolton.

Automated Cartography Office, Code NA
Defense Mapping Agency
Hydrographic Center
Washington, DC 20390

Available from originator only

Loran to Geographic and Geographic to Loran Conversion

Language - FORTRAN V
Hardware - UNIVAC 1108/15K words

Computes a geographic fix, given two loran readings, or computes the time difference reading at a given point for any two specified loran pairs. Uses Sodano inverse method. Informal Manuscript Report IMR No. N-3-64.

Kay Fox
Navigational Science Division
Defense Mapping Agency
Hydrographic Center
Washington, DC 20390

Available from originator only
Telephone (301) 763-1184

Loran Coordinate Computation

Language - FORTRAN V
Hardware - UNIVAC 1108/34K words

Computes charting coordinates along lines of latitude or longitude for loran hyperbolas at specified intervals. Uses Lambert's method of computing the geodesic and involves convergence by iteration. Informal Manuscript Report IMR No. N-1-64.

Kay Fox
Navigational Science Division
Defense Mapping Agency
Hydrographic Center
Washington, DC 20390

Available from originator only
Telephone (301) 763-1184

Loran Skywave Correction

Language - FORTRAN
Hardware - /15K words

Computes the loran-A or loran-C skywave corrections over a specified area. Uses Sodano inverse method. Input: Station positions, spheroid parameters, propagation velocity, area of coverage. Output: For Loran A, the nighttime skywave corrections from master, from slave, and from both; for Loran C, the daytime corrections as well.

Kay Fox
Navigational Science Division
Defense Mapping Agency
Hydrographic Center
Washington, DC 20390

Available from originator only
Telephone (301) 763-1184

Individual Point Generator for Map Projections

Language - FORTRAN II
Hardware - IBM 7074

Converts geographic positions to discrete points in rectangular coordinates on the following projections: Mercator, transverse Mercator, gnomonic, polar stereographic, azimuthal equidistant, Lambert conformal conic (with one or two standard parallels), Lambert azimuthal equal area polar, Lambert equal area cylindrical, Miller, Albers equal-area conic, rectified skew orthomorphic, and oblique Mercator. Cartographic data may be produced in either graphic or tabular form. OS No. 55646 main program (each of the 13 projection subroutines has its own open shop number). Authors - Ronald Bolton, Louis Rowen, Gregory Vega. Informal report IR No. 69-23.

"Computer Programs and Subroutines for Automated Cartography" by J. Parrinello, March 1969.

Data Systems Office U.S. Naval Oceanographic Office Washington, DC 20373	Available from originator only Telephone (301) 763-1449

Individual Point Generator for Distance and Azimuth Computations	Language - FORTRAN II Hardware - IBM 7074

Uses the geodetic latitude and longitude of two points to compute the distance and azimuth from one point to the other. Results will be in tabular form with the distance in meters and the azimuth and back azimuth in degrees, minutes, and seconds. OS No. 65616. Author - R.M. Bolton.

Data Systems Office U.S. Naval Oceanographic Office Washington, DC 20373	Available from originator only Telephone (301) 763-1449

Geodetic Datum Conversion	Language - FORTRAN Hardware - IBM 7074

Transforms geodetic coordinates from one datum to another by utilizing a given shift (in terms of rectangular space coordinates) between the origins of two datums and applying this shift, together with differences in the spheroidal parameters, in formulas derived for this purpose. OS No. 55305. Author - Robert M. Willems.

Data Systems Office U.S. Naval Oceanographic Office Washington, DC 20373	Available from originator only Telephone (301) 763-1449

Geodetic Datum Reduction	Language - FORTRAN Hardware - IBM 7074

Reduces geodetic positions from one geodetic datum to another by use of the Vening Meinesz equations. The preferred datums involved are European datum, North American datum, and Tokyo datum. OS No. 55301. Author - D.J. Findlay.

Data Systems Office U.S. Naval Oceanographic Office Washington, DC 20373	Available from originator only Telephone (301) 763-1449

Geodetic Position Computation and Plot	Language - FORTRAN Hardware - IBM 7074

Computes geodetic positions at desired intervals along incremental or miscellaneous azimuths. Option to plot or list. Plot uses the LAMB subroutine with two standard parallels. OS No. 55321. Author - Merle L. Nelson. An informal report IR No. 69-35 lists this and additional programs and describes procedures for production of secondary phase correction charts and tables. These supplementary programs, written by Edwin Stephenson and Barbara Gray, are in 7074 Autocoder or FORTRAN.

Data Systems Office U.S. Naval Oceanographic Office Washington, DC 20373	Copy on file at NODC (Above report; includes listing) Telephone (301) 763-1449

Astronomic Latitude	Language - FORTRAN Hardware -

Programs for determination of first-order astronomic latitude by the Sterneck method and also by the method of "Polaris and South Star"; subroutines for the Baldini, the Garfinkel, and the U.S. Coast and Geodetic Survey (now National Ocean Survey) refraction models. Informal report IR No. 68-21, "Investigations in Determining Astronomic Latitudes and The Computer Programs," by Larry Borquin, April 1968.

Data Systems Office U.S. Naval Oceanographic Office Washington, DC 20373	Copy on file at NODC (Above report, includes listing) Telephone (301) 763-1449

Sounding Plot — Language - FORTRAN; Hardware - CDC 3100/IBM 7074/CalComp plotter

Accepts lorac, loran, or Raydist lane values, plots ship's track and soundings in UTM mode. OS No. 58419. Author - G.R. Bills.

Data Systems Office U.S. Naval Oceanographic Office Washington, DC 20373	Available from originator only Telephone (301) 763-1449

Single Integration — Language - FORTRAN; Hardware - IBM 7074

Equally spaced time series data are integrated once using Tick's method. The data must be sampled at a rate of at least twice the Nyquist frequency. Informal report IM No. 66-36. OS No. 66-36. Author - E.B. Ross.

Data Systems Office U.S. Naval Oceanographic Office Washington, DC 20373	Available from originator only Telephone (301) 763-1449

Sodano Inverse — Language - FORTRAN; Hardware - CDC 3100

Computes the normal section length and the forward and reverse azimuths of the geodesic between two points for which the geographic coordinates are known. This computation is useful in determining azimuth and distance between triangulation stations for which geographic positions have been determined but which are not connected by direct observation. OS No. 4326. Authors - Andrew Campbell; modified by C.E. Pierce.

Data Systems Office U.S. Naval Oceanographic Office Washington, DC 20373	Copy on file at NODC (Deck, documentation) Telephone (301) 763-1449

Adjusts a State Plane Coordinate Traverse — Language - FORTRAN IV; Hardware - IBM 360-30/IBM 2311 disk/65K bytes

Computes a plane-coordinate traverse adjustment using condition equations and the method of least squares. The normal equations are solved using the Cholesky method. The program will adjust a network with as many as 250 stations, 600 observed directions, 250 measured distances, and 99 condition equations. It is limited to either a Lamber or traverse Mercator projection. Corrections are supplied for the reduction of observed data to grid data and options are available for various types of azimuth and position control. Documentation, "A Computer Program to Adjust a State Plane Coordinate Traverse by the Method of Least Squares" by Jeanne H. Holdahl and Dorothy E. Dubester, Sept. 1972.

Joseph F. Dracup
National Geodetic Survey, NOAA/NOS
6001 Executive Boulevard
Rockville, MD 20852

Telephone (301) 496-8650

Copy on file at NODC (Above report; includes listing)

Geodesy, Marine Surveying and Mapping, Nautical and Aeronautical Charting
NOS SCIENTIFIC SUBROUTINE SYSTEM

Language - FORTRAN IV
Hardware - IBM 360-65

The purpose of this system is to make accessible the tools to accelerate and simplify solutions to various scientific problems encountered in the National Ocean Survey disciplines. The user may use the system in the development of his subroutine library. Several aspects were considered in the design and organization of the subroutines so that this purpose could be accomplished. The subroutines were designed so the user need be concerned only with the input and output parameters, not with the internal design of the subroutine. The reference to any subroutine by the problem program is straightforward, thus minimizing user effort. The subroutines are purely computational in function and do not contain any reference to input or output operation. The problem program must be designed so that it contains whatever input/output operations are needed for the solution of the problem. Some routines are in double precision mode to optimize accuracy of the computations; the problem program must be designed to meet this requirement. Although the subroutines are FORTRAN IV programs, there is no restriction on the symbolic programing language which may be used in the problem. The subroutines are uniformly documented and are accompanied by comment statements in sufficient detail to permit the user to gain familiarity with the techniques and method of use of the routine. Following are descriptions of individual subroutines:

ANGLE converts an angle expressed in seconds of arc to degrees minutes, and seconds of arc. The angle, which may be positive or negative, is partitioned into its divisions by successive approximations for each of the divisions. A table is then searched for adjusting the decimal seconds to the desired precision to be used in the user's callable routine. (894 bytes)

ANLIS computes the long distance or geodetic distance and azimuths between two stations whose geodetic positions are known. Evaluation is based on equations of the Andoyer-Lambert method for solving the inverse position problem. This method is valid for distances up to 6,000 miles. (5,612 bytes)

APCTN computes the state plane coordinates from geographic positions and the inverse for stations in zones 2 to 9 of the Alaska plane coordinate system. (6,524 bytes)

APCWN computes the state plane coordinates from geographic positions and the inverse for stations in zone 1 of the Alaska plane coordinate system. (4,388 bytes)

APOLY computes the American polyconic grid coordinates of a station from geographic positions and the inverse. (4,320 bytes)

CGSPC computes the geodetic position (latitude, longitude) and azimuth of an observed station from a station of known geodetic position, with azimuth and distance to the observed station given. Evaluation is based on equations for the forward position computation and is valid for distances up to 600 miles. (2,606 bytes)

CUBIC approximates a third-order curve by interpolating coordinates between given points. The evaluation is based on a method which expresses a cubic curve by using two parametric equations and then choosing values for the parameters in the two equations. (1,926 bytes)

EXCES computes the spherical excess of a spherical triangle as determined from two angles and a side opposite one of them. The method is valid for triangles whose sides are less than 100 miles in length. (884 bytes)

GMLIC computes the geodetic distance and azimuths between two stations whose geodetic positions are known. Evaluation is based on equations of the Gauss midlatitude method for solving the inverse position problem. This method is valid for distances up to 600 miles. (2,452 bytes)

HIFIX computes the hyperbolic coordinates of a ship expressed in HIFIX phase differences from geographic positions, and the inverse. Evaluation is based on Campbell's equations to determine the geographic position of ship from HIFIX phase differences. (5,662 bytes)

LORAN computes the hyperbolic coordinates of ship expressed in loran time differences from geographic positions, and the inverse. The program is applicable to loran-A, loran-C, or a mixture of the two systems. Two configurations of fixed stations may be used. In the triad configuration, two pairs of fixed stations are used, each pair having one station, the master station, in common, and a slave station. In the tetrad configuration, two pairs of fixed stations are used, each pair having a separate master station and a slave station. Evaluation is based on Campbell's equations. (6,444 bytes)

OMEGA computes the hyperbolic coordinates of a ship expressed in Omega lane values from geographic positions, and the inverse. Evaluation is based on a modification of Campbell's equations. (5,708 bytes)

SODIN computes the geodetic distance and azimuths between two stations whose geodetic positions are known, using the Sodano method for solving the inverse position problem. This method is valid for distances up to 6,000 miles. (4,622 bytes)

SODPN computes the geodetic position (latitude, longitude) and azimuth of an observed station from a station of known geodetic position, with azimuth and distance to the observed station given. Evaluation is based on equations of the Sodano method for solving the direct position problem. This problem is valid for distances up to 6,000 miles. (4,986 miles)

TPFIX computes the geographic position, forward azimuth, back azimuth, and distance of an observing station using angles observed at that station to three fixed stations whose geographic positions are known. The computations include the effect of spherical excess. Evaluation is based on the method of resection to determine the position of an unknown station. (3,178 bytes)

UTMCO computes the universal transverse Mercator (UTM) grid coordinates of a station from geographic positions, and the inverse. This routine is designed to work for UTM zones 1 to 60, zone width 6 degrees, in both the Northern and Southern Hemispheres, within the latitude band of 80 degrees and 30 minutes north to 80 degrees and 30 minutes south, and 5 degrees and 45 minutes plus or minus from the central meridian of the major UTM zone. (7,930 bytes)

Milton Stein
ADP Programing Branch
National Ocean Survey, NOAA
6001 Executive Boulevard
Rockville, MD 20852

Copy on file at NODC (User's Guide; includes listing)

Telephone (301) 496-8026

Computes Geographic Positions

Language - SPS
Hardware - IBM 1620

Computes geographic positions, given starting position, azimuth, and length on any one of six spheroids. Three types of computations can be obtained: single positions, a loop, or a traverse. Control is by job card. Length input may be in meters, feet, statute or nautical miles, or electronic lanes. USGS Program No. 15.

ADP Programing Branch
National Ocean Survey, NOAA
6001 Executive Boulevard
Rockville, MD 20852

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LORAN C (Version 2)

Language - SPS
Hardware - IBM 1620/100K*

Computes tables giving the points of intersection of LORAN C hyperbolas with meridians and/or parallels of the earth spheroid. Microsecond values are computed at intervals varying from 1 1/4 minutes to 20 minutes for any or all of four possible pairs of stations. Program can also be used to compute microsecond values at grid intersections. *Can be modified for use on IBM 1620 of 60K capacity.

ADP Programing Branch
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6001 Executive Boulevard
Rockville, MD 20852

Copy on file at NODC (listing, documentation)

Compute Great-Circle Path
GCIRC

Language - FORTRAN IV-G
Hardware - IBM 360-65/1200 bytes

Computes distance (nautical miles) and initial course (degrees) of a great-circle path between two locations. Requires subroutines COS, SIN, ARCOS. Author - Ralph Johnson.

Oceanographic Services Branch
National Oceanographic Data Center
NOAA/EDS
Washington, DC 20235

Copy on file at NODC

Telephone (202) 634-7439

Map Projections and Grids
MAP

Language - FORTRAN IV
Hardware - IBM 360-40/CalComp 763 plotter

Provides a wide variety of map projections and grids to facilitate the display of geographical data. The subroutine has been written in as modular a form as possible to allow for ease of insertion or deletion of routines. Provides the following projections: Mercator, Miller, square, cylindrical stereographic, Lambert equal-area cylindrical, flat-polar equal-area sinusoidal, equal-area sinusoidal, Mollweide homolographic, polar stereographic, Lambert equal-area polar, Colligan's equal-area projection of the sphere, azimuthal equidistant, transversed sinusoidal, transversed Mollweide. Author - John O. Ward.

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National Oceanographic Data Center
NOAA/EDS
Washington, DC 20235

Copy on file at NODC (tape, including land mass data file, and documentation)

Telephone (202) 634-7439

GRAPHIC DISPLAY

Vertical Bar Graphs

Language - MASTER FORTRAN
Hardware - CDC 3300/34 17K words/CalComp Plotter

Reads and edits bar graph parameters and data; calls the CalComp software which generates a plot tape. The CalComp Plotter draws the graphs as vertical bars for any set of data which has less than 101 items. The program uses numeric data and bar graph descriptive data as input. Major parameter categories are X access, Y access, titles, groups, and bar labels. File output is produced on CalComp continuous line plotter which draws individual bars; bars may have labels and may be shaded; there are four different types of shading.

James C. Cheap
Department of Water Resources
Computer Systems Division
1416 Ninth Street
Sacramento, CA 95814

Available from originator only

X-Y Plots
MUDPAK

Language - FORTRAN
Hardware - CDC 3600/24K words/CalComp Plotter

Generates plots of several dependent (y) variables vs. a common independent (x) variable. Numerous user options control type of plot, titling, etc. Exhaustively plots all data from files, one plot per data set (data sets defined by change in key field value). Input: From 1 to 10 card or tape files, comprising 15 dependent variables, file definition cards, plot axis cards, title cards. Output: 11-inch or 30-inch CalComp plots (uses standard CCPLOT routine) and diagnostic listing.

Peter B. Woodbury
Deep Sea Drilling Project
Box 1529
La Jolla, CA 92037

Available from originator only

Telephone (714) 452-3526

Plotting Program
PROFL

Language - FORTRAN IV
Computer - CDC 3600

Plots data values against depth or other parameters.

David Wirth
Oceanic Research Division
Scripps Institution of Oceanography
P.O. Box 109
La Jolla, CA 92037

Available from originator only

Dendrograph

Language - FORTRAN, ASSEMBLER
Hardware - IBM 360 or 370/45K for 360/CalComp Plotter and/or 132 character line printer

Draws a two-dimensional diagram depicting the mutual relationships among a group of objects whose pairwise similarities are given. Input: A distance or correlation type matrix. Output: Printer and/or CalComp plot of the dendrograph. This program is a modification of a program by McCammon and Wenninger in Computer Contribution 48, Kansas Geological Survey. The changes are dynamic storage allocation and printer plots. The size of the input matrix is limited by the amount of core available; core is dynamically allocated at execution time.

Dennis T. O. Kam | Available from originator only
Hawaii Institute of Geophysics
University of Hawaii at Manoa
2525 Correa Road
Honolulu, HI 96822 | Telephone (808) 948-8952

Beach and Nearshore Maps | Language - FORTRAN IV
Hardware - IBM 1130/8K words

Topographic maps of the beach and nearshore area are computed and plotted based on nine profiles from a baseline across the beach. Profiles are spaced at 100-foot intervals along the beach with survey points at five-foot intervals along each profile. Linear interpolation is made parallel to the baseline between adjacent profiles. Numbers and symbols are printed to form the maps. Profiles for a series of days are used to print maps of erosion and deposition by subtracting elevations for each day from the elevations for the previous day. ONR Tech. Report No. 4, "Beach and Nearshore Dynamics in Eastern Lake Michigan," by Davis and Fox, 1971.

William T. Fox | Available from originator only
Williams College
Department of Geology
Williamstown, MA 01267 | Telephone (413) 597-221

X-Y Plots in a Flexible Format | Language - FORTRAN
MEDSPLOT | Hardware - CDC CYBER 74/60K octal words/ CalComp or Zeta Plotter

General purpose program to produce x-y coordinate plots in a flexible format. Point and line plots are available in either a time-sharing (interactive) or batch mode. The prime objective of the program is to permit very *flexible control* over the plot size and labeling at run time through the use of control cards. Input: (1) Control cards with plot description, (2) any formatted BCD file with fixed length records containing one pair of x-y coordinates, on tape or disk. Output: x-y coordinate plot and summary listing. The x-y coordinates are transferred directly from data. User-controlled range checks and multiple plots can be obtained, based on the sort sequence of a control field in each data record. This field will be in addition to the data fields to be plotted. Can use either an off-line CalComp Plotter or an on-line Zeta Plotter connected with a telephone line.

D. Branch | Available from originator only
Marine Environmental Data Service
580 Booth Street
Ottawa, Ont. K1A 0H3 | Telephone (613) 995-2011

Plots Hydro Cast Data | Language - FORTRAN IV
PLOG | Hardware - IBM 1130/IBM 1627 plotter

Plots the results of hydrographic casts in a format suitable for publication. Produces 8 1/2- by 10-inch plots of log (10) depth vs. temperature, salinity, and oxygen.

Pacific Biological Station | Copy on file at NODC (documented listing)
Fisheries Research Board of Canada
P. O. Box 100
Nanaimo, B. C. V9R 5K6

Plots STD Data | Language - FORTRAN IV
STP01 | Hardware - IBM 1130/IBM 1627 plotter

Plots digitized STD data in a format suitable for publication The plotter draws and labels axes and plots temperature and salinity vs. depth.

Pacific Biological Station
Fisheries Research Board of Canada
P. O. Box 100
Nanaimo, B. C. V9R 5K6

Copy on file at NODC (documented listing)

Plots Temperature-Salinity
PSAL1

Language - FORTRAN
Hardware - IBM 1130

Plots T-S and expanded T-S curves. Another program, PSAL3, plots oxygen, salinity, and temperature-oxygen curves. FRB Manuscript Report No. 1071, by C.A. Collins, R.L. Tripe, and S.K. Wong, Dec. 1969.

Pacific Biological Station
Fisheries Research Board of Canada
P. O. Box 100
Nanaimo, B. C. V9R 5K6

Copy on file at NODC (PSAL1 only, documented listing)

Section Plotting

Language - FORTRAN
Hardware - CDC 3100/PDP-8/CalComp Plotter

The program uses the CDC 3100 plotting subroutines to generate data for the PDP-8 plotting program. The user may specify a legend (up to 480 characters), label sizes, scale factors, the parameter to be plotted, and the isopleths to be determined. The plotting is done on a CalComp 31-inch plotter under control of the PDP-8. Cruise data is read from magnetic tape by the CDC 3100 in modified CODC (MEDS) format or Bedford Institute format. An iterative method is used in conjunction with an interpolation function to determine isopleth depths. The interpolation function is described in a Bedford Institute report, BIO 66-3 (unpublished manuscript) by R.F. Reiniger and C.K. Ross, Feb. 1966.

Director
Bedford Institute of Oceanography
P. O. Box 1006
Dartmouth, N. S. B2Y 4A2

Available from originator only

Horizontal Histograms
HISTO

Language - FORTRAN IV-H
Hardware - XDS Sigma 7

Produces horizontal bar histograms on a line printer for any variable on magnetic tape in a standard WHOI format. Format described in a technical report, Ref. No. 69-55, "A Nine Channel Digital Magnetic Tape for Storing Oceanographic Data," by John A. Maltais, July 1969.

Richard E. Payne
Woods Hole Oceanographic Institution
Woods Hole, MA 02543

Available from originator only
Telephone (617) 548-1400

Printer Plots
LISPLO

Language - FORTRAN IV-H
Hardware - XDS Sigma 7

Lists and plots the data stored on WHOI format magnetic tape. See HISTO format reference. Output is on the line printer. Three types of plot are possible: (1) Variable vs. time or sequence number, (2) angle and speed vs. time, and (3) two variables (one on a minus and one on a plus scale) vs. time.

Richard E. Payne
Woods Hole Oceanographic Institution
Woods Hole, MA 02543

Available from originator only
Telephone (617) 548-1400

Plot of Frequency Distribution — Language - FORTRAN IV-H
THISTO — Hardware - XDS Sigma 7

Produces a two-dimensional frequency distribution of samples averaged over chosen interval against time. Input: Control cards and data on 9-track tape. Output: A line printer plot of averaged compass, vane, direction, and speed against time.

Richard E. Payne
Woods Hole Oceanographic Institution
Woods Hole, MA 02543
Available from originator only
Telephone (617) 548-1500

Velocity Vector Averages — Language - FORTRAN IV-H
VECTAV — Hardware - XDS Sigma 7

Produces a 9-track tape in WHOI format of east and north velocity vector averages and their corresponding polar representations. (See HISTO format reference.)

Richard E. Payne
Woods Hole Oceanographic Institution
Woods Hole, MA 02543
Available from originator only
Telephone (617) 548-1400

Progressive Vectors — Language - FORTRAN IV-H
PROVEC — Hardware - XDS Sigma 7/PDP-5 driven CalComp Plotter optional

Computes progressive vectors from direction and speed values. Input: Control cards and tape in WHOI format. See HISTO format reference. Output: Listing of progressive vectors and/or a tape to be used with a PDP-5 driven CalComp for a plot of the vectors.

Richard E. Payne
Woods Hole Oceanographic Institution
Woods Hole, MA 02543
Available from originator only
Telephone (617) 548-1400

Plots Data Along Track — Language - FORTRAN IV
TRACK — Hardware - XDS Sigma 7/2986 32 bit words*/ CalComp or Versatec plotter

Plots data in profile along a ship's track. Map is in Mercator projection. The ship's heading is used to determine the orientation of the data. Standard CalComp software is used. Input data can be in any WHOI format or in a user specified format and can be from any device, but typically from a nine-track magnetic tape; also input are run-time parameters to specify scales and other options. *Another version of the program exists for the Hewlett-Packard minicomputer and works in a 16K word environment.

Robert C. Groman
Woods Hole Oceanographic Institution
Woods Hole, MA 02543
Available from originator only
Telephone (617) 548-1400, ext. 469

Profile versus Time or Distance — Language - FORTRAN IV
PROFILE — Hardware - XDS Sigma 7/4010 32 bit words*/ CalComp or Versatec plotter

Plots in profile versus time or cumulative distance, all WHOI standard formats or a user-supplied format. Uses standard CalComp software. Input: Data from any device and run-time parameters to specify scales and other options. Output: Plot tape for offline use and printed information about the run. *Another version of this program exists for the Hewlett-Packard minicomputer and works in a 16K word environment.

Robert C. Groman | Available from originator only
Woods Hole Oceanographic Institution
Woods Hole, MA 02543 | Telephone (617) 548-1400, ext. 469

Plots Navigation with Any Other Data Type | Language - FORTRAN IV
DEEP6 | Hardware - Hewlett-Packard minicomputer/ 16K 16 bit words/CalComp plotter

Merges and plots x-y navigation with another data type. For each data point a linearly interpolated position is calculated. Plots can be annotated x-y charts, data profiles along the ship's track, or profiles vs. time or distance. Input: x-y navigation data in meters or fathoms; a time series of data to be merged with the navigation; and input parameters specifying scales and options.

Robert C. Groman | Available from originator only
Woods Hole Oceanographic Institution
Woods Hole, MA 02543 | Telephone (617) 548-1400, ext. 469

Line Printer Plots | Language - FORTRAN, COMPASS
GRAPH2 | Hardware - CDC 3800/4112 octal (2122 decimal) locations*

This subroutine is intended to be valuable for scientists who want a fast and economical method of producing plots of their data but do not require the high resolution (100 points per inch) of the CalComp plotter. Modified by Dianna L. Denton from a program written at the University of Wisconsin. NRL Memorandum report 2046 (NRL Computer Bulletin 12), Aug. 1969. (*excluding the common block (11031 octal - 4633 decimal) and system library routines).

Research Computation Center | Copy on file at NODC (tape, above report)
Naval Research Laboratory
Washington, DC 20375

Magnetic Signatures | Language - FORTRAN
MAGPLOT | Hardware - CDC 3600/CDC 3800/706,768 words/On-line plotter

Separates and characterizes the various components of magnetic noise in magnetometer records taken from a sensor towed at sea. Gives a printout of histogram data for each of three wavelength filters: N(amplitude) vs. amplitude; N (wavelength) vs. wavelength. Also produces plots of filtered magnetic fields as function of distance. Program is briefly described in NRL Formal Report No. 7760, "Geological and Geomagnetic Background Noise in Two Areas of the North Atlantic."

Perry B. Alers | Available from originator only
Naval Research Laboratory
Washington, DC 20375 | Telephone (202) 767-2530

Sequential Plotting | Language - FORTRAN
Hardware - IBM 360-65

Subroutines produce plots using a digital computer output printer. The consecutive x, y data points are plotted with symbols consisting of letters and numerals. Permits rapid plotting of either a single- or a multivalued curve when high resolution is not required. NELC Report 1613 by R.G. Rock, March 1969.

Naval Electronics Laboratory Center | Copy on file at NODC (documented listing)
San Diego, CA 92152

Machine Plotting on Mercator Projection | Language - FORTRAN 63
Hardware - CDC 1604/CalComp 165 plotter

Utilizes meridional parts to locate data points on Mercator-projection maps, using a shared-time plotting routine. The continent outlines can also be plotted by straight-line segments. NUWC Report TP-89 by L.A. Smothers, Dec. 1966. Final version of program written by K.K. Starr.

Ocean Sciences Department
Naval Undersea Research and Development Center
San Diego, CA 92132

Copy on file at NODC (above report)

Overlay Plotting
OVLPLT

Language - FORTRAN
Hardware - UNIVAC 1108/12K plotter compatible with Integrated Graphics System

Performs overlay plots on the FR-80 graphic system using the Integrated Graphics System. No knowledge of IGS required by user. Fitting of data into bounds of "good looking" graph.

Peter D. Herstein
Naval Underwater Systems Center
New London, CT 06320

Available from originator only

Telephone (203) 442-0771, ext. 2305

Physical Data Plot
FRAME

Language - FORTRAN
Hardware - CDC 3300

Using arrays of profile data and specification parameters, this subroutine prepares a tape for the UCC plotter to provide a profile plot of depth vs. temperature, conductivity, salinity, sigma-t, and sound speed.

K. Crocker
Naval Underwater Systems Center
Newport, RI 02840

Available from originator only

Telephone (401) 841-3307

Reformats Data, Plots Track Chart
MASTRACK

Language - FORTRAN V
Hardware - UNIVAC 1108/Instructions 5K words/ Data 5K words/2K Plotter buffer/ 3 tape units/CalComp Plotter

Decodes blocked BCD data tapes in NGSDC format into UNIVAC SDF format and plots user-scaled Mercator track charts annotated with any and all underway parameters. Author - Peter J. Topoly.

Data Systems Office
U.S. Naval Oceanographic Office
Washington, DC 20373

Available from originator only

Telephone (202) 763-1449

Produce Contour Charts
GRIDIT, REGRIDIT, AUTOMATED CONTOUR

Language - FORTRAN
Hardware -

Three programs which enable the user to graphically produce a contour chart by the computer-plotter method. GRIDIT produces a digitized matrix from data points which have been screened for gross errors. REGRIDIT produces a digitized matrix from raw unchecked data points. AUTOMATED CONTOUR constructs a contour chart from a digitized matrix. An example is given for use of the program in contouring the bathymetry of the ocean bottom. Informal manuscript report IM No. 67-4, "An Automated Procedure for Producing Contour Charts," by Roger T. Osborn, Feb. 1967.

Data Systems Office
U.S. Naval Oceanographic Office
Washington, DC 20373

Copy on file at NODC (Above report; includes listing)
Telephone (301) 763-1449

Profile Plots, Time Axis
PROFL3

Language - FORTRAN IV
Hardware - IBM 360-67/110K bytes for 1500 values per profile/Plotter

Makes profile plots of up to three values along a time axis. Uses Benson-Lehrner plotter or easy conversion to CalComp. Input: Cards with specifications for profiles (scales, values, titles, symbols, etc.) and formats, and data cards with Julian day, hour, minute, and one to three values.

Graig McHendrie
Office of Marine Geology
U.S. Geological Survey
345 Middlefield Road
Menlo Park, CA 94025

Available from originator only
Telephone (415) 323-8111, ext. 2174

Profile Plots, Distance Axis
PFLDST

Language - FORTRAN IV
Hardware - IBM 360-67/130K bytes for 1500 values per profile/plotter

Produces profile plots of up to three values along a cumulative distance axis. Uses Benson-Lehrner plotter or easy conversion to CalComp. Input: Cards with specifications for each profile (scale, values, symbols, title, etc.) and formats, and data cards with Julian day, hour, minute, latitude, longitude, and one to three values.

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Office of Marine Geology
U.S. Geological Survey
345 Middlefield Road
Menlo Park, CA 94025

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Telephone (415) 323-8111, ext. 2174

Map Plots
MAPPLT

Language - FORTRAN IV
Hardware - IBM 360-67/244K bytes for 7500 nav. or 6000 data points/Plotter

Makes map plots of either data values or navigation data on a Mercator, transverse Mercator, conic, or Lambert conformal projection. Maximum map size is 28 x 61 inches. Assumes equatorial radius of earth is 251,117,000 inches and that west longitude and south latitude are input as negative values. Uses Benson-Lehrner plotter or easy conversion to CalComp. Input: Eleven cards with title, formats, and map window specifications followed by data on either cards or tape. Navigation data: Julian day, hour, minute, latitude, longitude. Data values: minute (or sequence no.) value, latitude, longitude.

Graig McHendrie
Office of Marine Geology
U.S. Geological Survey
345 Middlefield Road
Menlo Park, CA 94025

Available from originator only
Telephone (415) 323-8111, ext. 2174

Plots Scattergram
SCTGM4 and SCTGM5

Language - FORTRAN IV
Hardware - IBM 360-65

These subroutines plot a simple scattergram from a set of data pairs. The data are first adjusted to fit in a range of 1 to 100, then rounded, and the scattergram is generated by subtracting the origin from each data point and then fixing, or truncating, the number to yield a set of subscript pairs. The location for each subscript pair in the black array is filled with the number of occurrences and finally a plot is produced. These routines ignore out of bound points.

Paul Sabol
Center for Experiment Design and
Data Analysis, NOAA/EDS
Washington, DC 20235

Available from originator only

Telephone (202) 634-7344

X-Y Plots
EBTPLT

Language - FORTRAN IV
Hardware - CDC 6600/FR80 Precision Microfilm Recorder

A generalized x-y plot package. Allows various manipulations of axes as well as special character plotting.

Robert Dennis
Center for Experiment Design and
Data Analysis, NOAA/EDS
Washington, DC 20235

Available from originator only

Telephone (202) 634-7340

Displays VHRR Satellite Data
V5DMD

Language - FORTRAN
Hardware - CDC 6600/54K words/Digital Muirhead Displayer/NESS displayer run by CDC 924

Displays VHRR data from the ingest tape on the Digital Muirhead Displayer (DMD) in 5000 mode (5000 picture elements per scan line; 5000 maximum scan lines per picture). The program uses a two spot running mean of 5000 spots of a possible 6472 along each scan made by the VHRR instrument. It converts each averaged spot via lookup table to a display grayscale. The starting scan line, the number of scan lines to be processed, the starting spot, and the grayscale lookup table are controlled by data cards.

John A. Pritchard
National Environmental Satellite
Service, NOAA
Suitland, MD 20233

Available from originator only

Telephone (301) 763-8403

Microfilm Plots of VHRR Sattellite Data
SVHRR4KM

Language - FORTRAN H Extended
Hardware - IBM 360-195/FR-80 Precision Microfilm Recorder/256K 8 bit bytes

Displays the VHRR data from the VHRR ingest tape in the form of printed characters on 16mm microfilm in blocks of 128 characters by 48 characters. Each printed character will represent a square four kilometers on a side at the subsatellite point, is obtained by averaging four lines and six spots along each scan line of data from the VHRR ingest tape, and then is determined by a character lookup table. The program is capable of utilizing 3840 digital spots of a possible 4842.

John A. Pritchard
National Environmental Satellite
Service, NOAA
Suitland, MD 20233

Available from originator only

Telephone (301) 763-8403

Vertically Analyzed Contours of Oceanographic Temperatures and Salinities, VACO1S

Language - FORTRAN 63
Hardware - CDC 3600/CalComp plotter/32K words

Provides a rapid and accurate means of constructing vertical cross sections of sea temperatures and salinities. Although this program has been designated to use STD data recorded on magnetic tape, other versions are being used to contour biological, chemical, and other physical oceanographic data. Each vertical section is divided into two parts: the upper section for the contours from the surface to 300 m, and the lower section from 300 m to 1,000 m. Running time: To analyze and plot contours at intervals of 1 degree C for temperature and 0.1 parts per thousand for salinity from the surface to 1,000 m for 50 stations requires four minutes of computer time on the CDC 3600 and 25 minutes on the CalComp 30-inch plotter. Author - Forrest Miller.

Southwest Fisheries Center
National Marine Fisheries Service, NOAA
P.O. Box 271
La Jolla, CA 92037

Copy on file at NODC (deck, documentation)
Telephone (714) 453-2820

Oxygen, Phosphate, Density Plots

Language - FORTRAN IV
Hardware - IBM 360-65/CalComp plotter/33K bytes

Plots oxygen vs. phosphate, oxygen vs. sigma-t, and phosphate vs. sigma-t (single or multiple station) for purposes of quality control and study of water types. Input: Hydrographic data in ICES format. Author - Marilynn Borkowski.

Southeast Fisheries Center
National Marine Fisheries Service, NOAA
75 Virginia Beach Drive
Miami, FL 33149

Copy on file at NODC (documented listing)

General Mercator Plot

Language - FORTRAN IV
Hardware - IBM 360-65/CalComp Plotter/42K bytes

Plots any variable on a Mercator projection; has option of writing in value or making a point plot, and of connecting the points with lines. Input: Any header cards in ICES format. Projection plot may be in any scale per degree, and may include a coastline (obtained from a digitized world tape layout). Author - Marilyn Borkowski.

Southeast Fisheries Center
National Marine Fisheries Service, NOAA
75 Virginia Beach Drive
Miami, FL 33149

Copy on file at NODC documented listing)

Plotter Commands
PLOT, DVR10

Language - Assembly language under RTE
Hardware - HP 2100S

These subroutines are modifications of the HP subroutine PLOT and the RTE driver DVR10. Together they control a CalComp or CalComp compatible .01" or .0025" incremental step drum plotter with three-pen operation. Equipment type is identified through subchannel. Plot increments are calculated in double precision integer.

Robert A. O Brien, Jr.
Shipboard Computing Group, Code 8003
Naval Research Laboratory
Washington, DC 20375

Available from originator only
Telephone (202) 767-2387

TIME AND SPECTRAL SERIES ANALYSIS

Spectral Analysis Subroutines

Language - FORTRAN
Hardware - UNIVAC 1108/30K

Given digital time and spectral series, produces autospectral autocorrelation plots and listings, and phase angle vs. frequency plots.

Peter D. Herstein
Naval Underwater Systems Center
New London, CT 06320

Available from originator only

Telephone (203) 442-0771, ext. 2970

Scalar Time Series
TEMPLT7

Language - FORTRAN IV
Hardware - CDC 6400 (SCOPE 3.4)/100K (octal) 10 character words/CalComp 936/905 Plotting System

Computes and plots statistics, histogram, time series, and spectrum for time series of any scalar quantity. Input: Scalar time series on tape in CDC 6400 binary format; maximum number of data points is 5?36. Output: Listing and tape for off-line plotter. Perfect Daniel frequency window used to compute spectral estimates from FFT generated periodogram values.

James R. Holbrook
Pacific Marine Environmental
Laboratory, NOAA
3711 Fifteenth Avenue N.E.
Seattle, WA 98105

Available from originator only

Telephone (206) 442-0199

Time Series Plotting

Language - FORTRAN 32
Hardware - CDC 3100/PDP-8/CalComp Plotter

The program uses the CDC 3100 plotting subroutines to generate data for the PDP-8 plotting program. The user may specify a legend (up to 480 characters), label sizes, scale factors, the parameter to be plotted and the isopleths to be determined. The plotting is done on a CalComp 31 inch plotter under control of the PDP-8. Cruise data is read from magnetic tape by the CDC 3100 in Bedford Institute format. Time is plotted along the X axis (drum movement) and depth along the Z axis (pen movement). Stations are plotted to the nearest day. Author - D.J. Lawrence. June 1969.

Director
Bedford Institute of Oceanography
P. O. Box 1006
Dartmouth, N. S. B2Y 4A2

Available from originator only

Telephone (902) 426-3584

Time Series Analysis Programs
TSAP

Language - MS FORTRAN
Hardware - CDC 6400 or CDC 3150/Disk/3 tape units/CalComp Plotter

A series of programs that edit digitized time series data, produce plots, probability distributions, perform fast Fourier transforms on data and convert Fourier coefficients into power and cross spectra. Input: Digitized magnetic tape output from program A TO D and data cards. Output: CalComp plots, printer plots, option dump of data tape, magnetic tape of Fourier coefficients, listing of spectra, disk file of spectra. Computer Note BI-C-74-2, May 1974.

P. W. Dobson
Bedford Institute of Oceanography
P. O. Box 1006
Dartmouth, N. S. B2Y 4A2

Available from originator only

Telephone (902) 426-3584

Time Series - Analog to Digital
A TO D

Language - MS FORTRAN
Hardware - CDC 3150/32 K words/1500 tracks on scratch disk/2 tape units/Crown CI822 tape recorder and Airpax FPS24 discriminators for BIO A-D converter

Digitizes analog time series data at fixed time intervals; removes means and trends and writes data on digital magnetic tape; processes data from sensors used in air-sea interaction studies. Input: Up to 12-channel magnetic tape read in through on-line A-D converter; control cards. Output: Summary listing and digital magnetic tape. Computer Note BI-C-74-1, Feb. 1974.

S. D. Smith
Bedford Institute of Oceanography
P. O. Box 1006
Dartmouth, N. S. B2Y 4A2

Available from originator only

Telephone (902) 426-3584

Time Series Routines
ARAND SYSTEM

Language - FORTRAN/COMPASS (assembly)
Hardware - CDC 3300/OS-3 time-sharing operating system/Less than 32 K 4 character words/Graphics: Tektronix 4002 or 4010 graphics terminal, CalComp 1627 II drum incremental X-Y plotter. Hewlett-Packard 7200A graphics plotter

(Number in parentheses at end of each abstract is key to references at end of series.)

ACFFT computes the autocorrelation or autocovariance function of a single time series using a variation of the convolution property of the discrete Fourier transform in conjunction with a fast Fourier transform algorithm. (2, 4, 5)

ACORR computes the autocorrelation function of a time series for a given number of lags. (3)

ACRPLT is designed to plot estimated autocorrelation or partial autocorrelation functions; standard error designations are included. Provision is made for the inclusion of confidence intervals that correspond to hypotheses that all theoretical correlation values beyond a certain lag are zero. CalComp or Tektronix. (3, 6)

ALIGN aligns cross correlation or cross covariance values, shifting the estimates so that a specified lag becomes lag zero. It is intended for use prior to computing estimates of the squared coherence and phase spectra of two time series. (2, 7)

AMPHCO determines the amplitude, phase, and the squared coherence, given the spectral density functions, the cospectrum and the quadrature spectrum of two time series. (1, 7, 8)

ARMAP produces realizations or observed time series of an autoregressive, moving average, or mixed regressive-moving average process. The order of the autoregressive and/or moving average operator cannot exceed three; one realization is produced per call and there is no restriction on the length of the observed time series. (3, 6)

AUTO calculates values of the biased autocovariance function. (1, 9)

AUTOPLT is designed to plot autocorrelation or autocovariance functions on the CalComp 1627 II plotter. The routine scales the values, determining the range of the values to be plotted on the Y-axis. (2)

AXISL is a plotting aid allowing for general purpose axis drawing and labeling. It is written in assembly language and uses elements of the COMPLOT drivers. (3)

CCFFT employs the convolution property of the discrete Fourier transform in conjunction with the fast Fourier transform algorithm to compute the cross-correlation (covariance) function. (2, 4, 5)

CCORR computes the biased auto- and cross-correlation functions of two time series. (1)

COHPLT accepts squared-coherency spectrum values and plots coherency on a hyperbolic arctangent scale which allows a constant length confidence interval to be constructed. (2, 7)

COMPLOT is a set of subroutines intended to provide a basis for easily programing graphics applications. These subroutines expand relatively simple instructions specified by the programer to include all of the necessary details for the plotting device. COMPLOT was designed to be utilized in a time-sharing environment with any of the above plotting devices; also, provisions have been made for plotting on combinations of these devices. (3)

CONFID determines multiplicative factors used in constructing confidence intervals for mean-lagged product spectral estimation. (1, 7)

CONFID1 determines the multiplicative factors necessary to construct confidence intervals for power spectral estimates found by averaging short modified periodograms, as in FOUSPC, FOUSPC1, FOUSPC2, and FFTPS. (3, 10)

CONMODE is a series of subprograms designed as aids to conversational programing with the following four objectives: (1) to allow the user to respond in as natural a way as possible within the limitations of the operating system available; (2) To make all responses entered by the user consistent in use; (3) To provide a complete set of input/output subprograms for conversational-mode use; (4) To allow ease in usage from a programing point of view, with fairly fast and efficient execution. (3)

COPH computes squared-coherence and phase estimates, given power spectral, cospectral, and quadrature spectrum estimates. The phase estimates can be in either degrees or radians. Similar to AMPHCO. (2)

COSTR computes the discrete cosine transform of an even function (array of values). Goertzel's method is used. (1)

CPEES is a conversational program used in modeling. CPEES picks up information output on file by the CUSID routine, asks the user a few questions, and then determines initial or final parameter estimates for the identified model. Calls USPE and USES, getting preliminary and final parameter estimates. (3, 6)

CPLT1 is a conversational calling program for the plotting routine PLTSPC, used to plot spectral estimates with confidence intervals and bandwidth. The program allows the user to plot as many data sets as he likes from the same or different files. (2)

CPLT2 is a conversational program to produce plots of frequency dependent data using routine PLTFRQ. The program allows the user to plot as many data sets as he likes from the same or different files. (2)

CROPLT is designed to plot the cross correlation (covariance) functions of two time series on the CalComp 1627 II plotter. The routine automatically scales the values, determining the range of values to be plotted on the Y-axis. (2)

CROSS computes the two cross covariance functions (biased) of two time series. (1, 9)

CUSID is the first of a series of three conversatinal programs that collectively perform model identification, parameter estimation (see CPEES), and forecasting (see CUSFO) for autoregressive integrated moving average models. This program corresponds to the identification phase in the modeling process, accepting time series data and computing the autocorrelation and partial correlation functions of the series after seasonal and/or nonseasonal difference operators have been applied. The routine is designed for use at a Teletype or a Tektronix graphics terminal; selection of graphics output of the data and correlation functions on either the CalComp plotter or the graphics terminal is available. (3, 6, 11, 12)

CUSFO computes and plots forecasts from the original data and a fitted model. See CUSID. (3)

CZT computes z-transform values of a finite sequence of real data points using the chirp z-transform algorithm. Points at which transform values will be computed must lie on circular or spiral contours in the complex plane. The contour may begin at any point in the plane and the constant angular frequency spacing between points on this contour is arbitrary. A special contour of particular importance is the unit circle in which case a Fourier transform is computed. (2, 13, 14)

DATPLT is a general purpose plot routine for time series data. (3)

DEMOD1 estimates values of the energy spectrum of a time series using complex demodulates. The frequencies (in cycles per data interval) at which spectral estimates are to be computed are input in the form of an array, allowing one to consider isolated frequencies or a collection of related frequencies, such as an arithmetic progression. Only every Lth value of the complex demodulate at a particular frequency is computed and averaged to form the spectral estimate at that frequency, where L is specified by the user. (1, 15, 16)

DEMOD2 finds the complex demodulate at the given frequency, given a time series, an array of filter weights, a selection integer, and a single frequency. The values of the complex demodulate at the given frequency are returned either as real and imaginary parts of complex numbers or in terms of amplitudes and phases. As in DEMOD1, the calculations use the method of Goertzel for the evaluation of discrete Fourier transforms. (1, 15, 16)

DEMOD3 accepts output from DEMOD2 and calculates an energy spectrum estimate at a single frequency. (1, 15, 16)

DETREND removes a mean or linear trend from a time series, writing over the input array. (1)

DIFF12 computes first or second forward differences of a series. (1)

EUREKA finds either the solution to the matrix equation R·f = g where R is a Toeplitz matrix (i.e., a symmetric matrix with the elements along the diagonals equal) and f is a column vector, or the solution of the normal equations which arise in least-square filtering and prediction problems for single-channel time series. (1, 17, 18)

EXSMO computes a triple exponentially smoothed series. (1, 9)

FFIN, a free-form input routine, allows for the reading of numeric information in BCD that is relatively format free. FFIN returns a single value on each call, and operates by reading 160 characters (2 cards or 2 card images) and advancing a pointer through the buffer on each subsequent call until more information must be input or reading is complete. A companion routine, FFINI, operates exactly as FFIN except that the buffer is cleared and new information input on each call. Both routines set the EOF bit if an end of file is encountered. (3)

FFTCNV computes the convolution of a series with a weighting function using the fast Fourier transform algorithm. The program is designed for the convolution of long series with a relatively short weighting function. (2, 4, 5)

FFTPS uses a fast Fourier transform algorithm to compute spectral estimates by a method of time averaging over short, modified periodograms. (1, 7, 10)

FFTS computes the direct or inverse transform of real or complex data, using a power of two fast Fourier transform algorithm. (2)

FFTSPC finds a raw or modified periodogram for a sequence of real data points using a power of two fast Fourier transform algorithm, i.e., the absolute value squared of raw or Hanned Fourier coefficients are found and suitably scaled. This subroutine is intended for use with time series whose length is slightly smaller than or equal to a power of two. (3)

FILTER1 designs symmetrical, non-recursive digital filters. It is conversational in form and is intended for use at a Tektronix 4002 graphic terminal. Two design techniques are supported, corresponding to the subroutines GENER1 and FIVET. Outputs include an array of filter weights and the attained frequency response. (2)

FIVET designs non-recursive symmetrical digital filters. The design technique is known as the 5½'s method and requires that the specifications be given for the desired frequency response function, the maximum allowable deviation from the desired response, and the bandwidth of transitions in the attained response corresponding to discontinuities in the desired response. (2, 19)

FOLD performs polynomial multiplication or, equivalently, the complete transient convolution of two series. (1, 17)

FOURTR takes the Fourier transform of real data; many output options are available. (1, 20)

FOUSPC finds the Fourier transforms of segments of a time series. The segments must be of equal length, but may abut, overlap, or be in any order relative to the given time series. FOUSPC can be used in conjunction with SPEC to estimate power spectra by a method of time averaging over short, modified periodograms. Note that if one is not interested in examining the Fourier-like coefficients of each segment before passing on to spectral estimates, then FOUSPC1 or FOUSPC2 should be used. (1)

FOUSPC1 computes the power spectrum of a time series by a method of averaging over short, modified periodograms. (3, 7)

FOUSPC2 is similar to FOUSPC1, but accepts two time series, computing the cross spectral matrix at specified frequencies. (1)

FRESPON computes the frequency response of a filter. (1)

GAPH computes and plots estimated gain and phase functions of a time invariant linear system. The gain values are plotted on a logarithmic scale and both gain and phase plots include confidence interval constructions. Input includes smoothed power and cross spectra estimates. (3, 7)

GENER1 is a filter design program. It may also be used to generate weights of lag window or data window, although the routine WINDOW is specifically designed to perform this task and is therefore somewhat easier to use. (1, 26)

GENER2 generates an arithmetic progression. (1)

GENER3 designs a symmetrical low-pass filter given an array containing desired frequency responses at equally spaced frequencies from zero to one-half cycle per data interval. (1)

LOGPLT plots power spectral estimates on a base ten logarithmic scale, the output device being a CalComp 1627 II plotter. The subroutine automatically scales the estimates, determining the range of values to be plotted on the Y-axis. The estimates must have been computed at equally spaced frequencies. An 80% or 95% confidence interval (computed using routine CONFID) is also plotted. (2)

NOIZT tests a time series to determine if it can be considered a realization of a white noise process. The test is a frequency domain test involving the integrated spectrum of the series. The results are plotted with 80% and 95% confidence regions. (2, 7, 21)

PHAPLT plots the phase estimates with 95% confidence intervals on the CalComp 1627 II plotter. The phase estimates must have been computed at equally spaced frequencies and, in order to generate approximate confidence intervals, the associated squared-coherency estimates at these same frequencies must be given. (2, 7)

PLTFOR graphs an initial segment of time series data followed by a set of forecasts that include upper and lower probability limits as generated by CUSFO or USFO. (3)

PLTFRQ allows frequency dependent functions to be plotted versus any arithmetic progression of frequencies, using the CalComp 1627 II plotter. The routine scales the frequency values, determining the range of the values to be plotted on the Y-axis. (2)

PLTSPC is designed to plot power spectra on the CalComp 1627 II plotter. The routine scales the spectral estimates, automatically determining the range of values to be plotted on the y-axis. Also, the plotting of spectral window bandwidth and confidence intervals is possible. The bandwidth of the spectral window associated with any lag window the user may have used, is computed by WINDOW and the multiplicative factors needed to determine confidence intervals can be found using the CONFID routines. (2)

POLRT computes the real and complex roots of a polynomial with real coefficients. (1, 9, 17)

POLYDV divides one polynomial by another or deconvolves one signal by another. (1, 17)

PROPLT produces a profile plot on either the Tektronix graphics terminals or the CalComp plotter or both, and is intended for use with the routine TIMSPEC which produces spectra from segments of a long record, the segments being equally spaced in time. This profile is not a true perspective view, as the frequency (horizontal) axis of each spectrum is of constant length and separated on the time (vertical) axis by a constant amount. (3)

PSQRT computes the coefficients of the square root of a power series or polynomial. (1, 17)

RANDM generates a (pseudo) random sample from one of four possible population distributions, with the size of the sample specified by the user. The population mean is fixed at zero; the variance or scale parameter is user definable. Provisions have been made for repeated calls to RANDM; that is, one can generate a number of independent random samples from the same or different populations. (3, 22)

RCTFFT computes the discrete Fourier transform of real data using the Cooley-Tukey fast Fourier transform algorithm. The number of data points must be a power of two. (1)

RESPON computes the square of the absolute values of the frequency response of a general filter. (1)

REVERS performs bit-reversing on an array of complex data points. REVERS is written in COMPASS and is used in programs employing the fast Fourier transform algorithm. (1)

RPLACE changes specified values of a time series. The indices of the values to be changed and the new values themselves are read in by RPLACE according to a format specified by the user. (1)

RRVERS performs bit-reversing on an array of real data points; the subroutine is written in COMPASS and is used in FFTPS. (1)

SARIT produces a series by serial computations on one or two other series; there are seven different choices for the series to be produced. (1)

SERGEN generates a time series by adding random numbers or noise to a signal, in this case a trigonometric series. Inputs include amplitudes or coefficients of the trigonometric series, an array of random numbers, and a parameter specifying the desired signal level to noise level ratio. (1, 23)

SHAPE designs a filter which will shape a given series into a desired output series. (1, 17)

SINTR calculates the discrete sine transform of a series of data points. (1)

SMO calculates a smoothed or filtered series, given a time series, a selection integer, and a weighting function. (1, 9)

SPEC accepts output from FOUSPC, computing either the power spectrum of a single time series or the cross spectral matrix of two time series. In the latter case, FOUSPC must be called twice with different time series at each call, but with the same arithmetic progression of frequencies. (1)

SPECT1 is a conversational main program designed to estimate, output, and plot the autocorrelation and auto spectral functions of a single time series. It is intended for use at a teletypewriter. (2)

SPECT2, a conversational main program for use at a teletypewriter, computes power spectral, squared coherence, and phase estimates. The program allows the correlation functions of the two time series involved, the power spectral, squared coherency, and phase estimates to be output on a combination of devices, including the Teletype, line printer, CalComp plotter and disk. (2, 7)

TAUTOPLT is designed to plot autocorrelation or autocovariance functions on a Tektronix 4002 graphics terminal; the routine scales the values, determines the range of the values to be plotted on the Y-axis. (2)

TCOHPLT, designed for use with a Tektronix graphics terminal, plots coherence estimates on a hyperbolic arctangent scale, allowing the construction of confidence intervals whose length is independent of frequency. (2, 7)

TCROPLT plots the cross correlation (covariance) functions of two time series on the Tektronix graphics terminal; the routine automatically scales the values, determining the range of values to be plotted on the Y-axis. (2)

TFORM1 calculates values of the spectral density function at any arithmetic progression of frequencies on [0,1/2] cycles per data interval, given autocorrelation or autocovariance function of a time series and an array to be used as a weighting kernel. This weighting kernel can be generated using the routine WINDOW. (2, 7, 8)

TFORM2 computes the co- and quadrature spectrum estimates for an arithmetic progression of frequencies on the interval zero to one half cycles per data interval, given the auto and cross correlation functions. Similar to TRANFRM except that it does not produce the associated autospectral estimates. (2, 7, 8)

TIMSPC finds power spectral estimates computed from segments of a long time series, the beginning of each segment being equally spaced in time. The computational approach is a direct one via a fast Fourier transform algorithm and the technique is appropriate for segment lengths slightly less than or, ideally, exactly equal to a power of two. Thus, the routine allows one to compute a type of "time varying" spectra and these spectra can be graphically examined with the aid of a profile plot (PROPLT) or a contour plotting routine. (3)

TLOGPLT plots power spectral estimates on a logarithmic scale and is designed for use with a Tektronix graphics terminal. The routine automatically scales the estimates, determining the range of values to plot on the Y-axis. The estimates must have been computed at equally spaced frequencies. An 80% or 95% confidence interval (computed using routine CONFID) is also plotted. (2)

TNOIZT performs a frequency domain test to determine if a time series can be considered a white noise or purely random process. The test is appropriate for detecting departures from whiteness due to periodic effects, and is intended for use in conjunction with a test based on the autocorrelation function for detecting local correlation. The routine plots theoretical integrated spectrum values with 80% and 95% confidence regions, the integrated spectrum estimates of the time series being computed from Fourier coefficients input to TNOIZT. These Fourier coefficients may be computed using the FOURTR or RCTFFT routine. (2, 7, 21)

TPHAPLT plots the phase estimates with 95% confidence intervals on a Tektronix 4002 graphics terminal. The phase estimates must have been computed at equally spaced frequencies and, in order to generate approximate confidence intervals, the associated squared-coherency estimates at these same frequencies must be given. (2, 7)

TPLTFRQ is designed to plot frequency response function (or any function of frequency) on a Tektronix graphics terminal. The routine scales the frequency values, determining the range of the values to be plotted on the Y-axis. (2)

TPLTSPC is designed to plot power spectra on a Tektronix graphics terminal. The routine scales the spectral estimates, automatically determining the range of values to be plotted on the Y-axis. Also, the plotting of spectral window bandwidth and confidence intervals is possible. The bandwidth of the spectral window associated with any lag window the user may have used is computed by WINDOW and the multiplicative factors needed to determine confidence intervals can be found using the CONFID routine. (2)

TRISMO is designed for smoothing spectral estimates evenly spaced over the interval [0,1/2] (including end points), or equivalently, zero to the Nyquist frequency. The spectral window applied is a triangular one and the smoothing or convolution is done in a recursive fashion, making it relatively fast. (3, 24)

TSGEN is a conversational program for the generation of a wide variety of time series. More specifically, the program constructs realizations of autoregressive integrated moving average processes where the noise process or "random shock" terms involved may be input from file or generated within the program. In the latter case, a selection of one of four possible families of distributions for the noise is allowed. TSGEN can be run from any Teletype-like terminal, including the Tektronix graphics terminals. (3, 25, 6)

TSPECT1 and TSPECT2 are respectively versions of SPECT1 and SPECT2 that are suitable for use at a Tektronix graphics terminal. (2)

TRANFR calculates values of the spectral density function given the autocorrelation (or autocovariance) function of a time series and an array to be used as a weighting kernel. This weighting kernel can be generated using the routine WINDOW. (1, 7, 8)

TRANFRM calculates spectral density functions, the cospectrum, and the quadrature spectrum, given the autocorrelation (or autocovariance) functions, the cross correlation (or cross covariance) functions of two time series and an array to be used as a weighting kernel. This weighting kernel can be generated using the routine WINDOW. (1, 7, 8)

TTYCON, written in COMPASS, is designed to be used in conversational programs for the output of alphanumeric messages and the input of signed numbers, integer or floating point, and alphanumeric characters. (2)

TTYNUM is designed to be used in conversational programs for the output of one or more alphanumeric messages and the input of one or more signed numbers (integer or floating point) or eight-character alphanumeric identifiers. (2)

UNLEAV is primarily designed for use with RECTFFT. The routine takes an array of interleaved coefficients and separates them, sending the coefficients into two distinct arrays of one half the length of the input array. The length of the input array must be of the form M+2 where M is a power of 2. (1)

USES accepts initial parameter estimates for a seasonal or nonseasonal autoregressive-moving average model and then employs the (possibly differenced and transformed) time series being modeled, computing final parameter estimates. These final parameter estimates are output, along with their covariance and correlation matrix, the residuals from the fitted model, and the sample autocorrelation function of these residuals, and chi-square statistic based on the residual autocorrelations. (3)

USFO generates forecasts with upper and lower probability limits, given the original time series data and a fitted nonseasonal or seasonal autoregressive-integrated-moving average model. Weights for updating forecasts are also output. USFO thus represents the fourth and final stage in a successful modeling attempt, beginning with model identification (USID, CUSID), preliminary estimation of parameters (USPE, CPEES), and final parameter estimated and diagnostic checking (USES, CPEES). (3)

USID accepts a time series as input, possibly transforms and differences the series in seasonal and/or nonseasonal fashion, and then finds the sample autocovariance, autocorrelation, and partial autocorrelation functions. This marks the first of the four programs employed in model identification, parameter estimation, and forecasting, the remaining subroutines being USPE, USES and USFO. Conversational programs (CUSID) and support graphics (ACRPLT) are available for USID. (3, 6, 11, 12)

USPE accepts output from USID and choices for the order of the autoregressive and moving average parts in modeling possibly transformed and differenced time series data; a conversational calling routine for USPE is CPEES. (3)

WINDOW generates an array to be used as a weighting function or lag window. One of six different lag windows may be selected: The rectangular or box car window, the Parzen lag window, the Bartlett or triangle window, the Tukey or cosine window, the Lanczos data window, and the Lanczos-squared data window. (1, 7)

WINDOW1 generates a symmetrical array of weights for use as a data window, as required, for example, in the spectrum estimation procedures of the ARAND routines FOUSPC, FOUSPC1, FOUSPC2, and FFTPS. Two basic window shapes are available, the first having a spectral window very similar to the Tukey or cosine window, while the second produces the Parzen spectral window. (1, 10)

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Generates Arbitrary Filter
HILOW

Language - FORTRAN IV
Hardware - IBM 1800

Generates a lowpass, bandpass, or highpass filter defined by three parameters, with or without its conjugate; punches the multipliers on cards; and lists its amplitude response over the full frequency range. NIO Program No. 158. Author - D.E. Cartwright.

National Institute of Oceanography
Wormley, Godalming, Surrey, England

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Two-Dimensional Autocorrelation

Language - FORTRAN
Hardware - IBM 7090/IBM 1401

Applies regression and correlation analyses to a sample of ocean terrain. Computes variance and covariance as function of position in data field. Ref. Arthur D. Little, Inc., Technical Report No. 1440464, "Statistical Analyses of Ocean Terrain and Contour Plotting Procedures," by Paul Switzer, C. Michael Mohr, and Richard E. Heitman, April 1964. Appendices B and C of report describe (but do not list) two routines used: (1) "Correlation Constants" (IBM 7090); (2) "Local Means and Variances" (IBM 1401).

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Copy on file at NODC (listing); documentation (above report) available from NTIS, Order No. AD 601 538/LK, $4.75 paper, $2.25 microfiche.

Time Series Analysis
BLACKY

Language - FORTRAN IV
Hardware - IBM 360

Computes, for two simultaneous time series, cross spectra, power spectra, phase and coherence. Subprograms obtain the filtered series, remove the trend, and compute the auto- and cross correlations. This NPGS library program is listed in a thesis by John G. McMillan, June 1968. The thesis uses digital analysis by program BLACKY in the study of temperature fluctuations near the air-sea interface, the wave field at the same point, and the downstream wind velocity.

Naval Postgraduate School
Monterey, CA 93940

Thesis available from NTIS, Order No. AD 855 533/LK, $3.25 paper, $2.25 microfiche.

Spectral Analysis of Time Series

Language - FORTRAN IV/ALGOL 60
Hardware - UNIVAC 1108/Burroughs B5500

Finds the spectra, cospectra, quadspectra, coherence, and phase of two series or a single spectrum of one series, using the fast Fourier transform (algorithm of Cooley and Tukey, 1965). Special Report No. 6, by Everett J. Fee, March 1969.

The Librarian Center for Great Lakes Studies University of Wisconsin-Milwaukee Milwaukee, WI 53201	Copy on file at NODC (above report)

Spectra Programs DETRND, AUTCOV, CRSCOV, FOURTR	Language - FORTRAN IV Hardware - IBM 360-40

DETRND removes the mean, or the mean and linear trend (slope), from a time series. AUTCOV computes the autocovariance of the time series. CRSCOV computes the auto- and cross-covariances of two sequences. FOURTR computes either the sine or cosine Fourier transform. Smoothing of either is optional. Technical Note 13, "Water Wave Teaching Aids," by Ralph H. Cross. Adapted (with permission) from a program written at Bell Laboratories by M.J.R. Healy, 1962.

Hydrodynamics Laboratory Massachusetts Institute of Technology Cambridge, MA 02139	Copy on file at NODC (above report)

Analysis of Non-Linear Response Surface	Language - FORTRAN IV Hardware - IBM 1130

Analyzes the data from response surface experiments when two or three factors are measured. Options allow calculation of maximum likelihood estimates of power transformations of both independent and dependent variables, and the plotting of their relative maximum likelihood graphs, as a measure of the precision of the principal estimates. The data is then subjected to analysis of variance, using orthogonal polynomials, and principle component analysis; specified contours of the dependent variable are plotted, both without and with transformation. FRB Technical Report No. 87 by J.K. Lindsey, Aug. 1968.

Pacific Biological Station Fisheries Research Board of Canada P. O. Box 100 Nanaimo, B. C. V9R 5K6	Copy on file at NODC (above report)

Multiple Discriminant Analysis MULDA	Language - FORTRAN IV Hardware - IBM 1130

A complete multiple discriminant analysis is performed by six interrelated programs which are executed in succession through the link feature in 1130 FORTRAN. Will accept up to 25 variates and as many as 10 groups. Any number of additional data cards can be read and processed after the discriminant analysis has been completed. The value of the discriminant function, classification chi-squares, and probabilities of group membership are computed and printed for each additional m-variate observation. FRB Technical Report No. 112 (unpublished manuscript), by L.V. Pienaar and J.A. Thomson, March 1969.

Pacific Biological Station Fisheries Research Board of Canada P. O. Box 100 Nanaimo, B. C. V9R 5K6	Copy on file at NODC (above report)

Fourier Analysis L101	Language - FORTRAN Hardware - IBM 7090/32K

Obtains amplitudes and phases of frequency components in any record. Standard Fourier analysis plus use of Tukey cosine window to reduce edge effects. Author - Alsop.

Lamont-Doherty Geological Observatory — Copy on file at NODC (deck, documentation)
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Palisades, NY 10964

Cluster Analysis — Language - FORTRAN; Hardware - IBM 1800

Carries out a single linkage cluster analysis using data in the form of an upper triangular similarity matrix. Output: (1) similarity level of clustering cycle; (2) a list of the linkages that occur at that similarity level; (3) at the end of the cycle, the cluster numbers and a list of the entities making up each cluster are printed. Running time: A matrix of order 60 took approximately 15 minutes to cluster. NIO Program No. 166. Author - M. Fasham.

National Institute of Oceanography — Copy on file at NODC (listing, documentation)
Wormley, Godalming, Surrey, England

Probability Distribution — Language - FORTRAN IV
WEIBUL — Hardware - IBM 370/120K

Parameters for a Weibull probability distribution are calculated from low, most probable, and high estimates of random variables.

Robert T. Lackey — Available from originator only
Department of Fisheries and Wildlife Sciences
Virginia Polytechnic Institute and State University
Blacksburg, VA 24061

Statistics from WHOI Format — Language - FORTRAN IV-H
STATS — Hardware - XDS Sigma 7

Computes and lists statistical quantities related to variables stored on tape in WHOI standard format. See HISTO format reference.

Richard W. Payne — Available from originator only
Wood Hole Oceanographic Institution
Woods Hole, MA 02543 — Telephone (617) 548-1400

Extended Normal Separator Program — Language - FORTRAN IV
ENORMSEP — Hardware - IBM 360-651/168K where K is 1024 bytes

Separates a polynomial distribution into its component groups where no a priori information is available on the number of modes, their overlap points, or variance. Transformation of frequency distribution by probit analysis, polynomial regression analysis, and program NORMSEP (Hasselblad, 1966). Input: Observed frequency distribution together with values for identification and control purposes. Output: means, variances, and numerical representation of the separated groups.

Marian Y.Y. Yong — Available from originator only
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Honolulu, HI 96812 — Telephone (808) 946-2181

Single Integration

Language - FORTRAN
Hardware - IBM 7074

Equally spaced time series data are integrated once using Tick's method. The data must be sampled at a rate of at least twice the Nyquist frequency. Informal report IM No. 66-36. OS No. 66-36. Author - E.B. Ross.

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U.S. Naval Oceanographic Office
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CURVE FITTING

Fits a Smooth Curve
SMOOTH

Language - FORTRAN IV
Hardware - IBM 360-65

Fits a smooth curve between supplied points that passes exactly through those points. Author - Dave Pendleton.

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Curve Fitting: Velocity Profile
NEWFIT

Language - FORTRAN V
Hardware - UNIVAC 1108/25K

Fits a velocity profile with a series of curve segments having continuous first derivatives at points of intersection. Output: Printed listings of original data, fitted data, and coefficients of curve segments; also, cards for input to program "Sonar in Refractive Water". NEWFIT is the main routine of the program described in Report AP-PROG-C-8070, "A New Curve-Fitting Program," by Melvin O. Brown, Associated Aero Science Laboratories, Inc., Pasadena, for NUSC, Feb. 1968.

Naval Undersea Center
Pasadena Laboratory
3202 E. Foothill Blvd.
Pasadena, CA 91107

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Least-Squares Curve Fitting in Two, Three, and Four Dimensions
UCF, BCF, TCF

Language - FORTRAN II
Hardware - CDC 3100

Three subroutines, UCF, BCF, and TCF (for Univariate, Bivariate, and Trivariate Curve Fit), for use in two-, three-, and four-space. Curve coefficients calculated by reduction technique due to P.D. Crout (1941). Output: printout of coefficients, in normalized floating point, and differences curve-to-points, in same format. Satellite subroutine SYMMET is called to solve m simultaneous equations in x. BIO Computer Note 68-1-C by F.K. Keyte, Jan. 1968.

Director
Bedford Institute of Oceanography
P.O. Box 1006
Dartmouth, N.S., Canada B2Y 4A2

Copy on file at NODC (Report with listing and documentation)

Subroutine for Fitting a Least-Squares Distance Hyperplane to Measured Data

Language - FORTRAN V
Hardware - UNIVAC 1108

A subroutine for modeling measured data in k-space by a least-squares distance hyperplane, and numerically compared with ordinary least squares. Minimizes the sum of the squares of the perpendicular distances from the points X_m to the hyperplane model. Input: Points $X_m = (x_{m1}, x_{m2}, \ldots, x_{mk})$ in k-space, where each component x_{mi} is in error. Output: Normal form of the hyperplane: $AX'-p = 0$ ($AA' = 1$); p is the distance from the origin of the coordinate axes to the hyperplane. NUSC/NL Tech. Memo. No. PA4-121-74, "A Computer Subroutine for Fitting a Least Squares Distance Hyperplane to Measured Data," by M.J. Goldstein.

Marvin J. Goldstein
Naval Underwater Systems Center
New London, CT 06320

Available from originator only

Telephone (203) 442-0771, ext. 2415

Fits Polynomial Language - FORTRAN IV
P3TERM Hardware - IBM 360-65

This routine fits a polynomial function $Y(x) = a_0 + a_1x + a_2x^2 + \ldots a_mx^m$ to the data (x_1, Y_1), $(x_2, Y_2) \ldots (x_n, Y_n)$ by using the least squares criterion. The method is very accurate and should perform well for up to a 20-term polynomial and 100 data points.

Jerry Sullivan
Center for Experiment Design and Data Analysis
Washington, DC 20235

Available from originator only

Telephone (202) 634-7288

Least-Squares Plot Language - FORTRAN
Hardware - IBM 7074

Fits an n-degree polynomial (max. n = 10) or an exponential function to data points (max. 300), plotting the actual curve and the computed curve for comparison or plotting the data points only to help identify the type of curve they represent. OS No. 10112. Author - James S. Warden.

Data Systems Office
U.S. Naval Oceanographic Office
Washington, DC 20373

Available from originator only

Telephone (301) 763-1449

Temperature, Salinity Corrections Language - FORTRAN
CURVFIT N1S512 Hardware - UNIVAC 1108/DEC PDP-9/6K words

Determines corrections for electronically measured temperature and salinity data, using linear and curvilinear regression techniques. Input: Temperatures or salinity data collected simultaneously with electronic sensors, reversing thermometers, and Niskin bottles. Output: Corrections for a range of possible observed values, equations of best fit linear, parabolic, and cubic equations, and standard error of estimate.

Harry Iredale
U.S. Naval Oceanographic Office
Washington, DC 20373

Copy on file at NODC (Deck, listing, documentation)

Telephone (202) 433-3257

Bartlett's Curve Fitting Language - FORTRAN
Hardware - IBM 1800

Bartlett's method for computing the best value for fitting a linear relationship or an exponential relationship. The 70% and 90% confidence limits on the slope are also found. The program takes a maximum of 99 sets of data, each with a maximum of 500 points. NIO Program No. 174. Author - Maureen Tyler.

National Institute of Oceanography
Wormley, Godalming, Surrey, England

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Curve Fitting Language - FORTRAN II
CRVFT Hardware - GE 225

Finds either best least-squares fit to n points within specified standard deviation "sigma," or fits a specified "M-curve" order curve -- the former executed by M-curve negative, the latter by M-curve non-negative. In either case "SD" is the actual standard deviation as calculated. BIO Computer Note 66-5-C, Appendix 5; also, a 14-page writeup is in the "COPE" catalog (1965) of the Woods Hole Oceanographic Institution. Author - F.K. Keyte.

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P. O. Box 1006
Dartmouth, N. S. B2Y 4A2

Copy on file at NODC (deck, documentation)

Telephone (902) 426-3410

Linear Interpolation — Language - PL/1
LININT — Hardware - IBM 360-65/144 (hex) bytes

Computes a linear interpolation on fullword fixed binary integers. Author - Robert Van Wie.

Oceanographic Services Branch — Copy on file at NODC
National Oceanographic Data Center
NOAA/EDS
Washington, DC 20235 — Telephone (202) 634-7439

Lagrangian Three-Point Interpolation — Language - PL/1
LAG3PT — Hardware - IBM 360-65

Computes a Lagrangian three-point interpolation; calls subroutine LININT. Author - Robert Van Wie.

Oceanographic Services Branch — Copy on file at NODC
National Oceanographic Data Center
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Washington, DC 20235 — Telephone (202) 634-7439

Calculates Spline Coefficient — Language - FORTRAN IV
SPLCOF — Hardware - IBM 360-65

Calculates spline coefficient for use by routine SPLINE. Author - Dave Pendleton.

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National Oceanographic Data Center
NOAA/EDS
Washington, DC 20235 — Telephone (202) 634-7439

Interpolating by Cubic Spline — Language - FORTRAN IV
SPLINE — Hardware - IBM 360-65/832 bytes (object form)

Performs interpolation by cubic splines. This method fits a cubic spline between adjacent points while insuring that the first two derivatives remain continuous. The endpoints (X(1) and X(N)) use an extrapolation of the curvature at points X(2) and X(N-1). Author - Dave Pendleton.

Oceanographic Services Branch — Copy on file at NODC
National Oceanographic Data Center
NOAA/EDS
Washington, DC 20235 — Telephone (202) 634-7439

Program for Smoothing Data Using the Cubic Spline — Language - FORTRAN IV
Hardware - UNIVAC 1108

Fits measured data with the smoothing cubic spline, using an extension of Reinsch's technique which brings the second derivative of the spline to zero at its end points. The extension allows end conditions on either first or second derivatives. Input: Set of sample data (x_i, y_i), $i = 0), 1, \ldots, n \geq 2$; $x_0 < x_1 < \ldots < x_n$ and end conditions on either the first or second derivative and a smoothing paramerer $S \in (N-\sqrt{2N}, N+\sqrt{2N})$ where $N = n+1$. Output: Smoothed data values

$\hat{y}_i$ and pointwise approximations to the first and second derivatives at the points x_i. NUSC Tech. Memo. No. PA4-48-74, "On a Computer Program for Smoothing Data Using the Cubic Spline," by M.J. Goldstein.

Marvin J. Goldstein	Available from originator only
Naval Underwater Systems Center	
New London, CT 06320	Telephone (203) 442-0771, ext. 2415

Solve Algebraic Equations	Language - USASI FORTRAN
MATRIX	Hardware - CDC 3300/20K words

Solves n linear algebraic equations in n unknowns, using Cholesky's method.

Alan T. Massey	Available from originator only
Naval Underwater Systems Center	
Newport, RI 02840	Telephone (401) 841-4772

Checks Angles	Language - FORTRAN IV
TWOPI	Hardware - IBM 360-65/CDC 6600

In the use of angles, this routine assures that any angle remains between 0° and 360°.

Robert Dennis	Available from originator only
Center for Experiment Design and Data Analysis, NOAA/EDS	
Washington, DC 20235	Telephone (202) 634-7344

Trigonometry Subroutines	Language - FORTRAN
ASSUB, SAS, ASA	Hardware - IBM 1800

ASSUB calculates trig other side. Input: 1 angle, 2 sides. Output: Two possible side lengths; if either or both returned sides are zero, these values are undefined. SAS calculates other side. Input: Side, angle, side. Output: Length of other side. ASA calculates other two sides. Input: Angle, side, angle. Output: Length of other two sides.

Michael Moore	Available from originator only
Scripps Institution of Oceanography	
P.O. Box 1529	
La Jolla, CA 92037	Telephone (714) 452-4194

Inter-Active Calculations	Language - ALGOL
DSDP/CALC	Hardware - Burroughs 6700/6K words

Provides inter-active computing abilities for persons with the occasional need to do numerical calculations involving small amounts of data. The user may address either the "definition level" or "evaluation level" of ten independent working spaces in which any number of expressions may be defined. The program can save the total working environment for later use. Input: General arithmetic expressions defined in terms of alpha-numeric identifiers, system intrinsic functions and previously defined expressions. An expression is evaluated by assigning values to the independent variables in either an identifier prompting mode or free-field input mode.

W. Thomas Birtley	Available from originator only
Deep Sea Drilling Project	
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La Jolla, CA 92037	Telephone (714) 452-3526

DATA REDUCTION, EDITING, CONVERSION, INVENTORY, RETRIEVAL, AND SPECIAL INPUT-OUTPUT

Thermometer Correction
TCPLO

Language - FORTRAN IV
Hardware - XDS Sigma 7/12,500 words/2 tape units/CalComp Plotter

Plots thermometer correction curves and prints the calibration data for each thermometer. Formulas used are from "On Formulas for Correcting Reversing Thermometers," by F.K. Keyte.

Mary Hunt
Woods Hole Oceanographic Institution
Woods Hole, MA 02543

Available from originator only

Telephone (617) 548-1400

Thermometer Correction, Depth Computation
HYD1

Language - HP ASA Basic FORTRAN
Hardware - HP 2100/HP 2116/12K words/Keyboard/CalComp Plotter/Paper tape optional

Corrects thermometer readings and computes depth or pressure. Input: Station information, including thermometer readings, and thermometer calibrations. Output: Depth and corrected temperature for each station.

Chris Polloni
Woods Hole Oceanographic Institution
Woods Hole, MA 02543

Available from originator only

Telephone (617) 548-1400

Areal Concentration
INTEGRATE

Language - FORTRAN IV
Hardware - IBM 360/3676 bytes

Performs integration of samples taken at discrete depths to produce areal concentrations. Integration is of form $\sum_{N}[d_{n+1}-d_n][(A_{n+1}+A_n)/2]$ where d = depth and A = values of a variable for each of N depths. Input: Data cards containing sample identification codes and depth values along with substance to be integrated. An unlimited number of depths and variables may be integrated. Output: Printed output includes sample identification codes, list of depths and variable values, a depth-weighted average for each depth interval, and the running sum; punched output includes identification codes and integration from surface to selected depths. "A Computer Program Package for Aquatic Ecologists," by Paul J. Godfrey, Lois White, and Elizabeth Keokosky.

Paul J. Godfrey
Department of Natural Resources
Cornell University, Fernow Hall
Ithaca, NY 14850

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Telephone (607) 256-3120

Unweighted Averages
AVERAGE

Language - FORTRAN IV
Hardware - IBM 360/5824 bytes

Calculates unweighted averages over depth; depths for which data are averaged may be controlled. Input: Data cards with sample identification codes, depth and variables to be averaged; if average is to be controlled by a variable such as thermocline depth, this must also be included. Output: Printed or punched averages of several variables in a form similar to the input data, i.e., one variable after another on each card, thus suitable for use in packaged programs. "A Computer Program Package for Aquatic Ecologists," by Paul J. Godfrey, Lois White, and Elizabeth Keokosky.

Paul J. Godfrey
Department of Natural Resources
Cornell University, Fernow Hall
Ithaca, NY 14850

Copy on file at NODC (listing, documentation)

Telephone (607) 256-3120

Bathymetric Data Reduction

Language - FORTRAN
Hardware - IBM 7074

Processes data gathered while navigating with any circular and/or hyperbolic system. Eight options are available pertaining to position conversion, form of input, data smoothing, special corrections, and interpolation of position-dependent values such as contour crossings. OS No. 53559.

Data Systems Office
U.S. Naval Oceanographic Office
Washington, DC 20373

Available from originator only

Telephone (301) 763-1449

Julian Day Conversion
JDAYWK

Language - FORTRAN IV
Hardware - IBM 360-65

Computes the date from the Julian day.

Paul Sabol
Center for Experiment Design and
Data Analysis, NOAA/EDS
Washington, DC 20235

Available from originator only

Telephone (202) 634-7344

Julian Date Conversion Routines
JULDAY, JULIAN, JULYAN, JULSEC, CESLUJ

Language - FORTRAN IV
Hardware - IBM 360/CDC 6600/PDP-11

Given the month (1-12), day, and year, JULDAY returns the Julian Day. JULIAN calculates month (in 10-character words) and day, given the year and Julian date. JULYAN calculates month (digital) and day from given year and Julian date. JULSEC yields Julian seconds from Julian day, hour, minute, and second. CESLUJ computes the Julian date, hour, minute, and second, given Julian seconds.

Robert Dennis
Center for Experiment Design and
Data Analysis, NOAA/EDS
Washington, DC 20235

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Telephone (202) 634-7344

Day of the Week
NDAYWK

Language - FORTRAN IV
Hardware - IBM 360-65

This subroutine returns the day of the week for any date in the nineteenth or twentieth century. Modifications include conversion of the function to a subroutine so Julian day can be extracted and addition of an array containing an alphanumeric description of the day.

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Center for Experiment Design and
Data Analysis, NOAA/EDS
Washington, DC 20235

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Date Calculations
DAYWK, NWDAT, NXTDY, YSTDY

Language - FORTRAN
Hardware - IBM 1800

Given year (4 digits) and Julian Day (1-366), DAYWK produces the day of the week (1-7, Sun.-Sat.). Given packed date (bits 0-3 month, 4-8 day, 9-15 year), NWDAT produces following date, packed and unpacked. Given day, month, year, NXTDY returns day, month, year of next day. Given packed date, YSTDY produces preceding date (packed).

Michael Moore Scripps Institution of Oceanography P.O. Box 1529 La Jolla, CA 92037	Available from originator only Telephone (714) 452-4194

Julian Day Subroutines
CLEJL, CLJUL

Language - FORTRAN
Hardware - IBM 1800

Both subroutines calculate Julian Day. Input formats vary. CLEJL format, 01 Nov. 70; CLJUL format, day (1-31), year (00-99), month (1-12).

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Time Conversion
DTIME

Language - FORTRAN
Hardware - IBM 1800

Calculates hours, minutes, and seconds, given thousandths of hours.

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Current Meter Data Reduction

Language - FORTRAN IV
Hardware - IBM 1800

Converts data in the form of angular positions of the rotor and compass arcs from Braincon type 316 current meters into values of current speed and direction, tilt direction, N-S and E-W current components and displacements in kilometers from any arbitrary origin. Data are output to lineprinter with column headings and magnetic tape without headings. Author - W.J. Gould.

National Institute of Oceanography Wormley, Godalming, Surrey United Kingdom	Copy on file at NODC (listing, documentation)

Reduction and Display of Data Acquired at Sea

Language - FORTRAN II
Hardware - IBM 1130/Disk/CalComp 30" plotter

A system of programs (navigation, gravity, topography, magnetics) for the reduction, storage, and display of underway data acquired at sea. A large number of the programs utilize navigation points together with raw digitized geophysical data presented as a time series, where the different data may be read at unequal intervals. Technical Report No. 1, by Manik Talwani, August 1969.

Lamont-Doherty Geological Observatory Columbia University Palisades, NY 10964	Available from NTIS, Order No. AD 693 293/LK, $10.00 paper copy, $2.25 microfiche.

Hydrographic Data Reduction
TWO FIVE

Language - FORTRAN 63
Hardware - CDC 3600

Processes raw data to obtain corrected depth, temperature, salinity, and oxygen, as follows: (1) from protected deep-sea reversing thermometer readings, obtains corrected in situ temperature; (2) from unprotected deep-sea reversing thermometer readings, obtains the thermometric depth, corrected for gravity variations and for the mean density of the overlying water column in any ocean; (3) fits least-squares curves to wire length vs. (wire length minus thermometric depth) to determine the accepted depth; (4) calculates salinity from raw salinity readings; (5) calculates dissolved oxygen concentrations from titrations. Report (unpublished manuscript) by Norma Mantyla, Oct. 1970.

Marine Life Research Group
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La Jolla, CA 92037

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Station Data Reduction
SYNOP

Language - FORTRAN II, FAP
Hardware - IBM 7094-7040 DCS/25,335 words (main program), 2058 words (subroutines)

Reduces data from raw shipboard observations. Corrects thermometers and computes thermometric depths, wire angle depths, salinities from bridge readings, oxygen values from titrations; then computes sigma-t, oxygen saturation percent, and apparent oxygen utilization. Technical Report No. 181 (M67-8), "Processing of Oceanographic Station Data: A Coordinated Computer-Compatible System," by Eugene E. Collias, Jan. 1968.

Department of Oceanography
University of Washington
Seattle, WA 98105

Available from NTIS, Order No. AD 670 472/LK, $5.75 paper, $2.25 microfiche.

Thermometer Correction
TCHK2

Language - FORTRAN VI
Hardware - IBM 1130

Corrects deep-sea reversing thermometers, computes thermometric depths, allows spurious values to be removed from L-Z table, smooths the L-Z table, and punches smoothed depth and observed temperature and salinity and oxygen values onto cards in CODC format. Two other thermometer correction programs are available: TCHK1 uses the L/Z method; TCHK3 computes pressure. FRB Manuscript report No. 1071 (unpublished manuscript), by C.A. Collins, R.L.K. Tripe and S.K. Wong, Dec. 1969.

Pacific Biological Station
Fisheries Research Board of Canada
P. O. Box 100
Nanaimo, B. C. V9R 5K6

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Read NODC Format Station Data

Language - FORTRAN IV
Hardware - XDS Sigma 7

READTAPE	1,000 words
MASTER	200 words
ENVIR	118 words
DETAIL	280 words

Subprogram READTAPE reads, unpacks, and returns to the user NODC oceanographic station data records, one station at a time. Subprogram MASTER takes information from master record and returns the information to the calling program. Subprogram ENVIR takes information from the first 24 characters of master or observed detail record and returns the information to the calling program in usable form. Subprogram DETAIL takes the information from an observed detail record and returns to the calling program correct values for all variables and suitable indicators for special conditions. Input to all subprograms: NODC station data on cards or tape.

Mary Hunt | Available from originator only
Woods Hole Oceanographic Institution
Woods Hole, MA 02543 | Telephone (617) 548-1400

Reads NODC Station Data Tape | Language - FORTRAN IV
EDIT | Hardware - IBM 360-65

This subroutine reads a NODC station data tape (120 characters per record), checks the indicators in characters 81-120, sets the decimal points, then prints the master records, observed station data, and standard station data for each station. See program CAPRICORN.

Ruth McMath | Available from originator only
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Texas A&M University
College Station, TX 77843 | Telephone (713) 845-7432

Converts NODC Format Data to BNDO Format | Language - FORTRAN IV
TRANSNODC | Hardware - XDS Sigma 7/2 tape or disk units

This system prepares data in NODC format for introduction into the Poseidon system; header data are listed, stations are selected and separated into cruises with inventories at the cruise level, and output is provided in BNDO format. Report, "Transcodage des donnees NODC."

Mr. Stanislas, BNDO | Copy on file at NODC
Centre National pour l'Exploitation des Oceans
Boite Postale 337
29273 Brest Cedex, France | Telephone 80.46.50, telex 94-627

Converts Data to BNDO Format | Language - FORTRAN IV
TRANSCOD | Hardware - XDS Sigma 7/2 tape or disk units

This system prepares data in out-of-house formats for introduction into the Poseidon system; header data are listed, stations are selected and separated into cruises with inventories at the cruise level, and output is provided in BNDO format. Input formats are those of ORSTOM, SHOM, etc.

Mr. Stanislas, BNDO | Copy on file at NODC
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29237 Brest Cedex, France | Telephone 80.46.50, telex 94-627

Reads BNDO Format Data | Language - FORTRAN IV
LSTA 1142 | Hardware - XDS Sigma 7

This subroutine is used to read easily the physical, chemical, and biological data in the complex and very flexible BNDO format. Data may be on disk, tape, or cards. After the call, the station is stored in a common area.

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Editing for WHOI format — Language - FORTRAN IV-H
SCRUB — Hardware - XDS Sigma 7

Provides several methods by which data stored in WHOI standard format may be edited and tested. Output is the corrected version of the data on 9-track tape. See HISTO format reference.

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Telephone (617) 548-1400

Mailing Labels — Language - ALGOL
MAILER — Hardware - Burroughs 6700/16K words

Generates 4-up peel-off mailing labels on the line printer. Options: Bulk mail handling, sorting by user defined key, rejection of records by user defined key. Input: Addresses on punched cards; privileged information may be included which is not printed.

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Fortran Access to Scientific Data — Language - FORTRAN II, CODAP-1
FASD — Hardware - CDC 1604/4850 48 bit words

Designed to be used as a subroutine, FASD accomplishes the dual purpose of converting an existing data base to FASD format as well as providing a convenient unpack data handling tool. For user convenience, I/O tape status checking, bit shifting, data bias manipulation, etc., have been absorbed by the package so that raw data can be made immediately available from the FASD pack; or raw data can be packed into the FASD format by a single instruction. Available functions are fixed or floating point READ, WRITE, READ IDENT only, and SKIP. The present data base is NODC station data. Access time is 44 seconds for 1,000 random length observations. A table of pointers is maintained to insure accurate transmission of observation data. The FASD format provides an extremely tight pack of thermal structure data where the observation format consists of an identification (parameters such as position, metering device, station number, date time group) and a temperature profile. The FASD format is not computer word length oriented. Input: (1) Raw data to be packed into the FASD format, or (2) magnetic tape containing data in the FASD format. Output: If input (1), a magnetic tape containing FASD packed data; if input (2), raw data are output to the driving program.

Alan W. Church, Code 80
Fleet Numerical Weather Central
Monterey, CA 93940

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Reproduce and Serialize Deck — Language - FORTRAN IV
DUPE — Hardware - CDC 6600

Reproduces, lists, and serializes source or data decks. Program options allow reproduction without serialization and up to 999 reproductions and listings of the input deck. Input may be any standard FORTRAN or alphanumeric punch deck.

Jack Foreman
Center for Experiment Design and
Data Analysis, NOAA/EDS
Washington, DC 20235

Available from originator only

Telephone (202) 634-7344

Flags Suspicious Data Values — Language - FORTRAN IV
EDITQ — Hardware - IBM 360-65

EDITQ is designed as a computationally fast and efficient means of flagging suspiciously large or small values in a series of data. The data series is fitted with a least-squares fit straight line under the assumption that the programer limits the length of the data series to regions sufficiently small so that the straight line is locally a good approximation to the trend.

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Data Analysis, NOAA/EDS
Washington, DC 20235

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Telephone (202) 634-7288

Format Free Input Subroutine
QREAD

Language - FORTRAN
Hardware - IBM 1800

A format free input subroutine for cards or other sources. Input: Integer array with first eight variables set to determine input.

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La Jolla, CA 92037

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Meters vs. Fathoms
MATBL

Language - FORTRAN
Hardware - IBM 1800/16K words

Produces table of corrected depths in meters vs. raw fathoms.

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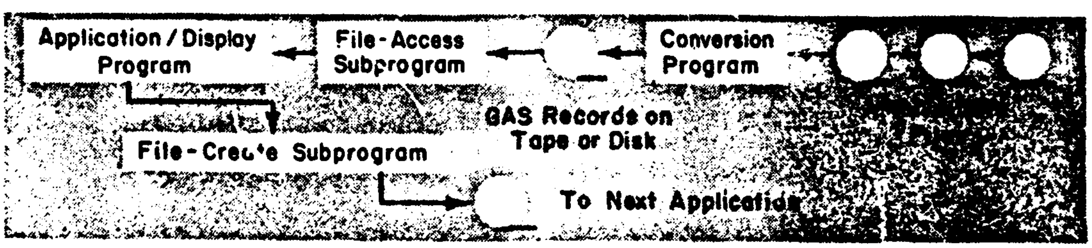
A File-Independent, Generalized Application System, GAS

Language - FORTRAN IV-G, Assembler, PL/1-F
Hardware - IBM 360-65

Development of GAS was based on the following premises: (1) most files of oceanographic data consist of identification fields (location, date, etc.), an independent variable (perhaps water depth or time), and one or more dependent variables (e.g., water temperature or dissolved oxygen); (2) a system could be designed to treat these items uniformly, i.e., instead of tailoring programs to a discrete data file, the basic units could be extracted and transmitted to a generalized applications system from which many products could be derived. As a result, GAS has "n" number of applications programs, rather than a theoretical maximum of "n" times the number of files. Only one extra program was necessary -- the conversion module which provides a link between the various data files and the GAS system. The system of applications programs is tailored to an intermediate file created by this conversion module. Version 1 of the conversion module can access the files for Nansen casts, mechanical bathythermographs (BT), and expendable bathythermographs (XBT); soon to be added are the continuous salinity-temperature-depth (STD) file, ICES ocean surface reference file, and data from cooperative oceanographic research projects.



Following are descriptions of individual programs and subroutines:

GASDIPBS reads the NODC GAS file and, on one pass of the data, produces any one of three different printouts, depending on the control card entry. Author - Gary Keull (44K, FORTRAN IV-G).

GASSAMPC prints the first three and the last basic master records only of a GAS formatted data set and gives a record count. Author - Gary Keull (38K, FORTRAN IV-G).

GASEINV prints out a geographic inventory of GAS data by ten-degree square, one-degree square, and month, and gives counts of all one degrees and ten degrees and a total number of stations processed. Author - Gary Keull (40K, FORTRAN IV-G).

GASCCI reads GAS records and prints out country code, reference identification number, and from and to consec numbers. Also gives a total station count. Author - Gary Keull (40K, FORTRAN IV-G).

GASVAPRT reads the output of the program GASVASUM and prints vertical array summaries. Author - Walter Morawski (48K, FORTRAN IV-G).

GVAREFRM takes the GAS vertical array summary programs summed records and produces a 110 character output record. Author - Gary Keull (30K, FORTRAN IV-G).

GASTHERM computes the depth of the thermocline and mixed layer if desired. Also outputs a temperature gradient analysis. Author - Walter Morawski (40K, Assembler).

GASMASK reads the basic and supplementary master information and produces a detailed printout of master information and headings for each station. Author - Judy Yavner (100K, PL/1-F).

INDATA reads GAS records and transfers all the fields present into a common area in core of the calling program. With each call to this subroutine, all master and independent-dependent parameter pairs are transferred to the common area. Author - Walter Morawski (748 bytes (object form), Assembler).

Subroutine CANADA computes Canadian ten-degree, five-degree, two-degree, one-degree, and quarter-degree squares from latitude and longitude degrees and minutes. Authors - Walter Morawski and Gary Keull (5K, FORTRAN IV-G).

Subroutine CREATE creates GAS records when called from a user's program. Author - Walter Morawski (630 bytes (object form), Assembler).

GAS accesses the major files of NODC and creates records compatible with the GAS system. Author - Walter Morawski (96K, FORTRAN IV-G).

MONTH80 selects all stations with a month entry that corresponds to a particular control card entry. Author - Gary Keull (44K, Assembler).

CHEM80 selects all stations with a non-zero chemistry percentage that corresponds to a control card entry. Author - Gary Keull (44K, Assembler).

DEPTH80 selects all stations with a maximum depth greater than the control card entry. Author - Gary Keull (24K, Assembler).

LATLON80 selects an area based on latitude and longitude degrees and minutes entered in a control card. Author - Gary Keull (44K, Assembler).

GASORDER selects certain GAS records (specified by cruise and consec numbers) from an input tape and inserts a sort-order number in an unused area. The output, when sorted on this order number, will be in whatever order the user has specified on the control cards. Author - Walter Morawski (38K, Assembler).

GASVASUM reads GAS type 1, 2, or 3 records and produces three output GAS format records that contain a vertical array summary. (Depth, Max, Avg, Min, Number, Standard Deviation). Summaries are at NODC standard levels, five meter intervals, or ten meter intervals, depending on the input. Author - Walter Morawski (86K, FORTRAN IV-G).

ALTERGAS reads a primary GAS file and finds matches to these records in an auxiliary GAS file. Before outputting, records may be altered and a single file of records may be altered in any way. Author - Walter Morawski (90K, FORTRAN IV-G).

GASB accesses several major files at NODC and creates records compatible with GAS. Author - Walter Morawski (90K, FORTRAN IV-G with Assembler input-output routines).

NODCSQ takes the latitude and longitude fields from the GAS master fields and computes the NODC ten-degree, five-degree, two-degree, one-degree, quarter-degree, and six-minute squares and replaces them into the master field arrays. Author - Walter Morawski (2K, FORTRAN IV-G).

NAMES prints the names of the dependent and independent parameters of the GAS system. At present, there are 29 names which may be printed all at once or singularly; this subroutine is used in program GASDIPBS for output type 2 listings. Author - Gary Keull (28K, FORTRAN IV-G).

SD2GAS accesses the NODC SD2 (station data 2) file, selects upon various criteria, and outputs GAS records of various types; user may at same time output regular SD2 records for use by non-GAS programs. The following options are available:

- A. Standard and/or observed depths only will be returned;
- B. If a value is missing at a particular level, it may be interpolated;
- C. Doubtful and questionable data may or may not be included;
- D. Chemistry values may be shifted to NODC prescribed nearest standard levels.

Output formats available:

- -1 Basic GAS master fields;
- -2 Basic GAS master fields and all supplementary fields present;
- 0 Basic GAS master fields and one independent-dependent parameter pair;
- 1 Basic GAS master fields and parameter pairs at five-meter intervals;
- 2 Basic GAS master fields and parameter pairs at ten-meter intervals;
- 3 Basic GAS master fields and parameter pairs at Nansen levels;
- 4 Basic GAS master fields and parameter pairs whenever they appeared in that particular record;
- 5 Basic GAS master fields and parameter pairs at depth intervals specified by the user.

Author - Walter Morawski (96K, FORTRAN IV-G).

GASSCUDS summarizes SCUDS (surface current-ship drift) records by area, ten-degree, five-degree, two-degree, one-degree, quarter-degree, one-tenth-degree squares, year, month, or day. Outputs produced are optional. Variations include two print formats or two tape formats. Parameters include all geographic information, month, year, day, north and east components, resultant speed and direction, total observations, number of calms, max and mean speeds, and standard deviation. Also available is a distribution of individual observations by speed and direction. Authors - Gary Keull and Walter Morawski (80K, FORTRAN IV-G).

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Washington, DC 20235	Telephone (202) 634-7439

Other NODC Programs — Hardware - IBM 360-65

STD Data:

STDRETV retrieves records from the STD geofile; sections are made on the basis of optional select fields; with one exception, these select fields are located in the master records. Author - Robert Van Wie (Assembler).

Station Data:

SD2TOSD1 converts station data from SD2 variable length record to SD1 80 or 83 byte records. Author - Walter Morawski (36K bytes, Assembler).

SDCHAR processes a series of 83 byte records to construct a one-record-per-station file of variable length character records. Author - Robert Van Wie (92K bytes, PL/1).

SDPRT2 produces an edited listing of the SD2 variable length record or data in the 80 byte format. Author - Sally Heimerdinger (36K bytes, Assembler).

SDSELECT selects SD1 records by Marsden square, one-degree square, or card type. Author - Michael Flanagan (24K bytes, Assembler).

SD2MSTCT counts the number of SD2 records and prints the first 50 records and the last record. Author - Elmer Freeman (50K bytes, Assembler).

SD2SAMP selects five records from SD2 tape; used to give users a sample of SD2 data. Author - Walter Morawski (36K bytes, Assembler).

SDGEOIV reads SD2 master file and summarizes the number of stations by month, year, one-degree square, five-degree square, and modified Canadian (ten-degree) square; best results are obtained when running against a geographically sorted file. Author - Michael Flanagan (14K bytes, PL/1).

MAKE120 converts an 80 or 83 byte record from the NODC station data geofile to the 120 character zone-edit format for the IBM 7074. Author - Walter Morawski (36K bytes, Assembler).

DEPTH selects full station data records with depths greater than a given hundred-meter interval. Author - J. Gordon (17K bytes, Assembler).

CRUCON reads either the SD2 file or SD2 master file and prints the NODC cruise consec number inventory. Author - Walter Morawski (36K bytes, Assembler).

CODCCONV converts station data in the format of the Marine Environmental Data Service (formerly CODC - Canadian Oceanographic Data Center) to the NODC format. A table of control cards is required to convert the Canadian cruise reference numbers to the NODC system. Author - Walter Morawski (24K bytes, Assembler).

SUPERSEL selects from the SD2 geofile or master file by Canadian (ten-degree) square. Input file is sorted in Canadian square order; output is identical in format, but contains only the data from the desired Canadian squares. Author - Walter Morawski (36K bytes, Assembler).

SDPASS retrieves SD2 records from either the cruise-sorted file, the geosorted file, or the master file. Output is on one of four formats: (1) the original variable length record; (2) a series of 80 byte fixed-length records; (3) 105 byte fixed-length records; (4) undefined records. Author - Robert Van Wie (Assembler).

Expendable Bathythermograph Data:

XORDER selects XBT data by cruise consec number, inserts a sort number in an unused space; the output, when sorted on this number, will be in whatever order was specified by the user on control cards. Author - Walter Morawski (36K bytes, Assembler).

XBEVALU compares production with standard sample XBT's; sorts input by reference number and consec number before testing and evaluation; prints evaluation statistics. Author - Michael Flanagan (PL/1).

XBTQKOUT enables the user to choose the type of XBT output and the mode of output. Author - Philip Hadsell (60K bytes, FORTRAN IV-G).

XBCONV converts data from seven-track tapes in old NODC XBT format to new NODC format suitable for nine-track tape. Input: Contractor-processed XBT's. Output on disk. Author - Pearl Johnson (56K bytes, PL/1-4).

XBTCOUNT gives a station count of XBT data from either the cruise file or the geofile. Author - Elmer Freeman (Assembler).

XBFNWC, run after XBFNWSUM, reads control cards providing cruise and other master information and, for each cruise, converts (or deletes) Fleet Numerical Weather Central XBT data to the NODC XBT tape record format. Author - Judy Yavner (50K bytes, PL/1).

XBFNWSUM provides a summary of the cruises contained on a file of XBT data from Fleet Numerican Weather Central. Author - Judy Yavner (22K bytes, PL/1).

XBSELECT retrieves from the XBT data file by inputting the desired FORTRAN "if" statements. Author - Philip Hadsell (9K bytes, FORTRAN IV-G).

RETXBT retrieves records from the XBT cruise file or the XBT geofile. Author - Robert Van Wie (Assembler).

XBTCONV converts the XBT binary-character formatted records to an undefined all-character record with a maximum length of 2,500 bytes; primarily used to satisfy requests for XBT data on seven-track tape. Author - Sally Heimerdinger (650 bytes plus 2 times the sum of the buffer lengths, Assembler).

XBMSINV, using the subroutine XBREAD, reads cruise-ordered XBT data and produces a summary of each cruise (one line per cruise), indicating the NODC cruise number, the number of observations per cruise, the beginning and ending dates, the NODC ship code, and the originator's cruise number. Author - Philip Hadsell (FORTRAN).

XBGEOSUM prints a summary of the number of observations within given seasons, one-degree squares, ten-degree squares, and quadrants. Author - Philip Hadsell (80K bytes, FORTRAN IV-G).

Mechanical Bathythermograph Data:

RETBT retrieves records from the BT cruise file or the BT geofile. Author - Robert Van Wie (Assembler).

BTLISTC provides edited printout with headings of the NODC geographically-sorted bathythermograph file. Author - Michael Flanagan (2600 bytes, Assembler).

BTGEOIV reads the bathythermograph file, summarizes the number of stations by month, year, one-degree square, five-degree square, and Marsden square. Author - Charlotte Sparks (14K bytes, PL/1).

Other NODC programs:

SCHNINE prints data from H1-9 surface current file; produces simultaneously any one of the following combinations: (1) edited listing of the entire file; (2) edited listing and punched cards, both for the entire file; or (3) edited listing, unedited listing, and magnetic tape, all for only the first 100 records. Author - Rosa T. Washington (Less than 56K bytes, PL/1).

SCMULTI outputs surface current data in any one of the following combinations: (1) edited listing of the entire file; (2) edited listing and punched cards for the entire file; or (3) edited listing, unedited listing, and magnetic tape, all for only the first 100 records. Author - Rosa T. Washington (72K bytes, PL/1).

DRYLAND reads a sequential tape file and identifies any one-degree square which is completely on land. Author - Robert Van Wie (30K bytes, PL/1).

CANWMO computes a WMO square, given a Modified Canadian square. Requires subroutines GRIDSQ, TENSQ, and WMO. Author - Robert Van Wie (FORTRAN).

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Reformatted Station Output — Language - FORTRAN
IBM 1 — Hardware - IBM 370

Outputs formatted hydrographic and nutrient chemical data by station; input is NOAA format raw data. Author - Stephen A. Macko.

B.J. McAlice
Ira C. Darling Center (Marine Laboratory)
University of Maine at Orono
Walpole, ME 04573

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GENERAL INDEX

LANGUAGE INDEX

FORTRAN

126	FORTRAN	CDC 3300/OS3 TIME SERIES ARAND	ARMAP
126	FORTRAN	CDC 3300/OS3 TIME SERIES ARAND	AUTO
126	FORTRAN	CDC 3300/OS3 TIME SERIES ARAND	AUTOPLT
126	FORTRAN	CDC 3300/OS3 TIME SERIES ARAND	AXISL
126	FORTRAN	CDC 3300/OS3 TIME SERIES ARAND	CCFFT
127	FORTRAN	CDC 3300/OS3 TIME SERIES ARAND	CCORR
127	FORTRAN	CDC 3300/OS3 TIME SERIES ARAND	CONPLT
127	FORTRAN	CDC 3300/OS3 TIME SERIES ARAND	COMPLOT
127	FORTRAN	CDC 3300/OS3 TIME SERIES ARAND	CONFID
127	FORTRAN	CDC 3300/OS3 TIME SERIES ARAND	CONFID 1
127	FORTRAN	CDC 3300/OS3 TIME SERIES ARAND	CONMODE
127	FORTRAN	CDC 3300/OS3 TIME SERIES ARAND	COPH
127	FORTRAN	CDC 3300/OS3 TIME SERIES ARAND	CCSTR
127	FORTRAN	CDC 3300/OS3 TIME SERIES ARAND	CPEES
127	FORTRAN	CDC 3300/OS3 TIME SERIES ARAND	CPLT1
127	FORTRAN	CDC 3300/OS3 TIME SERIES ARAND	CPLT2
127	FORTRAN	CDC 3300/OS3 TIME SERIES ARAND	CROPLT
127	FORTRAN	CDC 3300/OS3 TIME SERIES ARAND	CRCSS
127	FORTRAN	CDC 3300/OS3 TIME SERIES ARAND	CUSID
127	FORTRAN	CDC 3300/OS3 TIME SERIES ARAND	CUSFO
128	FORTRAN	CDC 3300/OS3 TIME SERIES ARAND	CZT
128	FORTRAN	CDC 3300/OS3 TIME SERIES ARAND	DATPLT
128	FORTRAN	CDC 3300/OS3 TIME SERIES ARAND	DEMOD1
128	FORTRAN	CDC 3300/OS3 TIME SERIES ARAND	DEMOD2
128	FORTRAN	CDC 3300/OS3 TIME SERIES ARAND	DEMOD3
128	FORTRAN	CDC 3300/OS3 TIME SERIES ARAND	DETRND
128	FORTRAN	CDC 3300/OS3 TIME SERIES ARAND	DIFF12
128	FORTRAN	CDC 3300/OS3 TIME SERIES ARAND	EUREKA
128	FORTRAN	CDC 3300/OS3 TIME SERIES ARAND	EXSMO
129	FORTRAN	CDC 3300/OS3 TIME SERIES ARAND	FFIN
128	FORTRAN	CDC 3300/OS3 TIME SERIES ARAND	FFINI
128	FORTRAN	CDC 3300/OS3 TIME SERIES ARAND	FFTCNV
128	FORTRAN	CDC 3300/OS3 TIME SERIES ARAND	FFTPS
128	FORTRAN	CDC 3300/OS3 TIME SERIES ARAND	FFTS
128	FORTRAN	CDC 3300/OS3 TIME SERIES ARAND	FFTSPC
128	FORTRAN	CDC 3300/OS3 TIME SERIES ARAND	FILTER1
128	FORTRAN	CDC 3000/OS3 TIME SERIES ARAND	FIVET
129	FORTRAN	CDC 3300/OS3 TIME SERIES ARAND	FOLD
129	FORTRAN	CDC 3300/OS3 TIME SERIES ARAND	FOURTR
129	FORTRAN	CDC 3300/OS3 TIME SERIES ARAND	FOUSPC
129	FORTRAN	CDC 3300/OS3 TIME SERIES ARAND	FOUSPC1
129	FORTRAN	CDC 3300/OS3 TIME SERIES ARAND	FOUSPC2
129	FORTRAN	CDC 3300/OS3 TIME SERIES ARAND	FRESPON
129	FORTRAN	CDC 3300/OS3 TIME SERIES ARAND	GAPH
129	FORTRAN	CDC 3300/OS3 TIME SERIES ARAND	GENER1
129	FORTRAN	CDC 3300/OS3 TIME SERIES ARAND	GENER2
129	FORTRAN	CDC 3300/OS3 TIME SERIES ARAND	GENER3
129	FORTRAN	CDC 3300/OS3 TIME SERIES ARAND	LOGPLOT
129	FORTRAN	CDC 3300/OS3 TIME SERIES ARAND	NO12T
129	FORTRAN	CDC 3300/OS3 TIME SERIES ARAND	PHAPLT
129	FORTRAN	CDC 3300/OS3 TIME SERIES ARAND	PLTFOR
129	FORTRAN	CDC 3300/OS3 TIME SERIES ARAND	PLTFRQ
129	FORTRAN	CDC 3300/OS3 TIME SERIES ARAND	PLTSPC
130	FORTRAN	CDC 3300/OS3 TIME SERIES ARAND	POLRT
130	FORTRAN	CDC 3300/OS3 TIME SERIES ARAND	POLYDV
130	FORTRAN	CDC 3300/OS3 TIME SERIES ARAND	PROPLT
130	FORTRAN	CDC 3300/OS3 TIME SERIES ARAND	PSORT
130	FORTRAN	CDC 3300/OS3 TIME SERIES ARAND	RANDM
130	FORTRAN	CDC 3300/OS3 TIME SERIES ARAND	RCTFFT
130	FORTRAN	CDC 3300/OS3 TIME SERIES ARAND	RESPON

130	FORTRAN	CDC 3300/OS3	TIME SERIES ARAND REVERS
130	FORTRAN	CDC 3300/OS3	TIME SERIES ARAND RPLACE
130	FORTRAN	CDC 3300/OS3	TIME SERIES ARAND RRVERS
130	FORTRAN	CDC 3300/OS3	TIME SERIES ARAND SARIT
130	FORTRAN	CDC 3300/OS3	TIME SERIES ARAND SERGEN
130	FORTRAN	CDC 3300/OS3	TIME SERIES ARAND SHAPE
130	FORTRAN	CDC 3300/OS3	TIME SERIES ARAND SINTR
130	FORTRAN	CDC 3300/OS3	TIME SERIES ARAND SMO
130	FORTRAN	CDC 3300/OS3	TIME SERIES ARAND SPEC
130	FORTRAN	CDC 3300/OS3	TIME SERIES ARAND SPECT1
130	FORTRAN	CDC 3300/OS3	TIME SERIES ARAND SPECT2
131	FORTRAN	CDC 3300/OS3	TIME SERIES ARAND TAUTOPLT
131	FORTRAN	CDC 3300/OS3	TIME SERIES ARAND TCOHPLT
131	FORTRAN	CDC 3300/OS3	TIME SERIES ARAND TCROPLT
131	FORTRAN	CDC 3300/OS3	TIME SERIES ARAND TFORM1
131	FORTRAN	CDC 3300/OS3	TIME SERIES ARAND TFORM2
131	FORTRAN	CDC 3300/OS3	TIME SERIES ARAND TIMSPC
131	FORTRAN	CDC 3300/OS3	TIME SERIES ARAND TLOGPLT
131	FORTRAN	CDC 3300/OS3	TIME SERIES ARAND TNOIZT
131	FORTRAN	CDC 3300/OS3	TIME SERIES ARAND TPHAPLT
131	FORTRAN	CDC 3300/OS3	TIME SERIES ARAND TPLTFRQ
131	FORTRAN	CDC 3300/OS3	TIME SERIES ARAND TPLTSPC
131	FORTRAN	CDC 3300/OS3	TIME SERIES ARAND TRISMO
132	FORTRAN	CDC 3300/OS3	TIME SERIES ARAND TSGEN
132	FORTRAN	CDC 3300/OS3	TIME SERIES ARAND TSPECT1
132	FORTRAN	CDC 3300/OS3	TIME SERIES ARAND TSPECT2
132	FORTRAN	CDC 3300/OS3	TIME SERIES ARAND TRANFR
132	FORTRAN	CDC 3300/OS3	TIME SERIES ARAND TRANFRM
132	FORTRAN	CDC 3300/OS3	TIME SERIES ARAND TTYCON
132	FORTRAN	CDC 3300/OS3	TIME SERIES ARAND TTYNUM
132	FORTRAN	CDC 3300/OS3	TIME SERIES ARAND UNLEAV
132	FORTRAN	CDC 3300/OS3	TIME SERIES ARAND USES
132	FORTRAN	CDC 3300/OS3	TIME SERIES ARAND USFC
132	FORTRAN	CDC 3300/OS3	TIME SERIES ARAND USIC
132	FORTRAN	CDC 3300/OS3	TIME SERIES ARAND USPE
132	FORTRAN	CDC 3300/OS3	TIME SERIES ARAND WINDOW
133	FORTRAN	CDC 3300/OS3	TIME SERIES ARAND WINDOW1
25	FORTRAN	IBM 370/155	ESTUARINE DENSITY CURRENTS AND SALINITY
116	FORTRAN	IBM 360	DENDROGRAPH
116	FORTRAN	IBM 370	DENDROGRAPH
142	FORTRAN	IBM 1800	TRIGONOMETRY SUBROUTINES ASSUB SAS ASA
149	FORTRAN	IBM 1800	FORMAT FREE INPUT SUBROUTINE QREAD
149	FORTRAN	IBM 1800	METERS VS FATHOMS MATBL
144	FORTRAN	IBM 1800	DATE CALCULATIONS DAYWK
144	FORTRAN	IBM 1800	DATE CALCULATIONS NWDAT
144	FORTRAN	IBM 1800	DATE CALCULATIONS NXTDY
144	FORTRAN	IBM 1800	DATE CALCULATIONS YSTDY
145	FORTRAN	IBM 1800	JULIAN DAY SUBROUTINES CLEJL
145	FORTRAN	IBM 1800	JULIAN DAY SUBROUTINES CLJUL
145	FORTRAN	IBM 1800	TIME CONVERSION DTIME
105	FORTRAN	IBM 1800	PLOTS MERCATOR GRID CHART
105	FORTRAN	IBM 1800	NAVIGATIONAL SATELLITE PASSES ALRTX
106	FORTRAN	IBM 1800	LORAN FIX LPFIX
106	FPRTRAN	IBM 1800	PLAN COURSE AND SCHEDULE CRUIS
106	FORTRAN	IBM 1800	EARTH SPHERICAL SUBROUTINES ESTCH ESTC2 ESTPL
107	FORTRAN	IBM 1800	DEGREE CONVERSIONS DEGFR DEMI
107	FORTRAN	IBM 1800	MERCATOR DEGREES DMRCT
107	FORTRAN	IBM 1800	MAGNETIC FIELD COMPONENTS MAGFI
51	FORTRAN	CDC 3600	SPECIES AFFINITIES REGROUP
116	FORTRAN	CDC 3600	X-Y PLOTS MUCPAK
153	FORTRAN	IBM 370	REFORMATTED STATION OUTPUT IBM 1
55	FORTRAN	IBM 370	CHLOROPHYLL CHLOR

55 FORTRAN	IBM 370	PHYTOPLANKTON POPULATION DENSITY
55 FORTRAN	IBM 370	SPECIES DIVERSITY
20 FORTRAN	PDP-11	GENERAL PURPOSE EDITOR OMSEC
20 FORTRAN	PDP-11	TIME SERIES INTO PROFILES OMSCHP
20 FORTRAN	PDP-11	AANDERAA CURRENT METER DATA AACAL
20 FORTRAN	PDP-11	CURRENT PROFILER DATA MK2CAL
20 FORTRAN	PDP-11	APPENDS NEW DATA TO FILE DERIVE
20 FORTRAN	UNIVAC 1106	APPENDS NEW DATA TO FILE DERIVE
20 FORTRAN	UNIVAC 1106	CONCATENATES SORTS SEGMENTS OUTPUTS OMSCRT
20 FORTRAN	UNIVAC 1106	INTERPOLATES TO UNIFORM GRID MATRIX O1
20 FORTRAN	UNIVAC 1106	TIME SERIES STD OR PCM PROFILES PLSAD
20 FORTRAN	UNIVAC 1106	INTERNAL WAVES IWEG
20 FORTRAN	UNIVAC 1106	DYNAMICAL FIELDS INTERNAL WAVE RAYS CHRSEC
20 FORTRAN	UNIVAC 1106	AUTO AND CROSS SPECTRA TUKEY METHOD
20 FORTRAN	UNIVAC 1106	AUTO AND CROSS SPECTRA POLARIZED FORM CMXSPC
20 FORTRAN	UNIVAC 1106	AMPLITUDES PHASES LEAST SQUARES TIDES4
20 FORTRAN	UNIVAC 1106	METEOROLOGICAL FLUXES METFLX
20 FORTRAN	UNIVAC 1106	CROSS COVARIANCE MATRIX EMPEIGI
28 FORTRAN	IBM 370/155	MODELING AN OCEAN POND
143 FORTRAN	HP 2100	THERMOMETER CORRECTION DEPTH COMP HYD1
50 FORTRAN	IBM 370	OPTIMAL ECOSYSTEM POLICIES OEP
72 FORTRAN	CDC 3100	DANISH ADVECTION PROGRAM
83 FORTRAN	CDC 3100	SINGULAR WAVE PREDICTION MODEL
83 FORTRAN	CDC 3200	SINGULAR WAVE PREDICTION MODEL
22 FORTRAN	IBM 360	SPECIFIC CONDUCTIVITY WITH PRESSURE EFFECT
87 FORTRAN	CDC 1604	OCEAN CLIMATOLOGY ANALYSIS MODEL ANALYS
68 FORTRAN	CDC 3100	MIXED LAYER DEPTH ANALYSIS MODEL MEDMLD
88 FORTRAN	CDC 3100	ATMOSPHERIC WATER CONTENT MODEL
89 FORTRAN	CDC 1604	WIND COMPUTATION FROM SHIP OBSERVATIONS TRUWIND
75 FORTRAN	CDC 7600	OPTIMIZED MULTI-LAYER HN MODEL
75 FORTRAN	CDC 3100	OPTIMIZED MULTI-LAYER HN MODEL
75 FORTRAN	CDC 6500	MEAN DRIFT ROUTINE
75 FORTRAN	CDC 1604	MEAN DRIFT ROUTINE
120 FORTRAN	IBM 360/65	SEQUENTIAL PLOTTING
121 FORTRAN	UNIVAC 1108	OVERLAY PLOTTING CVLPLT
99 FORTRAN	UNIVAC 1108	RAY PATH SC4346
76 FORTRAN	CDC 6500	SEARCH AND RESCUE PLANNING NSAR
57 FORTRAN	CDC 6600	GENERALIZED STOCK PRODUCTION MODEL PRODFIT
57 FORTRAN	B 6700	GENERALIZED STOCK PRODUCTION MODEL PRODFIT
87 FORTRAN	B 6700	SUMMARIZES WEATHER REPORTS
97 FORTRAN	CDC 3100	SOUND SPEED COMPUTATION MODEL SCVEL
97 FORTRAN	CDC 3200	SOUND SPEED COMPUTATION MODEL SCVEL
97 FORTRAN	CDC 1604	SOUND SPEED COMPUTATION MODEL SCVEL
123 FORTRAN	CDC 6600	DISPLAYS VHRR SATELLITE DATA V5DMD
123 FORTRAN	IBM 360/195	MICROFILM PLOTS OF VHRR SATELLITE DATA
139 FORTRAN	IBM 1800	BARTLETT'S CURVE FITTING
136 FORTRAN	IBM 1800	CLUSTER ANALYSIS
103 FORTRAN	IBM 1800	SATELLITE NAVIGATION
13 FORTRAN	CDC 3600	CONVERTS STD DATA AGEDTP
13 FORTRAN	CDC 3600	CORRECTS STD DATA IPMOD
56 FORTRAN	B 6700	LENGTH FREQUENCY ANALYSIS LENFRE
56 FORTRAN	B 6700	YIELD PER RECRUIT FOR MULTI-GEAR FISHERIES
57 FORTRAN	B 6700	A GENERALIZED EXPLOITED POPULATION SIMULATOR
57 FORTRAN	CDC 6600	A GENERALIZED EXPLOITED POPULATION SIMULATOR
117 FORTRAN	CDC CYBER	X-Y PLOTS IN A FLEXIBLE FORMAT MEDSPLOT
4 FORTRAN	CDC 6400	DATA MGT SYS FOR PHYS CHEM DATA OCEANSV
85 FORTRAN	IBM 360/40	WATER WAVE TEACHING AIDS PROF1
85 FORTRAN	IBM 360/40	WATER WAVE TEACHING AIDS UMAX1
85 FORTRAN	IBM 360/40	WATER WAVE TEACHING AIDS UTMAX1
85 FORTRAN	IBM 360/40	WATER WAVE TEACHING AIDS WMAX1
85 FORTRAN	IBM 360/40	WATER WAVE TEACHING AIDS LENGI
85 FORTRAN	IBM 360/40	WATER WAVE TEACHING AIDS DETRND

85	FORTRAN	IBM 360/40	WATER WAVE TEACHING AIDS WTMAX2
85	FORTRAN	IBM 360/40	WATER WAVE TEACHING AIDS UCFT1
85	FORTRAN	IBM 360/40	WATER WAVE TEACHING AIDS WOFT1
85	FORTRAN	IBM 360/40	WATER WAVE TEACHING AIDS UTCFT1
85	FORTRAN	IBM 360/40	WATER WAVE TEACHING AIDS WTCFT1
85	FORTRAN	IBM 360/40	WATER WAVE TEACHING AIDS AUTCOV
85	FORTRAN	IBM 360/40	WATER WAVE TEACHING AIDS CRSCOV
85	FORTRAN	IBM 360/40	WATER WAVE TEACHING AIDS FCURTR
86	FORTRAN	IBM 360/40	WATER WAVE TEACHING AIDS PROFILE
86	FORTRAN	IBM 360/40	WATER WAVE TEACHING AIDS REFL1
86	FORTRAN	IBM 360/40	WATER WAVE TEACHING AIDS FORCE AND MOVEMENT
85	FORTRAN	IBM 360/40	WATER WAVE TEACHING AIDS EDSIT
63	FORTRAN	B 6700	YIELD CURVES WITH CONSTANT RATES TCPF2
63	FORTRAN	B 6700	EUMETRIC YIELD TCPF3
64	FORTRAN	B 6700	PIECEWISE INTEGRATION OF YIELD CURVES TCPF4
64	FORTRAN	B 6700	PIECEWISE INTEGRATION OF YIELD CURVES
65	FORTRAN	B 6700	CONSTANTS IN SCHAEFER'S MODEL TCPF6
65	FORTRAN	B 6700	SCHAEFER LOGISTICS MODEL OF FISH PRODUCTION
65	FORTRAN	B 6700	FITS GENERALIZED STOCK PRODUCTION MODEL TCPF8
65	FORTRAN	B 6700	BIOMETRY-LINEAR REGRESSION ANALYSIS TCSA1
66	FORTRAN	B 6700	GENERALIZED WEIGHTED LINEAR REGRESSION
66	FORTRAN	B 6700	LINEAR REGRESSION, BOTH VARIABLES
66	FORTRAN	B 6700	BIOMETRY-PRODUCT-MOMENT CORRELATION
67	FORTRAN	B 6700	COOLEY-LONNES MULTIPLE-REGRESSION
67	FORTRAN	B 6700	BIOMETRY-GOODNESS OF FIT
67	FORTRAN	B 6700	BIOMETRY-BASIC STATISTIC FOR UNGROUPED DATA
68	FORTRAN	B 6700	BIOMETRY-BASIC STATISTIC FOR GROUPED DATA
68	FORTRAN	B 6700	BIOMETRY-SINGLE CLASSIFICATION ANOVA
68	FORTRAN	B 6700	BIOMETRY-FACTORIAL ANOVA TCSD2
69	FORTRAN	B 6700	BIOMETRY-SUM OF SQUARES STP TCSD3
69	FORTRAN	B 6700	BIOMETRY-STUDENT-NEWMAN-KEULS TEST TCSD4
69	FORTRAN	B 6700	BIOMETRY-TEST OF HOMOGENEITY
69	FORTRAN	B 6700	BIOMETRY-TEST OF EQUALITY
70	FORTRAN	B 6700	BIOMETRY-TUKEY'S TEST
70	FORTRAN	B 6700	BIOMETRY-KRUSKAL-WALLIS TEST TCSE4
70	FORTRAN	B 6700	BIOMETRY-FISHER'S EXACT TEST TCSE5
71	FORTRAN	B 6700	BIOMETRY-R X C TEST OF INDEPENDENCE MAP
29	FORTRAN		NUMERICAL MDL ESTUARY DYNAMICS & KINEMATICS
28	FORTRAN		SALINITY DISTRIBUTION IN ONE-DIMENSIONAL ESTUARY
1	FORTRAN	HP 2115A	DIGITIZES STD DATA DEEP
2	FORTRAN	HP 2115A	STD PROCESSING WET
58	FORTRAN	B 6700	NORMAL DISTRIBUTION SEPARATOR TCPA1
58	FORTRAN	B 6700	SPAWNER-RECRUIT CURVE FITTING TCPA2
58	FORTRAN	B 6700	WEIGHT-LENGTH CURVE FITTING TCPA3
59	FORTRAN	B 6700	AGE COMPOSITION ESTIMATION TCPB1
59	FORTRAN	B 6700	ESTIMATE CATCH NUMBERS PERCENT WEIGHT
59	FORTRAN	B 6700	LENGTH-FREQUENCY DISTRIBUTION
60	FORTRAN	B 6700	VON BERTALANFFY GROWTH CURVE FITTING TCPC1
60	FORTRAN	B 6700	VON BERTALANFFY GROWTH UNEQUAL AGE INTERVAL
60	FORTRAN	B 6700	VON BERTALANFFY GROWTH EQUAL AGE INTERVAL
61	FORTRAN	B 6700	VON BERTALANFFY GROWTH CURVE FITTING TCPC4
64	FORTRAN	B 6700	ESTIMATION OF LINEAR GROWTH
61	FORTRAN	B 6700	FISHING POWER ESTIMATION TCPD1
62	FORTRAN	B 6700	SURVIVAL RATE ESTIMATION TCPE1
63	FORTRAN	B 6700	FISHING MORTALITIES ESTIMATION TCPE2
63	FORTRAN	B 6700	RELATIVE YIELD PER RECRUIT
17	FORTRAN	CDC 6600	INTERNAL WAVE OSCILLATIONS 2MODE
17	FORTRAN	CDC 7600	INTERNAL WAVE OSCILLATIONS 2MODE
87	FORTRAN	CDC 6400	PYRANOMETER AND RADIOMETER TIME SERIES RAD
152	FORTRAN	IBM 360/65	XBTQKCUT '
18	FORTRAN	IBM 360/65	ISENTROPIC INTERPOLATION
18	FORTRAN	IBM 360/65	SIGMAT

18	FORTRAN	IBM 360/65	SALINITY FROM CONDUCTIVITY T P SALINE
19	FORTRAN	IBM 360/65	VOLUME TRANSPORT FUNCTION QFUN
22	FORTRAN	IBM 360	CO2 AND DC SAT
97	FORTRAN	IBM 360/65	SOUND VELOCITY WILSONS FORMULA WLSND
97	FORTRAN	IBM 360/65	SOUND VELOCITY WILSONS FORMULA SVELFS
97	FORTRAN	IBM 360/65	SOUND VELOCITY WILSONS FORMULA VELPRS
116	FORTRAN	CDC 3300	VERTICAL BAR GRAPHS
4	FORTRAN	IBM 360/50	CONSISTENCY OF PHYSICAL AND CHEMICAL DATA
4	FORTRAN		CALCULATION OF THERMOMETRIC VALUES
4	FORTRAN		STATION DATA SYSTEM FINAL VALUES
102	FORTRAN		RAY TRACING KLERER-MAY USER LANGUAGE
135	FORTRAN	IBM 7090	FOURIER ANALYSIS L101
134	FORTRAN	IBM 7090	TWO-DIMENSIONAL AUTOCORRELATION
134	FORTRAN	IBM 1401	TWO-DIMENSIONAL AUTOCORRELATION
118	FORTRAN	CDC 3100	SECTION PLOTTING
118	FORTRAN	PDP-8	SECTION PLOTTING
79	FORTRAN	CDC 3150	CURRENT METER DATA PROCESSING SYSTEM TIDE
139	FORTRAN	IBM 7074	LEAST SQUARES PLOT
139	FORTRAN	UNIVAC 1108	TEMPERATURE SALINITY CORRECTIONS CURVEFIT NIS512
139	FORTRAN	PDP-9	BARTLETT'S CURVE FITTING
121	FORTRAN		PRODUCES CONTOUR CHARTS GRIDIT
121	FORTRAN		PRODUCES CONTOUR CHARTS AUTOMATED CONTOUR
100	FORTRAN	IBM 7074	CRITICAL ACOUSTIC RATIO
97	FORTRAN	UNIVAC 1108	SOUND VELOCITY FOR MARINE SEDIMENTS
98	FORTRAN	IBM 7074	LIGHT AND SOUND INSTRUCTION B
45	FORTRAN	IBM 7074	LIGHT AND SOUND INSTRUCTION D
144	FORTRAN	IBM 7074	BATHYMETRIC DATA REDUCTION
14	FORTRAN	IBM 7074	MONTHLY SONIC LAYER DEPTH
14	FORTRAN	IBM 7074	VERTICAL TEMPERATURE GRADIENTS
137	FORTRAN	IBM 7074	SINGLE INTEGRATION
111	FORTRAN	IBM 7074	GEODETIC DATUM REDUCTION
111	FORTRAN	IBM 7074	GEODETIC POSITION COMPUTATION AND PLOT
111	FORTRAN		ASTRONOMIC LATITUDE
112	FORTRAN	CDC 3100	SOUNDING PLOT
112	FORTRAN	IBM 7074	SOUNDING PLOT
112	FORTRAN	IBM 7074	SINGLE INTEGRATION
112	FORTRAN	CDC 3100	SODANO INVERSE
89	FORTRAN	IBM 7074	SOLAR RADIATION CONVERSION
89	FORTRAN	IBM 7074	WIND STRESS
89	FORTRAN	IBM 7074	TWO-DIMENSIONAL POWER SPECTRUM FOR SWOP II
90	FORTRAN	IBM 7074	PREDICTION OF VERTICAL TEMPERATURE CHANGE
90	FORTRAN	IBM 7074	CLOUD COVER AND DAILY SEA TEMPERATURE
46	FORTRAN	IBM 7074	SEAMOUNT MAGNETIZATION
46	FORTRAN	IBM 7074	OBSERVATION GRADING GRAVITY
48	FORTRAN	UNIVAC 1108	SEDIMENT SIZE
76	FORTRAN	IBM 7074	CURRENT METER TURBULENCE
76	FORTRAN	UNIVAC 1108	WATER DISPLACEMENT DISPLA
109	FORTRAN	UNIVAC 1108	FAA PLOT
109	FORTRAN	UNIVAC 1108	DISTANCE AND AZIMUTH DIRAZD
109	FORTRAN	UNIVAC 1108	PARAMETRIC MAP
110	FORTRAN	UNIVAC 1108	LORAN TO GEOGRAPHIC AND/GEOGRAPHIC TO LORAN
110	FORTRAN	UNIVAC 1108	LORAN COORDINATE COMPUTATION
110	FORTRAN	UNIVAC 1108	LORAN SKYWAVE CORRECTION
15	FORTRAN	CDC 3200	INTERPOLATION FOR OCEANOGRAPHIC DATA
15	FORTRAN	IBM 1620	INTERPOLATION FOR OCEANOGRAPHIC DATA
75	FORTRAN	CDC 3300	CURRENT METER DATA CREATE-C
75	FORTRAN	CDC 3300	CURRENT METER DATA CURRENT
75	FORTRAN	CDC 3300	CURRENT METER DATA CURRPLOT
75	FORTRAN	CDC 3300	CURRENT METER DATA SPECTRUM
93	FORTRAN	CDC 6400	HORIZONTAL RANGE
120	FORTRAN	CDC 3800	LINE PRINTER PLOTS
16	FORTRAN	CDC 3800	INTERNAL GRAVITY WAVES DISPER

107	FORTRAN	CDC 3800	ANNCTATED TRACK ON STEREOGRAPHIC PROJECTICN
85	FORTRAN	CDC 3800	MIE SCATTERING COMPUTATIONS
47	FORTRAN	CDC 3600	PLCTS TRACK AND DATA PROFILE TRACK
47	FORTRAN	CDC 3600	PLCTS TRACK AND DATA PROFILE TRACK
47	FORTRAN	CDC 3800	GECDATA
47	FORTRAN	CDC 3600	GECDATA
47	FORTRAN	CDC 3600	MAGNETIC SIGNATURES MAGPLOT
47	FORTRAN	CDC 3800	MAGNETIC SIGNATURES MAGPLOT
107	FORTRAN	CDC 3600	ANNCTATED TRACK ON STEREOGRAPHIC PROJECTICN
125	FORTRAN	UNIVAC 1108	SPECTRAL ANALYSIS SUBROUTINES
47	FORTRAN	UNIVAC 1108	TRUE OCEAN DEPTH FATHCR
142	FORTRAN	CDC 3300	SOLVE ALGEBRAIC EQUATICNS MATRIX
121	FORTRAN	CDC 3300	PHYSICAL DATA PLCT FRAME
95	FORTRAN	CDC 3300	ACOUSTIC PERFCRMANCE AND EVALUATION
94	FORTRAN	CDC 3300	SOUND REFRACTICN CCRRECTIONS FITIT
15	FORTRAN		SIGMA-T INVREJ
15	FORTRAN		STD PROCESSING OCEANDATA
15	FORTRAN		INTERNAL WAVES WITLCMB
84	FORTRAN	IBM 360/165	WAVE INTERACTICN WITH CURRENT CAPGRAY
24	FORTRAN	IBM 370/165	ESTUARINE MCDEL NCNLNRA
26	FORTRAN	CDC 6400	UPWELLING CSTLLPWL
126	FORTRAN	CDC 3300/OS3	TIME SERIES APAND ACFFT
126	FORTRAN	CDC 3300/OS3	TIME SERIES ARAND ACCRR
126	FORTRAN	CDC 3300/OS3	TIME SERIES ARAND ACFPLT
126	FORTRAN	CDC 3300/OS3	TIME SERIES ARAND ALIGN
126	FORTRAN	CDC 3300/OS3	TIME SERIES ARAND AMPACO
1	FORTRAN I	IBM 1620	TRANSPORT COMPUTATIONS FRCM ATMOSPHERIC PRESSURE
146	FORTRAN II	IBM 7094	STATICN DATA REDUCTICN SYNCP
5	FORTRAN II	PDP 8E	MASS TRANSPCRT AND VELOCITIES GEOMASS
79	FORTRAN II	IBM 1620	PRCCESSES CURRENT INSTRUMENT OBSERVATICNS
94	FORTRAN II	UNIVAC 1108	BCTTCM REFLECTIVITY
148	FORTRAN II	CDC 1604	FORTRAN ACCESS TO SCIENTIFIC DATA FASD
48	FORTRAN II	IBM 1620	SOIL AND SEDIMENT ENGINEERING TEST DATA
145	FORTRAN II	IBM 1130	REDUCTICN AND DISPLAY CF DATA ACQUIRED AT SEA
101	FORTRAN II	IBM 7090	ACOUSTIC RAY TRACING
138	FORTRAN II	CDC 3100	LEAST SQUARES CURVE FITTING 2 3 & 4 DIMENSICNS
139	FORTRAN II	GE 225	CURVE FITTING CRVFT
2	FORTRAN II	CDC 3100	SALINITY ANOMALY ISALBP
3	FORTRAN II	CDC 3100	OXYGEN SATURATICN OXYGEN ANOMALY ISAT8P
3	FORTRAN II	PDP-8	PLCT THETA-S CURVES
3	FORTRAN II	CDC 3100	PLCT THETA-S CURVES
3	FORTRAN II	CDC 3100	PLCTS STATICN POSITICNS
3	FORTRAN II	PDP-8	PLCTS STATICN POSITICNS
3	FORTRAN II	CDC 3150	NUTRIENT CONCENTRATICN PEAKS
91	FORTRAN II	CDC 160A	ICE DRIFT ANALYSIS/FORECAST
110	FORTRAN II	IBM 7074	INDIVIDUAL PCINT GENERATOR FOR MAP PROJECTICNS
111	FORTRAN II	IBM 7074	INDIVIDUAL PCINT GENERATOR FOR DISTANCE
39	FORTRAN IV	CDC 3300	GEOPHYSICAL DATA REDUCTION AND PLOTTING
39	FORTRAN IV	CDC 3300	PRCCESSING/DISPLAY MARINE GEOPHYSICAL DATA
39	FORTRAN IV	CDC 3300	MARINE SEISMIC DATA REDUCTICN AND ANALYSIS
39	FORTRAN IV	CDC 3300	A LIBRARY OF GEOPHYSICAL SUBROUTINES GLIB
7	FORTRAN IV	IBM 360/65	READ CALC INTERP STATICN DATA CAPRICORN
7	FORTRAN IV	IBM 360/65	STATICN DATA CALCULATICNS F3
8	FORTRAN IV	IBM 360/65	PLCTS STATICN DATA PLTEDT
8	FORTRAN IV	IBM 360/65	CALCULATES STATICN DATA SECPG
103	FORTRAN IV	IBM 360/65	PLCTS MAPS GRIDS TRACKS MAP
5	FORTRAN IV	B 6700	OCEANOGRAPHY STATICN COMPUTER PROGRAM
25	FORTRAN IV	IBM 360	DYNAMIC DETERMINISTIC SIMULATION SIMUDELT
83	FORTRAN IV	IBM 360/75	WAVE BOTTCM VELOCITY
91	FORTRAN IV	IBM 7090-94	SEA ICE STUDIES YAKIT
91	FORTRAN IV	IBM 7090-94	SEA ICE STUDIES FLIP
91	FORTRAN IV	IBM 7090-94	SEA ICE STUDIES SALPK

91	FORTRAN IV	IBM 7090-94	SEA ICE STUDIES RITE
38	FORTRAN IV	CDC 6600	CONVECTION INVARIABLE VISCOSITY FLUID CONVEC
116	FORTRAN IV	CDC 3600	PLOTTING PROGRAM PROFL
2	FORTRAN IV	CDC 6600	STD DATA PROCESSING
25	FORTRAN IV	IBM 360/65	MIT SALINITY INTRUSION PROGRAM
28	FORTRAN IV	IBM 370	ESTUARINE CHEMISTRY MYACHEM
28	FORTRAN IV	IBM 370	ESTUARINE TIDES
24	FORTRAN IV	UNIVAC 1108	THREE DIMENSIONAL ESTUARINE CIRCULATION MODEL
50	FORTRAN IV	UNIVAC 1108	INVERSE PROBLEM IN ECOSYSTEM ANALYSIS
5	FORTRAN IV	PDP 10	STATION DATA THIRP
5	FORTRAN IV	PDP 10	THERMOMETER CORRECTION THERMOMETRIC DEPTH
147	FORTRAN IV	IBM 360/65	READS NODC STATION DATA TAPE
51	FORTRAN IV	CDC 6600	PRODUCTIVITY OXYGEN
52	FORTRAN IV	CDC 6600	SPECIES DIVERSITY JOB
52	FORTRAN IV	CDC 6600	PRODUCTIVITY ECOPROD
27	FORTRAN IV	CDC 6400	THREE-DIMENSIONAL SIMULATION PACKAGE AUGUR
52	FORTRAN IV	IBM 7094	CONCENTRATIONS PER SQUARE METER OF SURFACE
118	FORTRAN IV	XDS SIGMA 7	HORIZONTAL HISTOGRAMS HISTO
118	FORTRAN IV	XDS SIGMA 7	PRINTER PLOTS LISPLO
119	FORTRAN IV	XDS SIGMA 7	PLOT OF FREQUENCY DISTRIBUTION THISTO
119	FORTRAN IV	XDS SIGMA 7	VELOCITY VECTOR AVERAGES VECTAV
119	FORTRAN IV	XDS SIGMA 7	PROGRESSIVE VECTORS PROVEC
119	FORTRAN IV	XDS SIGMA 7	PLOTS DATA ALONG TRACK
119	FORTRAN IV	XDS SIGMA 7	PROFILE VERSUS TIME OR DISTANCE
120	FORTRAN IV	HP MINI	PLOTS NAVIGATION WITH ANY OTHER DATA TYPE DEEPS
102	FORTRAN IV	XDS SIGMA 7	RAYTRACE
97	FORTRAN IV	XDS SIGMA 7	SOUND VELOCITY SONVEL
97	FORTRAN IV	XDS SIGMA 7	DEPTH CORRECTION MTCOR SOUND VELOCITY
148	FORTRAN IV	XDS SIGMA 7	EDITING FOR WHOI FORMAT SCRUB
143	FORTRAN IV	XDS SIGMA 7	THERMOMETER CORRECTION TCPLC
8	FORTRAN IV	HP 2100	STATION DATA HYD2
8	FORTRAN IV	XDS SIGMA 7	BRUNT-VAISALA FREQUENCY OBVFRQ
9	FORTRAN IV	XDS SIGMA 7	DYNAMIC HEIGHT DYNHT
9	FORTRAN IV	XDS SIGMA 7	POTENTIAL ENERGY ANOMALY PEN
9	FORTRAN IV	XDS SIGMA 7	VARIOUS PARAMETERS FROM STATION DATA OCCOMP
9	FORTRAN IV	XDS SIGMA 7	SPECIFIC VOLUME ANOMALY SVANOM
9	FORTRAN IV	XDS SIGMA 7	PRESSURE SUBROUTINE PRESS
10	FORTRAN IV	XDS SIGMA 7	READS STATION DATA
10	FORTRAN IV	XDS SIGMA 7	GEOSTROPHIC VELOCITY DIFFERENCE VEL
10	FORTRAN IV	XDS SIGMA 7	VOLUME TRANSPORT VTR
10	FORTRAN IV	XDS SIGMA 7	SIGMA-T SIGMAT AND DSIGMT
52	FORTRAN IV	CDC 6400	COMBINED CHLOROPHYLL AND PRODUCTIVITY
53	FORTRAN IV	IBM 7094	PHYTOPLANKTON NUMBERS VOLUME SURFACE AREA
134	FORTRAN IV	UNIVAC 1108	SPECTRAL ANALYSIS OF TIME SERIES
136	FORTRAN IV	IBM 370	PROBABILITY DISTRIBUTION WEIBUL
56	FORTRAN IV	IBM 370	RESOURCES ALLOCATION IN FISHERIES MGT PISCES
56	FORTRAN IV	IBM 370	WATER RESOURCES TEACHING GAME DAM
25	FORTRAN IV	IBM 1130	BEACH SIMULATION MODEL
25	FORTRAN IV	IBM 1130	BEACH AND NEARSHORE MAPS A-S
113	FORTRAN IV	IBM 360/65	NGS SCIENTIFIC SUBROUTINE SYSTEM ANGLE
93	FORTRAN IV	CDC 1604	SOUND SCATTERING BY ORGANISMS SKAT
72	FORTRAN IV	CDC 6500	THERMAL POLLUTION MODEL
72	FORTRAN IV	CDC 1604	THERMAL POLLUTION MODEL
134	FORTRAN IV	IBM 360	TIME SERIES ANALYSIS BLACKY
83	FORTRAN IV	CDC 6500	FRENCH SPECTRO-ANGULAR WAVE MODEL
83	FORTRAN IV	CDC 7600	FRENCH SPECTRO-ANGULAR WAVE MODEL
83	FORTRAN IV	CDC 3100	SURF PREDICTION MODEL
24	FORTRAN IV	CDC 6500	MULTI-LAYER HYDRODYNAMIC-NUMBERICAL MODEL
24	FORTRAN IV	CDC 7600	MULTI-LAYER HYDRODYNAMICAL-NUMERICAL MODEL
24	FORTRAN IV	CDC 6500	SINGLE LARGE HYDRODYNAMICAL-NUMERICAL MODEL
24	FORTRAN IV	IBM 360	SINGLE LARGE HYDRODYNAMICAL-NUMERICAL MODEL
88	FORTRAN IV	CDC 6500	HURRICANE HEAT POTENTIAL MODEL

88	FORTRAN IV	CDC 6500	OCEAN-ATMOSPHERE FEEDBACK MODEL
80	FORTRAN 60	IBM 360/195	TIDES IN THE OPEN SEA
15	FORTRAN EXT	CDC 6500	VARIANCE AND STANDARD DEVIATION SUMMARY
101	FORTRAN IV	UNIVAC 1108	SONAR IN REFRACTIVE WATER
101	FORTRAN IV	UNIVAC 1108	SONAR IN REFRACTIVE WATER
101	FORTRAN IV	UNIVAC 1108	SORTS SOUND RAY DATA RAY SORT
45	FORTRAN IV	UNIVAC 1108	PATTERN FUNCTION CALCULATIONS
141	FORTRAN IV	UNIVAC 1108	SMOOTHING DATA USING THE CUBIC SPLINE
94	FORTRAN IV	UNIVAC 1108	PROPAGATION LOSS FAST FIELD PROGRAM
14	FORTRAN EXT	CDC 6500	OCEANOGRAPHIC DATA COMPUTATION TPCONV
136	FORTRAN IV	IBM 360/65	EXTENDED NORMAL SEPARATOR PROGRAM ENORMSEP
124	FORTRAN IV	IBM 360/65	OXYGEN PHOSPHATE DENSITY PLOTS
124	FORTRAN IV	IBM 360/65	GENERAL MERCATOR PLOT
112	FORTRAN IV	IBM 360/30	ADJUSTS A STATE PLANE COORDINATE TRAVERSE
113	FORTRAN IV	IBM 360/65	NOS SCIENTIFIC SUBROUTINE SYSTEM ANLIS
113	FORTRAN IV	IBM 360/65	NOS SCIENTIFIC SUBROUTINE SYSTEM APCTN
113	FORTRAN IV	IBM 360/65	NOS SCIENTIFIC SUBROUTINE SYSTEM APCWN
113	FORTRAN IV	IBM 360/65	NOS SCIENTIFIC SUBROUTINE SYSTEM APOLY
113	FORTRAN IV	IBM 360/65	NOS SCIENTIFIC SUBROUTINE SYSTEM CGSPC
113	FORTRAN IV	IBM 360/65	NOS SCIENTIFIC SUBROUTINE SYSTEM CUBIC
113	FORTRAN IV	IBM 360/65	NOS SCIENTIFIC SUBROUTINE SYSTEM EXCEB
113	FORTRAN IV	IBM 360/65	NOS SCIENTIFIC SUBROUTINE SYSTEM GMLIC
113	FORTRAN IV	IBM 360/65	NOS SCIENTIFIC SUBROUTINE SYSTEM HIFIX
114	FORTRAN IV	IBM 360/65	NOS SCIENTIFIC SUBROUTINE SYSTEM LORAN
114	FORTRAN IV	IBM 360/65	NOS SCIENTIFIC SUBROUTINE SYSTEM OMEGA
114	FORTRAN IV	IBM 360/65	NOS SCIENTIFIC SUBROUTINE SYSTEM SODIN
114	FORTRAN IV	IBM 360/65	NOS SCIENTIFIC SUBROUTINE SYSTEM SODPN
114	FORTRAN IV	IBM 360/65	NOS SCIENTIFIC SUBROUTINE SYSTEM TPFIX
114	FORTRAN IV	IBM 360/65	NOS SCIENTIFIC SUBROUTINE SYSTEM UTMCO
80	FORTRAN IV	CDC 6600	HARMONIC ANALYSIS OF DATA AT TIDAL FREQUENCIES
82	FORTRAN IV	CDC 6600	HURRICANE STORM SURGE FORECASTS SPLASH I
82	FORTRAN IV	CDC 6600	HURRICANE STORM SURGE FORECASTS SPLASH II
82	FORTRAN IV	IBM 360/195	EAST COAST STORM SURGE
82	FORTRAN IV	IBM 360/195	WAVE FORECASTS
80	FORTRAN IV	IBM 360/195	ASTRONOMICAL TIDE PREDICTION
30	FORTRAN IV	CDC 6600	DEEP OCEAN LOAD HANDLING SYSTEMS DOLLS
30	FORTRAN IV	CDC 6600	LOAD MOTION AND CABLE STRESSES CABL
30	FORTRAN IV	CDC 6600	SOIL TEST DATA TRIAX
30	FORTRAN IV	CDC 6600	DYNAMIC STRESS RESPONSE OF LIFTING LINES CABANA
31	FORTRAN IV	CDC 6600	DYNAMIC RESPONSE OF CABLE SYSTEM SNAPLG
31	FORTRAN IV	CDC 6600	CHANGES IN ELECTROMECHANICAL CABLE RAMSC
31	FORTRAN IV	CDC 6600	END RESPONSES IN ELECTROMECHANICAL CABLE RACAC
17	FORTRAN IV	IBM 360	OBJECTIVE THERMOCLINE ANALYSIS
17	FORTRAN IV	CDC 6500	OBJECTIVE THERMOCLINE ANALYSIS
91	FORTRAN 60	IBM 1604	WIND DRIFT AND CONCENTRATION OF SEA ICE ICEGRID
145	FORTRAN IV	IBM 1800	CURRENT METER DATA REDUCTION
37	FORTRAN IV	IBM 1800	CABLE CONFIGURATION
134	FORTRAN IV	IBM 1800	GENERATES ARBITRARY FILTER HILOW
84	FORTRAN IV	IBM 1800	SHIPBORNE WAVE RECORDER ANALYSIS SBWRO
104	FORTRAN IV	IBM 1800	LORAN/DECCA COORDINATES CALCULATION HNAV
104	FORTRAN IV	IBM 1800	LORAN/DECCA FILE INITIALIZATION HNV1
104	FORTRAN IV	IBM 1800	GEODETIC DISTANCE AND AZIMUTH SOANO
12	FORTRAN IV	B 6700	PLOT TEMP LIST MIXED LAYER DEPTH WEEKPLOT
4	FORTRAN IV	CDC CYBER 74	DAILY SEAWATER OBSERVATIONS
135	FORTRAN IV	IBM 360/40	SPECTRA PROGRAMS DETRND AUTCOV CRSCOV FOURTR
25	FORTRAN IV	IBM 360/65	MIT SALINITY INTRUSION PROGRAM
40	FORTRAN IV	IBM 7074	COMPUTATION AND PLOTTING OF MAGNETIC ANOMALIES
135	FORTRAN IV	IBM 1130	ANALYSIS OF NON-LINEAR RESPONSE SURFACE
135	FORTRAN IV	IBM 1130	MULTIPLE DISCRIMINANT ANALYSIS MULDA
103	FORTRAN IV	IBM 1130	SATELLITE RISE AND SET TIMES ALERT ASORT
54	FORTRAN IV	IBM 1130	YIELD PER RECRUIT RYLD BICM

103	FORTRAN IV	IBM 360/65	ASTRONOMIC POSITION AZIMUTH METHOD
22	FORTRAN IV	IBM 360/65	PERCENTAGE SATURATION OF OXYGEN IN ESTUARY
23	FORTRAN IV	IBM 360/65	WATER CHEMISTRY DIELECTRIC CONSTANT
38	FORTRAN IV	IBM 360/65	GRAVITATIONAL ATTRACTION TWO-DIMENSIONAL BODIES
38	FORTRAN IV	XDS SIGMA 7	X-RAY DIFFRACTION ANALYSIS
39	FORTRAN IV	XDS SIGMA 7	MAGNETIC ANOMALIES MAG2D
122	FORTRAN IV	IBM 360/61	PROFILE PLOTS TIME AXIS PROFL3
122	FORTRAN IV	IBM 360/61	PROFILE PLOTS DISTANCE AXIS PFLOST
122	FORTRAN IV	IBM 360/61	MAP PLOTS MAPPLT
38	FORTRAN IV	IBM 1130	SEDIMENT GRAIN SIZE ANALYSIS
40	FORTRAN IV	IBM 1130	REDUCTION DISPLAY STORAGE GEOPHYSICAL DATA
117	FORTRAN IV	IBM 1130	PLOTS HYDRO CAST DATA PLOG
117	FORTRAN IV	IBM 1130	PLOTS STD DATA STPO1
118	FORTRAN IV	IBM 1130	PLOTS TEMPERATURE-SALINITY PSAL 1
1	FORTRAN IV	IBM 1130	TRANSPORT COMPUTATIONS FROM ATMOSPHERIC PRESSURE
1	FORTRAN IV	IBM 1130	STD COMPUTATIONS STPO2
1	FORTRAN IV	IBM 1130	HYDRO CAST COMPUTATIONS
42	FORTRAN IV	UNIVAC 1108	LISTS RAW DATA 2LIST
42	FORTRAN IV	UNIVAC 1108	PLOTS TRACKLINE QCKDRAW
42	FORTRAN IV	UNIVAC 1108	PLOTS CONTOUR CROSSING INTERVALS CCUBLX
42	FORTRAN IV	UNIVAC 1108	PLOTS GEOPHYSICAL DATA PLOT2
43	FORTRAN IV	UNIVAC 1108	LISTS EVERY HUNDREDTH VALUE SNOOP
43	FORTRAN IV	UNIVAC 1108	NAVIGATION COMPUTATIONS TPNAV
43	FORTRAN IV	UNIVAC 1108	EDITS GEOPHYSICAL DATA ZEDIT
43	FORTRAN IV	UNIVAC 1108	GEOPHYSICAL DATA CONVERSION HANDY
44	FORTRAN IV	UNIVAC 1108	LISTS GEOPHYSICAL DATA LISTP
44	FORTRAN IV	UNIVAC 1108	COURSE, SPEED, EOTVOS CORRECTION LCXNAV
44	FORTRAN IV	UNIVAC 1108	CONVERTS GEOPHYSICAL DATA PHONEY
44	FORTRAN IV	UNIVAC 1108	SOUND VELOCITY VARIATION AND NAVIGATION FATHOM
45	FORTRAN IV	UNIVAC 1108	REGIONAL FIELD RESIDUAL MAGNETIC ANOMALY GAMMA
45	FORTRAN IV	UNIVAC 1108	GRAVITY GAL
45	FORTRAN IV	UNIVAC 1108	PLOTS PROFILES OF GEOPHYSICAL DATA DISPLOT
46	FORTRAN IV	UNIVAC 1108	CONVERTS DIGITIZER DATA DYGYT
46	FORTRAN IV	UNIVAC 1108	EDITS REDUCED GEOPHYSICAL DATA EDIT
125	FORTRAN IV	CDC 6400	SCALAR TIME SERIES TEMPLT7
78	FORTRAN IV	CDC 6400	VECTOR TIME SERIES CURPLT6
51	FORTRAN IV	IBM 360	TOXICITY BIOASSAY PROBIT ANALYSIS
139	FORTRAN IV	IBM 360/65	FITS POLYNOMIAL P3TERM
142	FORTRAN IV	IBM 360/65	CHECKS ANGLES THOPI
142	FORTRAN IV	CDC 6600	CHECKS ANGLES THOPI
122	FORTRAN IV	IBM 360/65	PLOTS SCATTERGRAM SCTGM4 SCTGMS
123	FORTRAN IV	CDC 6600	X-Y PLOTS EBTPLT
148	FORTRAN IV	CDC 6600	REPRODUCE AND SERIALIZE DECK DUPE
148	FORTRAN IV	IBM 360/65	FLAGS SUSPICIOUS DATA VALUES EDITO
144	FORTRAN IV	IBM 360/65	JULIAN DAY CONVERSION JDAYWK
144	FORTRAN IV	IBM 360/65	JULIAN DATE CONVERSION ROUTINES JULDAY
144	FORTRAN IV	IBM 360/65	JULIAN DATE CONVERSION ROUTINES JULIAN
144	FORTRAN IV	IBM 360/65	JULIAN DATE CONVERSION ROUTINES JULYAN
144	FORTRAN IV	IBM 360/65	JULIAN DATE CONVERSION ROUTINES JULSEC
144	FORTRAN IV	IBM 360/65	JULIAN DATE CONVERSION ROUTINES CESLUJ
144	FORTRAN IV	IBM 360/65	DAY OF THE WEEK NDAYWK
17	FORTRAN IV	CDC 6500	WET BULB TEMPERATURE WETBLA
41	FORTRAN IV	IBM 360/65	MARINE GEOPHYSICAL DATA REDUCTION
41	FORTRAN IV	IBM 360/65	PLOTS PROFILES OF BATHYMETRY AND MAGNETIC
153	FORTRAN IV	IBM 360/65	XBSELECT
153	FORTRAN IV	IBM 360/65	XBMSINV
153	FORTRAN IV	IBM 360/65	XBGEOSUM
153	FORTRAN IV	IBM 360/65	CANWPC
18	FORTRAN IV	IBM 360/65	DYNAMIC DEPTH ANOMALY DYANCM
19	FORTRAN IV	IBM 360/65	POTENTIAL TEMP AND DENSITY PODENS
19	FORTRAN IV	IBM 360/65	VOLUME TRANSPORT VOLTRN
19	FORTRAN IV	IBM 360/65	COMPUTES PRESSURE PRESSR

115	FORTRAN IV	IBM 360/65	COMPUTE GREAT CIRCLE PATH GCIRC
115	FORTRAN IV	IBM 360/40	MAP PROJECTIONS AND GRIDS MAP
54	FORTRAN IV	IBM 360	PIGMENT RATIO
54	FORTRAN IV	IBM 360	SUCCESSION
54	FORTRAN IV	IBM 360	SPECIES ABUNDANCE
138	FORTRAN IV	IBM 360/65	FITS A SMOOTH CURVE
141	FORTRAN IV	IBM 360/65	CALCULATES SPLINE COEFFICIENT SPLCOF
141	FORTRAN IV	IBM 360/65	INTERPOLATING BY CUBIC SPLINE
150	FORTRAN IV	IBM 360/65	FILE INDEPENDENT GEN APP SYS GAS GASDIPBS
150	FORTRAN IV	IBM 360/65	FILE INDEPENDENT GEN APP SYS GAS GASSAMPC
150	FORTRAN IV	IBM 360/65	FILE INDEPENDENT GEN APP SYS GAS GASEINV
150	FORTRAN IV	IBM 360/65	FILE INDEPENDENT GEN APP SYS GAS GASCCI
150	FORTRAN IV	IBM 360/65	FILE INDEPENDENT GEN APP SYS GAS GASVPRT
150	FORTRAN IV	IBM 360/65	FILE INDEPENDENT GEN APP SYS GAS GVAREFRM
150	FORTRAN IV	IBM 360/65	FILE INDEPENDENT GEN APP SYS GAS CANADA
150	FORTRAN IV	IBM 360/65	FILE INDEPENDENT GEN APP SYS GAS GAS
150	FORTRAN IV	IBM 360/65	FILE INDEPENDENT GEN APP SYS GAS GASVASUM
151	FORTRAN IV	IBM 360/65	FILE INDEPENDENT GEN APP SYS GAS ALTERGAS
151	FORTRAN IV	IBM 360/65	FILE INDEPENDENT GEN APP SYS GAS GASB
151	FORTRAN IV	IBM 360/65	FILE INDEPENDENT GEN APP SYS GAS NODCSQ
151	FORTRAN IV	IBM 360/65	FILE INDEPENDENT GEN APP SYS GAS NAMES
151	FORTRAN IV	IBM 360/65	FILE INDEPENDENT GEN APP SYS GAS SO2 GAS
11	FORTRAN IV	CDC 3300	OXYGEN OPLOT
11	FORTRAN IV	CDC 3300	CHLOROPHYLL CHLO
11	FORTRAN IV	CDC 3300	SALINITY SALTY
11	FORTRAN IV	CDC 3300	TEMPERATURE SALINITY CLASS VOLUME TSVOL
12	FORTRAN IV	CDC 3300	THERMOMETER CORRECTION THERZ
12	FORTRAN IV	CDC 3300	TRANSPORT XPORT
91	FORTRAN IV	CDC 3300	ICEBERG DRIFT ICE-PLOT
143	FORTRAN IV	IBM 360	AREAL CONCENTRATION INTEGRATE
143	FORTRAN IV	IBM 360	UNWEIGHTED AVERAGES AVERAGE
84	FORTRAN IV	UNIVAC 1108	STORM SURGE
84	FORTRAN IV	UNIVAC 1108	WAVE REFRACTION
28	FORTRAN IV	IBM 360/40	MATHEMATICAL MODEL OF COASTAL UPWELLING
3	FORTRAN IV	HP 2100A	STD TABLES AND PLOTS STD
22	FORTRAN IV	CDC 3150	ALKALINITY ALCT
47	FORTRAN IV	CDC 3150	GEOPHYSICAL DATA STORAGE AND RETRIEVAL GEOFILE
48	FORTRAN IV	UNIVAC 1108	BOTTOM SEDIMENT DISTRIBUTION PLOT
93	FORTRAN IV	CDC 6500	NORMAL MODE CALCULATIONS NORMOD 3
16	FORTRAN IV	HP 2100S	THERMOMETRIC DEPTH CALCULATION CAST
16	FORTRAN IV	HP 2100S	THERMOMETER DATA FILE HANDLER THERMO
16	FORTRAN IV	CDC 3200	SEA SURFACE TEMPERATURES ANALYSIS
107	FORTRAN IV	HP 2100S	ANNOTES CHART
108	FORTRAN IV	HP 2100S	BATHYMETRIC OR MAGNETICS CHART PROFL
108	FORTRAN IV	HP 2100S	MERCATOR CHART DIGITIZATION ANTRK
108	FORTRAN IV	HP 2100S	BATHYMETRIC CHART DIGITIZATION DGBTH
108	FORTRAN IV	HP 2100S	PLOTS ON STEREOGRAPHIC CHART ANNOT
108	FORTRAN IV	HP 2100S	PLOTS NAVIGATION DATA OCEAN
109	FORTRAN IV	HP 2100S	LONG BASE LINE ACOUSTIC TRACKING
10	FORTRAN IV	XDS SIGMA 7	ADIABATIC TEMPERATURE GRADIENT ATG
10	FORTRAN IV	XDS SIGMA 7	POTENTIAL TEMPERATURE POTEMP
10	FORTRAN IV	XDS SIGMA 7	SPECIFIC VOLUME SPVOL
136	FORTRAN IV	XDS SIGMA 7	STATISTICS FROM WHOI FORMAT STATS
105	FORTRAN IV	HP 2100S	LORAN OR OMEGA CONVERSION GEPOS
105	FORTRAN IV	HP 3100A	CRUISE TRACK TMERC
105	FORTRAN IV	XDS SIGMA 7	TRANSFORMATION OF SPHERICAL COORDINATES ROTGUT
106	FORTRAN IV	XDS SIGMA 7	SUM OF FINITE ROTATIONS ON A SPHERE SUMROT
41	FORTRAN IV	XDS SIGMA 7	GEOMAGNETIC FIELD MFIELD
50	FORTRAN IV	XDS SIGMA 7	WHOI BIOLOGY SERIES FTAPE
50	FORTRAN IV	XDS SIGMA 7	WHOI BIOLOGY SERIES FLISHT
50	FORTRAN IV	XDS SIGMA 7	WHOI BIOLOGY SERIES CHKSPIT
50	FORTRAN IV	XDS SIGMA 7	WHOI BIOLOGY SERIES SELECT

50	FORTRAN IV	XDS SIGMA 7	WHOI BIOLOGY SERIES CHANAT
50	FORTRAN IV	XDS SIGMA 7	WHOI BIOLOGY SERIES PREPLOTG
50	FORTRAN IV	XDS SIGMA 7	WHOI BIOLOGY SERIES PLOTSPECG
50	FORTRAN IV	XDS SIGMA 7	WHOI BIOLOGY SERIES STATAB
77	FORTRAN IV	XDS SIGMA 7	CURRENT METER CLOCK SEQUENCE XTAL
78	FORTRAN IV	XDS SIGMA 7	CURRENT METER CALIBRATION CASDEC
78	FORTRAN IV	XDS SIGMA 7	CURRENT METER DATA REDUCTION AND EDITING CAMP
53	FORTRAN IV	UNIVAC 1108	GENERATES ZOOPLANKTON TAXONOMIC DIRECTORY
53	FORTRAN IV	UNIVAC 1108	DEEP OCEAN ZOOPLANKTON DISTRIBUTION
53	FORTRAN IV	UNIVAC 1108	DEEP OCEAN ZOOPLANKTON POPULATION STATISTICS
26	FORTRAN IV	IBM 360	MATHEMATICAL WATER QUALITY MODEL FOR ESTUARIES
26	FORTRAN IV	IBM 360	COMPUTATION OF FLOW THROUGH MASONBORO INLET NC
26	FORTRAN IV	IBM 360	CIRCULATION IN PAMLICO SOUND
138	FORTRAN V	UNIVAC 1108	CURVE FITTING VELOCITY PROFILE NEWFIT
45	FORTRAN V	UNIVAC 1108	RAYLEIGH-MORSE BOTTOM REFLECTION COEFFICIENTS
138	FORTRAN V	UNIVAC	FITTING A LEAST SQUARES DISTANCE HYPERPLANE
99	FORTRAN V	UNIVAC 1108	CONTINUOUS GRADIENT RAY TRACING SYSTEM CONGRATS
93	FORTRAN V	UNIVAC 1108	NORMAL MODE PROPAGATION MODEL
94	FORTRAN V	UNIVAC 1108	BEAM PATTERNS AND WIDTHS GBEAM
94	FORTRAN V	UNIVAC 1108	STATISTICS ACOUSTIC MEASUREMENTS AND PREDICTIONS
45	FORTRAN V	UNIVAC 1108	PROPAGATION LOSS
45	FORTRAN V	UNIVAC 1108	AMOS PROPAGATION LOSS
121	FORTRAN V	UNIVAC 1108	REFORMATS DATA PLOTS TRACK CHART MASTRACK
14	FORTRAN V	UNIVAC 1108	WATER CLARITY
76	FORTRAN V	UNIVAC 1108	IN-SITU CURRENT
77	FORTRAN V	UNIVAC 1108	CURRENT METER PRINT
77	FORTRAN V	UNIVAC 1108	CURRENT METER PLOT
77	FORTRAN V	UNIVAC 1108	CONVERT CURRENT METER TAPE
77	FORTRAN V	UNIVAC 1108	CURRENT METER DATA MPRINTO
36	FORTRAN V	UNIVAC 1108	TOWED SYSTEM DYNAMICS
36	FORTRAN V	UNIVAC 1108	TRAPEZOIDAL ARRAY DEPLOYMENT DYNAMICS
37	FORTRAN V	UNIVAC 1108	STEADY STATE CABLE LAYING
37	FORTRAN V	UNIVAC 1108	TOWED ARRAY CONFIGURATIONS
37	FORTRAN V	UNIVAC 1108	TRAPEZOIDAL ARRAY DYNAMICS
16	FORTRAN V	UNIVAC 1108	STD-S/V DATA 32049
32	FORTRAN V	UNIVAC 1108	STEADY STATE TRAPEZOIDAL ARRAY CONFIGURATIONS
32	FORTRAN V	UNIVAC 1108	ANCHOR LAST-BUOY SYSTEM DEVELOPMENT DYNAMICS
33	FORTRAN V	UNIVAC 1108	CABLE TOWED BUOY CONFIGURATIONS IN A TURN
33	FORTRAN V	UNIVAC 1108	FREE-FLOATING SPAR-ARRAY DYNAMICS
33	FORTRAN V	UNIVAC 1108	FREE-FLOATING SPAR-BUOY DYNAMICS
33	FORTRAN V	UNIVAC 1108	SHIP SUSPENDED ARRAY DYNAMICS
34	FORTRAN V	UNIVAC 1108	BOOMERANG CORER DESCENT/ASCENT TRAJECTORIES
34	FORTRAN V	UNIVAC 1108	BUOY-SHIP DYNAMICS
34	FORTRAN V	UNIVAC 1108	BUOY-SYSTEM DYNAMICS
34	FORTRAN V	UNIVAC 1108	FIXED THIN LINE ARRAY DYNAMICS
35	FORTRAN V	UNIVAC 1108	FIXED THIN LINE ARRAY STEADY STATE CONFIGURATION
35	FORTRAN V	UNIVAC 1108	MARINE CORER DYNAMICS
35	FORTRAN V	UNIVAC 1108	STEADY-STATE BUOY SYSTEM CONFIGURATIONS
36	FORTRAN V	UNIVAC 1108	STEADY-STATE SUBSURFACE BUOY SYSTM CONFIGURATION
36	FORTRAN V	UNIVAC 1108	TOWED ARRAY DYNAMICS
146	FORTRAN VI	IBM 1130	THERMOMETER CORRECTION TCHK2
125	FORTRAN 32	CDC 3100	TIME SERIES PLOTTING
125	FORTRAN 32	PDP-8	TIME SERIES PLOTTING
146	FORTRAN 63	CDC 6600	HYDROGRAPHIC DATA REDUCTION TWO FIVE
121	FORTRAN 63	CDC 1604	MACHINE PLOTTING ON MERCATOR PROJECTION
123	FORTRAN 63	CDC 3600	VERTICALLY ANALYZED CONTOURS VACOTS
12	FORTRAN 63	CDC 3600	VERTICAL SECTION PLOTS ESTPAC
100	FORTRAN 63	CDC 3800	GRASS UNDERWATER ACOUSTICS PREDICTION DTSTCV
100	FORTRAN 63	CDC 3800	GRASS UNDERWATER ACOUSTICS PREDICTION VFC
100	FORTRAN 63	CDC 3800	GRASS UNDERWATER ACOUSTICS PREDICTION CTOUR
100	FORTRAN 63	CDC 3800	GRASS UNDERWATER ACOUSTICS PREDICTION PRFPLT
100	FORTRAN 63	CDC 3800	GRASS UNDERWATER ACOUSTICS PREDICTION SERPENT

101	FORTRAN 63	CDC 3800	GRASS UNDERWATER ACCUSTICS PREDICTION RAPLOT
101	FORTRAN 63	CDC 3800	GRASS UNDERWATER ACCUSTICS PREDICTION LOSSPLOT
73	ANS FORTRAN	IBM 360	ECOLOGICAL STATISTICAL PROGRAMS ECOSTAT
73	ANS FORTRAN	IBM 370	ECOLOGICAL STATISTICAL PROGRAMS ECOSTAT
125	MS FORTRAN	CDC 6400	TIME SERIES ANALYSIS PROGRAMS TSAP
125	MS FORTRAN	CDC 3150	TIME SERIES ANALYSIS PROGRAMS TSAP
126	MS FORTRAN	CDC 3150	TIME SERIES-ANALOG TO DIGITAL A TO D

PL/1

74	PL/1	IBM 360/168	DRIFT BOTTLE/STATISTICS
74	PL/1	IBM 360/168	DRIFT BOTTLE PLOTS
74	PL/1	IBM 360/168	REFORMAT AND SORT DRIFT BOTTLE DATA
4	PL/1	IBM 360/85	DATA MGT SYS FOR PHYS CHEM DATA OCEANSV
72	PL/1	IBM 370/168	MONTE CARLO SPILL TRACKER
67	PL/1	IBM 370/180	MARKOVIAN ANALYSIS OF TDF-14 WIND DATA
151	PL/1	IBM 360/65	SD2CHAR
152	PL/1	IBM 360/65	SDGECIV
152	PL/1	IBM 360/65	XBEVALU
152	PL/1	IBM 360/65	XBCONV
152	PL/1	IBM 360/65	XBFNWC
152	PL/1	IBM 360/65	XBTNWSUM
153	PL/1	IBM 360/65	BTGEOIV
153	PL/1	IBM 360/65	SCHNINE
153	PL/1	IBM 360/65	SCMULTI
153	PL/1	IBM 360/65	DRYLAND
141	PL/1	IBM 360/65	LINEAR INTERPOLATION LININT
141	PL/1	IBM 360/65	LAGRANGIAN THREE POINT INTERPOLATION LAG3PT
150	PL/1	IBM 360/65	FILE INDEPENDENT GEN APP SYS GAS GAS THERM

MISCELLANEOUS

104	MAD	IBM 7090	GENERAL MAP PROJECTION
104	MAD	IBM 7090	FINITE MAP PROJECTION DISTORTIONS
80	MAD	IBM 7090	THEORETICAL RACIAL TIDAL FORCE
53	MAP	IBM 7094	PHYTOPLANKTON NUMBERS VOLUME SURFACE AREA
114	SPS	IBM 1620	COMPUTES GEOGRAPHIC POSITIONS
114	SPS	IBM 1620	LORAN C VERSION2

HARDWARE INDEX

BURROUGHS

CONTROL DATA CORPORATION

91	FORTRAN II	CDC 160A	ICE DRIFT ANALYSIS/FORECAST
121	FORTRAN 63	CDC 1604	MACHINE PLOTTING ON MERCATOR PROJECTION
93	FORTRAN IV	CDC 1604	SOUND SCATTERING BY ORGANISMS SKAT
89	FORTRAN	CDC 1604	WIND COMPUTATION FROM SHIP OBSERVATIONS TRUWIND
72	FORTRAN IV	CDC 1604	THERMAL POLLUTION MODEL
75	FORTRAN	CDC 1604	MEAN DRIFT ROUTINE
97	FORTRAN	CDC 1604	SOUND SPEED COMPUTATION MODEL SOVEL
87	FORTRAN	CDC 1604	OCEAN CLIMATOLOGY ANALYSIS MODEL ANALYS
148	FORTRAN II	CDC 1604	FORTRAN ACCESS TO SCIENTIFIC DATA FASD
138	FORTRAN II	CDC 3100	LEAST SQUARES CURVE FITTING 2 3 & 4 DIMENSIONS
118	FORTRAN	CDC 3100	SECTION PLOTTING
88	FORTRAN	CDC 3100	MIXED LAYER DEPTH ANALYSIS MODEL MEDMLD
88	FORTRAN	CDC 3100	ATMOSPHERIC WATER CONTENT MODEL
3	FORTRAN II	CDC 3100	OXYGEN SATURATION OXYGEN ANOMALY ISATBP
3	FORTRAN II	CDC 3100	PLOT THETA-S CURVES
3	FORTRAN II	CDC 3100	PLOTS STATION POSITIONS
83	FORTRAN IV	CDC 3100	SURF PREDICTION MODEL
83	FORTRAN	CDC 3100	SINGULAR WAVE PREDICTION MODEL
2	FORTRAN II	CDC 3100	SALINITY ANOMALY ISALBP
72	FORTRAN	CDC 3100	DANISH ADVECTION PROGRAM
112	FORTRAN	CDC 3100	SOUNDING PLOT
75	FORTRAN	CDC 3100	OPTIMIZED MULTI-LAYER HN MODEL
125	FORTRAN 32	CDC 3100	TIME SERIES PLOTTING
97	FORTRAN	CDC 3100	SOUND SPEED COMPUTATION MODEL SOVEL
112	FORTRAN	CDC 3100	SODANC INVERSE
125	MS FORTRAN	CDC 3150	TIME SERIES ANALYSIS PROGRAMS TSAP
47	FORTRAN IV	CDC 3150	GEOPHYSICAL DATA STORAGE AND RETRIEVAL GEOFILE
126	MS FORTRAN	CDC 3150	TIME SERIES-ANALOG TO DIGITAL A TO D
22	FORTRAN IV	CDC 3150	ALKALINITY ALCT
79	FORTRAN	CDC 3150	CURRENT METER DATA PROCESSING SYSTEM TICE
3	FORTRAN II	CDC 3150	NUTRIENT CONCENTRATION PEAKS
83	FORTRAN	CDC 3200	SINGULAR WAVE PREDICTION MODEL
16	FORTRAN IV	CDC 3200	SEA SURFACE TEMPERATURES ANALYSIS
15	FORTRAN	CDC 3200	INTERPOLATION FOR OCEANOGRAPHIC DATA
97	FORTRAN	CDC 3200	SOUND SPEED COMPUTATION MODEL SOVEL
11	FORTRAN IV	CDC 3300	OXYGEN OPLOT
11	FORTRAN IV	CDC 3300	CHLOROPHYLL CHLC
11	FORTRAN IV	CDC 3300	SALINITY SALTY
11	FORTRAN IV	CDC 3300	TEMPERATURE SALINITY CLASS VOLUME TSVOL
91	FORTRAN IV	CDC 3300	ICEBERG DRIFT ICE-PLOT
12	FORTRAN IV	CDC 3300	THERMOMETER CORRECTION THERZ
12	FORTRAN IV	CDC 3300	TRANSPORT XPORT
142	FORTRAN	CDC 3300	SOLVE ALGEBRAIC EQUATIONS MATRIX
116	FORTRAN	CDC 3300	VERTICAL BAR GRAPHS
75	FORTRAN	CDC 3300	CURRENT METER DATA CREATE-C
75	FORTRAN	CDC 3300	CURRENT METER DATA CURRENT
75	FORTRAN	CDC 3300	CURRENT METER DATA CURRPLOT
75	FORTRAN	CDC 3300	CURRENT METER DATA SPECTRUM
39	FORTRAN IV	CDC 3300	GEOPHYSICAL DATA REDUCTION AND PLOTTING
39	FORTRAN IV	CDC 3300	PROCESSING/DISPLAY MARINE GEOPHYSICAL DATA
39	FORTRAN IV	CDC 3300	MARINE SEISMIC DATA REDUCTION AND ANALYSIS
39	FORTRAN IV	CDC 3300	A LIBRARY OF GEOPHYSICAL SUBROUTINES GLIB
94	FORTRAN	CDC 3300	SOUND REFRACTION CORRECTIONS FITIT
95	FORTRAN	CDC 3300	ACOUSTIC PERFORMANCE AND EVALUATION
121	FORTRAN	CDC 3300	PHYSICAL DATA PLOT FRAME
131	FORTRAN	CDC 3300/OS3	TIME SERIES ARAND TAUTOPLT
131	FORTRAN	CDC 3300/OS3	TIME SERIES ARAND TOOHPLT

131	FORTRAN	CDC 3300/CS3	TIME SERIES	ARAND	TCRCPLT
131	FORTRAN	CDC 3300/OS3	TIME SERIES	ARAND	IFORM1
131	FORTRAN	CDC 3300/CS3	TIME SERIES	ARAND	IFORM2
131	FORTRAN	CDC 3300/OS3	TIME SERIES	ARAND	TIMSPC
131	FORTRAN	CDC 3300/CS3	TIME SERIES	ARAND	TLOGPLT
131	FORTRAN	CDC 3300/CS3	TIME SERIES	ARAND	INCIZT
131	FORTRAN	CDC 3300/CS3	TIME SERIES	ARAND	TPHAPLT
131	FORTRAN	CDC 3300/CS3	TIME SERIES	ARAND	TPLTFRQ
131	FORTRAN	CDC 3300/OS3	TIME SERIES	ARAND	TPLTSPC
131	FORTRAN	CDC 3300/CS3	TIME SERIES	ARAND	TRISMC
130	FORTRAN	CDC 3300/OS3	TIME SERIES	ARAND	PCLRT
130	FORTRAN	CDC 3300/CS3	TIME SERIES	ARAND	POLYDV
130	FORTRAN	CDC 3300/CS3	TIME SERIES	ARAND	PRCPLT
130	FORTRAN	CDC 3300/CS3	TIME SERIES	ARAND	PSQRT
130	FORTRAN	CDC 3300/CS3	TIME SERIES	ARAND	RANDM
130	FORTRAN	CDC 3300/CS3	TIME SERIES	ARAND	RCTFFT
130	FORTRAN	CDC 3300/OS3	TIME SERIES	ARAND	RESPCN
130	FORTRAN	CDC 3300/CS3	TIME SERIES	ARAND	REVERS
130	FORTRAN	CDC 3300/CS3	TIME SERIES	ARAND	RPLACE
130	FORTRAN	CDC 3300/OS3	TIME SERIES	ARAND	RRVERS
130	FORTRAN	CDC 3300/CS3	TIME SERIES	ARAND	SARIT
130	FORTRAN	CDC 3300/CS3	TIME SERIES	ARAND	SERGEN
130	FORTRAN	CDC 3300/CS3	TIME SERIES	ARAND	SHAPE
130	FORTRAN	CDC 3300/CS3	TIME SERIES	ARAND	SINTR
130	FORTRAN	CDC 3300/OS3	TIME SERIES	ARAND	SMO
130	FORTRAN	CDC 3300/CS3	TIME SERIES	ARAND	SPEC
130	FORTRAN	CDC 3300/CS3	TIME SERIES	ARAND	SPECT1
130	FORTRAN	CDC 3300/OS3	TIME SERIES	ARAND	SPECT2
129	FORTRAN	CDC 3300/CS3	TIME SERIES	ARAND	FFIN
129	FORTRAN	CDC 3300/OS3	TIME SERIES	ARAND	FOLD
129	FORTRAN	CDC 3300/CS3	TIME SERIES	ARAND	FOURTR
129	FORTRAN	CDC 3300/CS3	TIME SERIES	ARAND	FOUSPC
129	FORTRAN	CDC 3300/CS3	TIME SERIES	ARAND	FOUSPC1
129	FORTRAN	CDC 3300/CS3	TIME SERIES	ARAND	FOUSPC2
129	FORTRAN	CDC 3300/CS3	TIME SERIES	ARAND	FRESPON
129	FORTRAN	CDC 3300/CS3	TIME SERIES	ARAND	GAPH
129	FORTRAN	CDC 3300/CS3	TIME SERIES	ARAND	GENER1
129	FORTRAN	CDC 3300/OS3	TIME SERIES	ARAND	GENER2
129	FORTRAN	CDC 3300/OS3	TIME SERIES	ARAND	GENER3
129	FORTRAN	CDC 3300/CS3	TIME SERIES	ARAND	LOGPLOT
129	FORTRAN	CDC 3300/CS3	TIME SERIES	ARAND	NC12T
129	FORTRAN	CDC 3300/CS3	TIME SERIES	ARAND	PHAPLT
129	FORTRAN	CDC 3300/CS3	TIME SERIES	ARAND	PLTFCR
129	FORTRAN	CDC 3300/CS3	TIME SERIES	ARAND	PLTFRQ
129	FORTRAN	CDC 3300/CS3	TIME SERIES	ARAND	PLTSPC
127	FORTRAN	CDC 3300/CS3	TIME SERIES	ARAND	CCORR
127	FORTRAN	CDC 3300/CS3	TIME SERIES	ARAND	CONPLT
127	FORTRAN	CDC 3300/CS3	TIME SERIES	ARAND	CONPLOT
127	FORTRAN	CDC 3300/OS3	TIME SERIES	ARAND	CONFID
127	FORTRAN	CDC 3300/CS3	TIME SERIES	ARAND	CONFID 1
127	FORTRAN	CDC 3300/CS3	TIME SERIES	ARAND	CONMODE
127	FORTRAN	CDC 3300/CS3	TIME SERIES	ARAND	COPH
127	FORTRAN	CDC 3300/CS3	TIME SERIES	ARAND	COSTR
127	FORTRAN	CDC 3300/OS3	TIME SERIES	ARAND	CPEES
127	FORTRAN	CDC 3300/CS3	TIME SERIES	ARAND	CPLT1
127	FORTRAN	CDC 3300/CS3	TIME SERIES	ARAND	CPLT2
127	FORTRAN	CDC 3300/CS3	TIME SERIES	ARAND	CRCPLT
127	FORTRAN	CDC 3300/CS3	TIME SERIES	ARAND	CROSS
127	FORTRAN	CDC 3300/OS3	TIME SERIES	ARAND	CUSID

127	FORTRAN	CDC 3300/OS3	TIME SERIES ARAND CUSFC
128	FORTRAN	CDC 3300/OS3	TIME SERIES ARAND CZT
128	FORTRAN	CDC 3300/OS3	TIME SERIES ARAND DATPLT
128	FORTRAN	CDC 3300/OS3	TIME SERIES ARAND DEMC[illegible]
128	FORTRAN	CDC 3300/OS3	TIME SERIES ARAND DEM[illegible]2
128	FORTRAN	CDC 3300/OS3	TIME SERIES ARAND DEMCD3
128	FORTRAN	CDC 3300/OS3	TIME SERIES ARAND DETRND
128	FORTRAN	CDC 3300/OS3	TIME SERIES ARAND DIFF12
128	FORTRAN	CDC 3300/OS3	TIME SERIES ARAND EUREKA
128	FORTRAN	CDC 3300/OS3	TIME SERIES ARAND EXSMC
128	FORTRAN	CDC 3300/OS3	TIME SERIES ARAND FFINI
128	FORTRAN	CDC 3300/OS3	TIME SERIES ARAND FFTCNV
128	FORTRAN	CDC 3300/OS3	TIME SERIES ARAND FFTPS
128	FORTRAN	CDC 3300/OS3	TIME SERIES ARAND FFTS
128	FORTRAN	CDC 3300/OS3	TIME SERIES ARAND FFTSPC
128	FORTRAN	CDC 3300/OS3	TIME SERIES ARAND FILTER1
132	FORTRAN	CDC 3300/OS3	TIME SERIES ARAND TSGEN
132	FORTRAN	CDC 3300/OS3	TIME SERIES ARAND TSPECT1
132	FORTRAN	CDC 3300/OS3	TIME SERIES ARAND TSPECT2
132	FORTRAN	CDC 3300/OS3	TIME SERIES ARAND TRANFR
132	FORTRAN	CDC 3300/OS3	TIME SERIES ARAND TRANFRM
132	FORTRAN	CDC 3300/OS3	TIME SERIES ARAND TTYCON
132	FORTRAN	CDC 3300/OS3	TIME SERIES ARAND TTYNUM
132	FORTRAN	CDC 3300/OS3	TIME SERIES ARAND UNLEAV
132	FORTRAN	CDC 3300/OS3	TIME SERIES ARAND USES
132	FORTRAN	CDC 3300/OS3	TIME SERIES ARAND USFG
132	FORTRAN	CDC 3300/OS3	TIME SERIES ARAND USIC
132	FORTRAN	CDC 3300/OS3	TIME SERIES ARAND USPE
132	FORTRAN	CDC 3300/OS3	TIME SERIES ARAND WINDOW
126	FORTRAN	CDC 3300/OS3	TIME SERIES ARAND ACFFT
126	FORTRAN	CDC 3300/OS3	TIME SERIES ARAND ACCRR
126	FORTRAN	CDC 3300/OS3	TIME SERIES ARAND ACRPLT
126	FORTRAN	CDC 3300/OS3	TIME SERIES ARAND ALIGN
126	FORTRAN	CDC 3300/OS3	TIME SERIES ARAND AMPACO
126	FORTRAN	CDC 3300/OS3	TIME SERIES ARAND ARMAP
126	FORTRAN	CDC 3300/OS3	TIME SERIES ARAND AUTC
126	FORTRAN	CDC 3300/OS3	TIME SERIES ARAND AUTOPLT
126	FORTRAN	CDC 3300/OS3	TIME SERIES ARAND AXISL
126	FORTRAN	CDC 3300/OS3	TIME SERIES ARAND CCFFT
133	FORTRAN	CDC 3300/OS3	TIME SERIES ARAND WINDOW1
128	FORTRAN	CDC 3300/OS3	TIME SERIES ARAND FIVET
51	FORTRAN	CDC 3600	SPECIES AFFINITIES REGROUP
123	FORTRAN 63	CDC 3600	VERTICALLY ANALYZED CONTOURS VACOTS
13	FORTRAN	CDC 3600	CONVERTS STC DATA KOEDTP
13	FORTRAN	CDC 3600	CORRECTS STC DATA TPMCD
116	FORTRAN IV	CDC 3600	PLOTTING PROGRAM PKCFL
116	FORTRAN	CDC 3600	X-Y PLOTS MLCFAK
12	FORTRAN 63	CDC 3600	VERTICAL SECTION PLOTS ESTPAC
47	FORTRAN	CDC 3600	PLOTS TRACK AND DATA PROFILE TRACK
47	FORTRAN	CDC 3600	GEODATA
47	FORTRAN	CDC 3600	MAGNETIC SIGNATURES MAGPLOT
107	FORTRAN	CDC 3600	ANNOTATED TRACK ON STEREOGRAPHIC PROJECTION
101	FORTRAN 63	CDC 3800	GRASS UNDERWATER ACOUSTICS PREDICTION RAPLOT
101	FORTRAN 63	CDC 3800	GRASS UNDERWATER ACOUSTICS PREDICTION LOSSPLOT
120	FORTRAN	CDC 3800	LINE PRINTER PLOTS
100	FORTRAN 63	CDC 3800	GRASS UNDERWATER ACOUSTICS PREDICTION CTSTCV
100	FORTRAN 63	CDC 3800	GRASS UNDERWATER ACOUSTICS PREDICTION VFC
100	FORTRAN 63	CDC 3800	GRASS UNDERWATER ACOUSTICS PREDICTION CTCUR
100	FORTRAN 63	CDC 3800	GRASS UNDERWATER ACOUSTICS PREDICTION PRFPLT

100	FORTRAN 63	CDC 3800	GRASS UNDERWATER ACOUSTICS PREDICTION SERPENT
89	FORTRAN	CDC 3800	MIE SCATTERING COMPUTATIONS
16	FORTRAN	CDC 3800	INTERNAL GRAVITY WAVES DISPER
107	FORTRAN	CDC 3800	ANNOTATED TRACK ON STEREOGRAPHIC PROJECTION
47	FORTRAN	CDC 3800	PLOTS TRACK AND DATA PROFILE TRACK
47	FORTRAN	CDC 3800	GEODATA
47	FORTRAN	CDC 3800	MAGNETIC SIGNATURES MAGPLOT
4	FORTRAN	CDC 6400	DATA MGT SYS FOR PHYS CHEM DATA OCEANSV
78	FORTRAN IV	CDC 6400	VECTOR TIME SERIES CURPLT6
93	FORTRAN	CDC 6400	HORIZONTAL RANGE
26	FORTRAN	CDC 6400	UPWELLING CSTLUPWL
125	MS FORTRAN	CDC 6400	TIME SERIES ANALYSIS PROGRAMS TSAP
125	FORTRAN IV	CDC 6400	SCALAR TIME SERIES TEMPLT7
27	FORTRAN IV	CDC 6400	THREE-DIMENSIONAL SIMULATION PACKAGE AUGUR
67	FORTRAN	CDC 6400	PYRANOMETER AND RADIOMETER TIME SERIES RAD
52	FORTRAN IV	CDC 6400	COMBINED CHLOROPHYLL AND PRODUCTIVITY
24	FORTRAN IV	CDC 6500	MULTI-LAYER HYDRODYNAMIC-NUMBERICAL MODEL
88	FORTRAN IV	CDC 6500	HURRICANE HEAT POTENTIAL MODEL
24	FORTRAN IV	CDC 6500	SINGLE LARGE HYDRODYNAMICAL-NUMERICAL MODEL
14	FORTRAN EXT	CDC 6500	OCEANOGRAPHIC DATA COMPUTATION TPCONV
83	FORTRAN IV	CDC 6500	FRENCH SPECTRO-ANGULAR WAVE MODEL
93	FORTRAN IV	CDC 6500	NORMAL MODE CALCULATIONS NORMOD 3
76	FORTRAN	CDC 6500	SEARCH AND RESCUE PLANNING NSAR
72	FORTRAN IV	CDC 6500	THERMAL POLLUTION MODEL
75	FORTRAN	CDC 6500	MEAN DRIFT ROUTINE
15	FORTRAN EXT	CDC 6500	VARIANCE AND STANDARD DEVIATION SUMMARY
17	FORTRAN IV	CDC 6500	OBJECTIVE THERMOCLINE ANALYSIS
88	FORTRAN IV	CDC 6500	OCEAN-ATMOSPHERE FEEDBACK MODEL
17	FORTRAN IV	CDC 6500	WET BULB TEMPERATURE WETBLA
31	FORTRAN IV	CDC 6600	DYNAMIC RESPONSE OF CABLE SYSTEM SNAPLG
31	FORTRAN IV	CDC 6600	CHANGES IN ELECTROMECHANICAL CABLE RAMSC
31	FORTRAN IV	CDC 6600	END RESPONSES IN ELECTROMECHANICAL CABLE RADAC
51	FORTRAN IV	CDC 6600	PRODUCTIVITY OXYGEN
80	FORTRAN IV	CDC 6600	HARMONIC ANALYSIS OF DATA AT TIDAL FREQUENCIES
30	FORTRAN IV	CDC 6600	DEEP OCEAN LOAD HANDLING SYSTEMS DOLLS
30	FORTRAN IV	CDC 6600	LOAD MOTION AND CABLE STRESSES CAB1
30	FORTRAN IV	CDC 6600	SOIL TEST DATA TRIAX
30	FORTRAN IV	CDC 6600	DYNAMIC STRESS RESPONSE OF LIFTING LINES CABANA
148	FORTRAN IV	CDC 6600	REPRODUCE AND SERIALIZE DECK DUPE
57	FORTRAN	CDC 6600	A GENERALIZED EXPLOITED POPULATION SIMULATOR
123	FORTRAN IV	CDC 6600	X-Y PLOTS BBTPLT
123	FORTRAN	CDC 6600	DISPLAYS VHRR SATELLITE DATA V5DPD
146	FORTRAN 63	CDC 6600	HYDROGRAPHIC DATA REDUCTION TWO FIVE
142	FORTRAN IV	CDC 6600	CHECKS ANGLES TWOP1
82	FORTRAN IV	CDC 6600	HURRICANE STORM SURGE FORECASTS SPLASH I
82	FORTRAN IV	CDC 6600	HURRICANE STORM SURGE FORECASTS SPLASH II
57	FORTRAN	CDC 6600	GENERALIZED STOCK PRODUCTION MODEL PRODFIT
38	FORTRAN IV	CDC 6600	CONVECTION INVARIABLE VISCOSITY FLUID CONVEC
17	FORTRAN	CDC 6600	INTERNAL WAVE OSCILLATIONS ZMODE
2	FORTRAN IV	CDC 6600	STD DATA PROCESSING
52	FORTRAN IV	CDC 6600	SPECIES DIVERSITY JCB
52	FORTRAN IV	CDC 6600	PRODUCTIVITY ECOPROD
24	FORTRAN IV	CDC 7600	MULTI-LAYER HYDRODYNAMICAL-NUMERICAL MODEL
83	FORTRAN IV	CDC 7600	FRENCH SPECTRO-ANGULAR WAVE MODEL
75	FORTRAN	CDC 7600	OPTIMIZED MULTI-LAYER HN MODEL
17	FORTRAN	CDC 7600	INTERNAL WAVE OSCILLATIONS ZMODE
117	FORTRAN	CDC CYBER	X-Y PLOTS IN A FLEXIBLE FORMAT MEDSPLOT
4	FORTRAN IV	CDC CYBER 74	DAILY SEAWATER OBSERVATIONS

DIGITAL EQUIPMENT CORPORATION

125	FORTRAN 32	PDP-8	TIME SERIES PLOTTING
3	FORTRAN II	PDP-8	PLOTS STATION POSITIONS
3	FORTRAN II	PDP-8	PLOT THETA-S CURVES
118	FORTRAN	PDP-8	SECTION PLOTTING
5	FORTRAN II	PDP 8E	MASS TRANSPORT AND VELOCITIES GEOMASS
139	FORTRAN	PDP-9	BARTLETT'S CURVE FITTING
5	FORTRAN IV	PDP 10	STATION DATA THIRP
5	FORTRAN IV	PDP 10	THERMOMETER CORRECTION THERMOMETRIC DEPTH
20	FORTRAN	PDP-11	GENERAL PURPOSE EDITOR OMSEC
20	FORTRAN	PDP-11	TIME SERIES INTO PROFILES OMSCHP
20	FORTRAN	PDP-11	AANDERAA CURRENT METER DATA AACAL
20	FORTRAN	PDP-11	CURRENT PROFILER DATA MK2CAL
20	FORTRAN	PDP-11	APPENDS NEW DATA TO FILE DERIVE

GENERAL ELECTRIC

139	FORTRAN II	GE 225	CURVE FITTING CRVFT

HEWLETT-PACKARD

143	FORTRAN	HP 2100	THERMOMETER CORRECTION DEPTH COMP HYD1
8	FORTRAN IV	HP 2100	STATION DATA HYD2
3	FORTRAN IV	HP 2100A	STD TABLES AND PLOTS STD
16	FORTRAN IV	HP 2100S	THERMOMETER DATA FILE HANDLER THERMC
105	FORTRAN IV	HP 2100S	LORAN OR OMEGA CONVERSION GEPOS
107	FORTRAN IV	HP 2100S	ANNOTES CHART
108	FORTRAN IV	HP 2100S	BATHYMETRIC OR MAGNETICS CHART PROFL
108	FORTRAN IV	HP 2100S	MERCATOR CHART DIGITIZATION ANTRK
108	FORTRAN IV	HP 2100S	BATHYMETRIC CHART DIGITIZATION DGBTH
108	FORTRAN IV	HP 2100S	PLOTS ON STEREOGRAPHIC CHART ANNCT
108	FORTRAN IV	HP 2100S	PLOTS NAVIGATION DATA OCEAN
16	FORTRAN IV	HP 2100S	THERMOMETRIC DEPTH CALCULATION CAST
124	ASSEMBLY	HP 2100S	PLOTTER COMMANDS PLOT DVRIC
109	FORTRAN IV	HP 2100S	LONG BASE LINE ACOUSTIC TRACKING
2	FORTRAN	HP 2115A	STD PROCESSING WET
1	FORTRAN	HP 2115A	DIGITIZES STD DATA DEEP
105	FORTRAN IV	HP 3100A	CRUISE TRACK TMERC
32	BASIC	HP 9830A	UNMANNED FREE-SWIMMING SUBMERSIBLE
32	BASIC	HP 9830A	UNMANNED FREE-SWIMMING SUBMERSIBLE MOTEL LOAD
31	BASIC	HP 9830A	UNMANNED FREE-SWIMMING SUBMERSIBLE PLOT
120	FORTRAN IV	HP MINI	PLOTS NAVIGATION WITH ANY OTHER DATA TYPE DEEP6

IBM

51	FORTRAN IV	IBM 360	TOXICITY BIOASSAY PROBIT ANALYSIS
54	FORTRAN IV	IBM 360	SUCCESSION
54	FORTRAN IV	IBM 360	SPECIES ABUNDANCE
134	FORTRAN IV	IBM 360	TIME SERIES ANALYSIS BLACKY
24	FORTRAN IV	IBM 360	SINGLE LARGE HYDRODYNAMICAL-NUMERICAL MODEL
143	FORTRAN IV	IBM 360	AREAL CONCENTRATION INTEGRATE
143	FORTRAN IV	IBM 360	UNWEIGHTED AVERAGES AVERAGE
73	ANS FORTRAN	IBM 360	ECOLOGICAL STATISTICAL PROGRAMS ECOSTAT
24	FORTRAN IV	IBM 360	MATHEMATICAL WATER QUALITY MODEL FOR ESTUARIES

26	FORTRAN IV	IBM 360	COMPUTATICN CF FLOW THROUGH MASONBORO INLET NC
26	FORTRAN IV	IBM 360	CIRCULATICN IN PAMLICC SOUNC
116	FORTRAN	IBM 360	DENDRCGRAPH
25	FORTRAN IV	IBM 360	CYNAMIC DETERMINISTIC SIMULATICN SIMUDELT
54	FORTRAN IV	IBM 360	PIGMENT RATIC
13	BASIC	IBM 360	ENVIRCNMENTAL DYNAMICS SUBRCUTINES OCEANLIB
13	BASIC	IBM 360	GECSTRCPHIC CURRENT
22	FORTRAN	IBM 360	CO2 ANC OC SAT
22	FORTRAN	IBM 360	SPECIFIC CONCUCTIVITY WITH PRESSURE EFFECT
17	FORTRAN IV	IBM 360	CBJECTIVE THERMOCLINE ANALYSIS
112	FORTRAN IV	IBM 360/30	ADJUSTS A STATE PLANE COORDINATE TRAVERSE
28	FORTRAN IV	IBM 360/40	MATHEMATICAL MCDEL CF CCASTAL UPWELLING
86	FORTRAN	IBM 360/40	WATER WAVE TEACHING AICS PRCFILE
86	FORTRAN	IBM 360/40	WATER WAVE TEACHING AICS REFLI
86	FORTRAN	IBM 360/40	WATER WAVE TEACHING AIDS FORCE AND MOVEMENT
135	FORTRAN IV	IBM 360/40	SPECTRA PROGRAMS DETRND AUTCOV CRSCCV FCURTR
85	FORTRAN	IBM 360/40	WATER WAVE TEACHING AICS PRCFI
85	FORTRAN	IBM 360/40	WATER WAVE TEACHING AICS UMAXI
85	FORTRAN	IBM 360/40	WATER WAVE TEACHING AIDS UTMAXI
85	FORTRAN	IBM 360/40	WATER WAVE TEACHING AIDS WMAXI
85	FORTRAN	IBM 360/40	WATER WAVE TEACHING AICS LENGI
85	FORTRAN	IBM 360/40	WATER WAVE TEACHING AIDS DETRND
85	FORTRAN	IBM 360/40	WATER WAVE TEACHING AIDS WTMAX2
85	FORTRAN	IBM 360/40	WATER WAVE TEACHING AIDS UCFTI
85	FORTRAN	IBM 360/40	WATER WAVE TEACHING AIDS WCFTI
85	FORTRAN	IBM 360/40	WATER WAVE TEACHING AICS UTCFTI
85	FORTRAN	IBM 360/40	WATER WAVE TEACHING AIDS WTCFTI
85	FORTRAN	IBM 360/40	WATER WAVE TEACHING AIDS AUTCOV
85	FORTRAN	IBM 360/40	WATER WAVE TEACHING AICS CRSCOV
85	FORTRAN	IBM 360/40	WATER WAVE TEACHING AIDS FCURTR
85	FORTRAN	IBM 360/40	WATER WAVE TEACHING AIDS EOSIT
115	FORTRAN IV	IBM 360/40	MAP PROJECTICNS AND GRIDS MAP
4	COBOL	IBM 360/50	CONSISTENCY CF PHYSICAL AND CHEMICAL DATA
4	FORTRAN	IBM 360/50	CONSISTENCY CF PHYSICAL ANC CHEMICAL DATA
122	FORTRAN IV	IBM 360/61	PROFILE PLCTS TIME AXIS PRCFL3
122	FORTRAN IV	IBM 360/61	PRCFILE PLCTS DISTANCE AXIS PFLDST
122	FORTRAN IV	IBM 360/61	MAP PLCTS MAPPLT
41	FORTRAN IV	IBM 360/65	PLCTS PROFILES CF BATHYMETRY AND MAGNETIC
150	FORTRAN IV	IBM 360/65	FILE INDEPENCENT GEN APP SYS GAS GASCIPES
150	FORTRAN IV	IBM 360/65	FILE INDEPENCENT GEN APP SYS GAS GASSAMPC
150	FORTRAN IV	IBM 360/65	FILE INDEPENCENT GEN APP SYS GAS GASEINV
150	FORTRAN IV	IBM 360/65	FILE INDEPENCENT GEN APP SYS GAS GASCCI
150	FORTRAN IV	IBM 360/65	FILE INDEPENCENT GEN APP SYS GAS GASVPRT
150	FORTRAN IV	IBM 360/65	FILE INDEPENCENT GEN APP SYS GAS GVARCFRM
150	FORTRAN IV	IBM 360/65	FILE INDEPENCENT GEN APP SYS GAS CANADA
150	FORTRAN IV	IBM 360/65	FILE INDEPENCENT GEN APP SYS GAS GAS
150	FORTRAN IV	IBM 360/65	FILE INDEPENCENT GEN APP SYS GAS GASVASLM
150	PL/1	IBM 360/65	FILE INDEPENCENT GEN APP SYS GAS GAS THERM
150	ASSEMBLER	IBM 360/65	FILE INDEPENCENT GEN APP SYS GAS GASTHERM
150	ASSEMBLER	IBM 360/65	FILE INDEPENCENT GEN APP SYS GAS INCATA
150	ASSEMBLER	IBM 360/65	FILE INDEPENCENT GEN APP SYS GAS CREATE
150	ASSEMBLER	IBM 360/65	FILE INDEPENCENT GEN APP SYS GAS MCNTHEC
150	ASSEMBLER	IBM 360/65	FILE INDEPENCENT GEN APP SYS GAS CHEMBO
150	ASSEMBLER	IBM 360/65	FILE INDEPENCENT GEN APP SYS GAS CEPTHEC
150	ASSEMBLER	IBM 360/65	FILE INDEPENCENT GEN APP SYS GAS LATLCNEO
150	ASSEMBLER	IBM 360/65	FILE INDEPENCENT GEN APP SYS GAS GASCRCER
20	ASSEMBLER	IBM 360/65	TEMPERATURE CIFFERENCE CALCULATIONS
120	FORTRAN	IBM 360/65	SEQUENTIAL PLCTTING
144	FORTRAN IV	IBM 360/65	JULIAN CATE CCNVERSICN ROUTINES JULIAN

144	FORTRAN IV	IBM 360/65	JULIAN DATE CONVERSION ROUTINES JULYAN
144	FORTRAN IV	IBM 360/65	JULIAN DATE CONVERSION ROUTINES JULSEC
144	FORTRAN IV	IBM 360/65	JULIAN DATE CONVERSION ROUTINES CESLUJ
144	FORTRAN IV	IBM 360/65	DAY OF THE WEEK NDAYWK
124	FORTRAN IV	IBM 360/65	OXYGEN PHOSPHATE DENSITY PLOTS
124	FORTRAN IV	IBM 360/65	GENERAL MERCATOR PLOT
114	FORTRAN IV	IBM 360/65	NOS SCIENTIFIC SUBROUTINE SYSTEM LORAN
114	FORTRAN IV	IBM 360/65	NOS SCIENTIFIC SUBROUTINE SYSTEM OMEGA
114	FORTRAN IV	IBM 360/65	NOS SCIENTIFIC SUBROUTINE SYSTEM SCCIN
114	FORTRAN IV	IBM 360/65	NOS SCIENTIFIC SUBROUTINE SYSTEM SCOPN
114	FORTRAN IV	IBM 360/65	NOS SCIENTIFIC SUBROUTINE SYSTEM TPFIX
114	FORTRAN IV	IBM 360/65	NOS SCIENTIFIC SUBROUTINE SYSTEM UTMCO
138	FORTRAN IV	IBM 360/65	FITS A SMOOTH CURVE
18	FORTRAN	IBM 360/65	ISENTROPIC INTERPOLATION
18	ASSEMBLER	IBM 360/65	POTENTIAL TEMP AND/OR DENSITY POTDEN
18	FORTRAN	IBM 360/65	SIGMAT
18	FORTRAN IV	IBM 360/65	DYNAMIC DEPTH ANOMALY DYANOM
18	FORTRAN	IBM 360/65	SALINITY FROM CONDUCTIVITY T P SALINE
78	ASSEMBLER	IBM 360/65	SURFACE CURRENT SUMMARY SUFCUR
148	FORTRAN IV	IBM 360/65	FLAGS SUSPICIOUS DATA VALUES EDITQ
38	FORTRAN IV	IBM 360/65	GRAVITATIONAL ATTRACTION TWO-DIMENSIONAL BODIES
153	ASSEMBLER	IBM 360/65	RETXET
153	ASSEMBLER	IBM 360/65	XBTCONV
153	ASSEMBLER	IBM 360/65	RETET
153	ASSEMBLER	IBM 360/65	BTLISTC
153	FORTRAN IV	IBM 360/65	XBSELECT
153	FORTRAN IV	IBM 360/65	XBMSINV
153	FORTRAN IV	IBM 360/65	XBGEOSUM
153	FORTRAN IV	IBM 360/65	CANMMC
153	PL/1	IBM 360/65	BTGECIV
153	PL/1	IBM 360/65	SCMNINE
153	PL/1	IBM 360/65	SCMULTI
153	PL/1	IBM 360/65	DRYLAND
103	FORTRAN IV	IBM 360/65	ASTRONOMIC POSITION AZIMUTH METHOD
23	FORTRAN IV	IBM 360/65	WATER CHEMISTRY DIELECTRIC CONSTANT
113	FORTRAN IV	IBM 360/65	NOS SCIENTIFIC SUBROUTINE SYSTEM ANGLE
113	FORTRAN IV	IBM 360/65	NOS SCIENTIFIC SUBROUTINE SYSTEM ANLIS
113	FORTRAN IV	IBM 360/65	NOS SCIENTIFIC SUBROUTINE SYSTEM APCTN
113	FORTRAN IV	IBM 360/65	NOS SCIENTIFIC SUBROUTINE SYSTEM APCWN
113	FORTRAN IV	IBM 360/65	NOS SCIENTIFIC SUBROUTINE SYSTEM APOLY
113	FORTRAN IV	IBM 360/65	NOS SCIENTIFIC SUBROUTINE SYSTEM CGSPC
113	FORTRAN IV	IBM 360/65	NOS SCIENTIFIC SUBROUTINE SYSTEM CUBIC
113	FORTRAN IV	IBM 360/65	NOS SCIENTIFIC SUBROUTINE SYSTEM EXCEB
113	FORTRAN IV	IBM 360/65	NOS SCIENTIFIC SUBROUTINE SYSTEM GMLIC
113	FORTRAN IV	IBM 360/65	NOS SCIENTIFIC SUBROUTINE SYSTEM HIFIX
19	FORTRAN	IBM 360/65	VOLUME TRANSPORT FUNCTION QFUN
19	FORTRAN IV	IBM 360/65	POTENTIAL TEMP AND DENSITY PODENS
19	FORTRAN IV	IBM 360/65	VOLUME TRANSPORT VOLTRN
19	FORTRAN IV	IBM 360/65	COMPUTES PRESSURE PRESSR
139	FORTRAN IV	IBM 360/65	FITS POLYNOMIAL P3TERM
136	FORTRAN IV	IBM 360/65	EXTENDED NORMAL SEPARATOR PROGRAM ENORMSEP
25	FORTRAN IV	IBM 360/65	MIT SALINITY INTRUSION PROGRAM
103	FORTRAN IV	IBM 360/65	PLOTS MAPS GRIDS TRACKS MAP
152	ASSEMBLER	IBM 360/65	SDPRT2
152	ASSEMBLER	IBM 360/65	SDSELECT
152	ASSEMBLER	IBM 360/65	SD2MSTCT
152	ASSEMBLER	IBM 360/65	SD2SAMP
152	ASSEMBLER	IBM 360/65	MAKE120
152	ASSEMBLER	IBM 360/65	DEPTH

152	ASSEMBLER	IBM 360/65	CRUCON
152	ASSEMBLER	IBM 360/65	CCDCCCNV
152	ASSEMBLER	IBM 360/65	SUPERSEL
152	ASSEMBLER	IBM 360/65	SDPASS
152	ASSEMBLER	IBM 360/65	XCPDER
152	ASSEMBLER	IBM 360/65	XBTCCUNT
152	FORTRAN	IBM 360/65	XBTGKCUT
152	PL/1	IBM 360/65	SDGECIV
152	PL/1	IBM 360/65	XBEVALU
152	PL/1	IBM 360/65	XBCCNV
152	PL/1	IBM 360/65	XBFNWC
152	PL/1	IBM 360/65	XBTNWSUM
142	FORTRAN IV	IBM 360/65	CHECKS ANGLES TWOPI
122	FORTRAN IV	IBM 360/65	PLOTS SCATTERGRAM SCTGM4 SCTGMS
22	FORTRAN IV	IBM 360/65	PERCENTAGE SATURATION OF OXYGEN IN ESTUARY
25	FORTRAN IV	IBM 360/65	MIT SALINITY INTRUSION PROGRAM
115	FORTRAN IV	IBM 360/65	COMPUTE GREAT CIRCLE PATH GCIRC
144	FORTRAN IV	IBM 360/65	JULIAN DAY CONVERSION JDAYWK
144	FORTRAN IV	IBM 360/65	JULIAN DATE CONVERSION ROUTINES JULDAY
7	FORTRAN IV	IBM 360/65	READ CALC INTERP STATION DATA CAPRICORN
7	FORTRAN IV	IBM 360/65	STATION DATA CALCULATIONS F3
147	FORTRAN IV	IBM 360/65	READS NODC STATION DATA TAPE
8	FORTRAN IV	IBM 360/65	PLOTS STATION DATA PLTEDT
8	FORTRAN IV	IBM 360/65	CALCULATES STATION DATA SECPG
97	FORTRAN	IBM 360/65	SOUND VELOCITY WILSONS FORMULA WLSND
97	FORTRAN	IBM 360/65	SOUND VELOCITY WILSONS FORMULA SVELFS
97	FORTRAN	IBM 360/65	SOUND VELOCITY WILSONS FORMULA VELPRS
141	PL/1	IBM 360/65	LINEAR INTERPOLATION LININT
141	PL/1	IBM 360/65	LAGRANGIAN THREE POINT INTERPOLATION LAG3PT
141	FORTRAN IV	IBM 360/65	CALCULATES SPLINE COEFFICIENT SPLCOF
141	FORTRAN IV	IBM 360/65	INTERPOLATING BY CUBIC SPLINE
151	FORTRAN IV	IBM 360/65	FILE INDEPENDENT GEN APP SYS GAS ALTERGAS
151	FORTRAN IV	IBM 360/65	FILE INDEPENDENT GEN APP SYS GAS GASB
151	FORTRAN IV	IBM 360/65	FILE INDEPENDENT GEN APP SYS GAS NODCSQ
151	FORTRAN IV	IBM 360/65	FILE INDEPENDENT GEN APP SYS GAS NAMES
151	FORTRAN IV	IBM 360/65	FILE INDEPENDENT GEN APP SYS GAS SD2 GAS
151	ASSEMBLER	IBM 360/65	SDRETV
151	ASSEMBLER	IBM 360/65	SD2TCSD1
151	PL/1	IBM 360/65	SD2CHAR
41	FORTRAN IV	IBM 360/65	MARINE GEOPHYSICAL DATA REDUCTION
83	FORTRAN IV	IBM 360/75	WAVE BOTTOM VELOCITY
4	COBOL	IBM 360/85	DATA MGT SYS FOR PHYS CHEM DATA OCEANSV
4	PL/1	IBM 360/85	DATA MGT SYS FOR PHYS CHEM DATA OCEANSV
84	FORTRAN	IBM 360/165	WAVE INTERACTION WITH CURRENT CAPGRAY
74	PL/1	IBM 360/168	DRIFT BOTTLE/STATISTICS
74	PL/1	IBM 360/168	DRIFT BOTTLE PLOTS
74	PL/1	IBM 360/168	REFORMAT AND SORT DRIFT BOTTLE DATA
80	FORTRAN IV	IBM 360/195	ASTRONOMICAL TIDE PREDICTION
80	FORTRAN 6C	IBM 360/195	TIDES IN THE OPEN SEA
123	FORTRAN	IBM 360/195	MICROFILM PLOTS OF VHRR SATELLITE DATA
82	FORTRAN IV	IBM 360/195	EAST COAST STORM SURGE
82	FORTRAN IV	IBM 360/195	WAVE FORECASTS
28	FORTRAN IV	IBM 370	ESTUARINE CHEMISTRY MYACHEM
28	FORTRAN IV	IBM 370	ESTUARINE TIDES
73	ANS FORTRAN	IBM 370	ECOLOGICAL STATISTICAL PROGRAMS ECOSTAT
116	FORTRAN	IBM 370	DENDROGRAPH
136	FORTRAN IV	IBM 370	PROBABILITY DISTRIBUTION WEIBUL
56	FORTRAN IV	IBM 370	RESOURCES ALLOCATION IN FISHERIES MGT PISCES
56	FORTRAN IV	IBM 370	WATER RESOURCES TEACHING GAME DAM

55	FORTRAN	IBM 370	CHLOROPHYLL CHLOR
55	FORTRAN	IBM 370	PHYTOPLANKTON POPULATION DENSITY
55	FORTRAN	IBM 370	SPECIES DIVERSITY
153	FORTRAN	IBM 370	REFORMATTED STATION OUTPUT IBM 1
50	FORTRAN	IBM 370	OPTIMAL ECOSYSTEM POLICIES OEP
28	FORTRAN	IBM 370/155	MODELING AN OCEAN POND
25	FORTRAN	IBM 370/155	ESTUARINE DENSITY CURRENTS AND SALINITY
24	FORTRAN	IBM 370/165	ESTUARINE MODEL NCALNRA
72	PL/1	IBM 370/168	MONTE CARLO SPILL TRACKER
87	PL/1	IBM 370/180	MARKOVIAN ANALYSIS OF TDF-14 WIND DATA
117	FORTRAN IV	IBM 1130	PLOTS HYDRO CAST DATA PLOG
117	FORTRAN IV	IBM 1130	PLOTS STD DATA STPO1
145	FORTRAN II	IBM 1130	REDUCTION AND DISPLAY OF DATA ACQUIRED AT SEA
135	FORTRAN IV	IBM 1130	ANALYSIS OF NON-LINEAR RESPONSE SURFACE
135	FORTRAN IV	IBM 1130	MULTIPLE DISCRIMINANT ANALYSIS MULDA
146	FORTRAN VI	IBM 1130	THERMOMETER CORRECTION TCHK2
25	FORTRAN IV	IBM 1130	BEACH SIMULATION MODEL
29	FORTRAN IV	IBM 1130	BEACH AND NEARSHORE MAPS A-S
118	FORTRAN IV	IBM 1130	PLOTS TEMPERATURE-SALINITY PSAL 1
38	FORTRAN IV	IBM 1130	SEDIMENT GRAIN SIZE ANALYSIS
54	FORTRAN IV	IBM 1130	YIELD PER RECRUIT KYLD BIOM
40	FORTRAN IV	IBM 1130	REDUCTION DISPLAY STORAGE GEOPHYSICAL DATA
1	FORTRAN IV	IBM 1130	STD COMPUTATIONS STPO2
1	FORTRAN IV	IBM 1130	HYDRO CAST COMPUTATIONS
1	FORTRAN IV	IBM 1130	TRANSPORT COMPUTATIONS FROM ATMOSPHERIC PRESSURE
103	FORTRAN IV	IBM 1130	SATELLITE RISE AND SET TIMES ALERT ASORT
134	FORTRAN	IBM 1401	TWO-DIMENSIONAL AUTOCORRELATION
91	FORTRAN 60	IBM 1604	WIND DRIFT AND CONCENTRATION OF SEA ICE ICEGRID
1	FORTRAN I	IBM 1620	TRANSPORT COMPUTATIONS FROM ATMOSPHERIC PRESSURE
15	FORTRAN	IBM 1620	INTERPOLATION FOR OCEANOGRAPHIC DATA
114	SPS	IBM 1620	COMPUTES GEOGRAPHIC POSITIONS
114	SPS	IBM 1620	LORAN C VERSION2
79	FORTRAN II	IBM 1620	PROCESSES CURRENT INSTRUMENT OBSERVATIONS
48	FORTRAN II	IBM 1620	SOIL AND SEDIMENT ENGINEERING TEST DATA
149	FORTRAN	IBM 1800	FORMAT FREE INPUT SUBROUTINE QREAD
149	FORTRAN	IBM 1800	METERS VS FATHOMS MATBL
134	FORTRAN IV	IBM 1800	GENERATES ARBITRARY FILTER HILOW
84	FORTRAN IV	IBM 1800	SHIPBORNE WAVE RECORDER ANALYSIS SBWRO
104	FORTRAN IV	IBM 1800	LORAN/DECCA COORDINATES CALCULATION HNAV
104	FORTRAN IV	IBM 1800	LORAN/DECCA FILE INITIALIZATION HNV1
104	FORTRAN IV	IBM 1800	GEODETIC DISTANCE AND AZIMUTH SDANC
37	FORTRAN IV	IBM 1800	CABLE CONFIGURATION
144	FORTRAN	IBM 1800	DATE CALCULATIONS DAYWK
144	FORTRAN	IBM 1800	DATE CALCULATIONS NWDAT
144	FORTRAN	IBM 1800	DATE CALCULATIONS NXTDY
144	FORTRAN	IBM 1800	DATE CALCULATIONS YSTDY
103	FORTRAN	IBM 1800	SATELLITE NAVIGATION
135	FORTRAN	IBM 1800	BARTLETT'S CURVE FITTING
136	FORTRAN	IBM 1800	CLUSTER ANALYSIS
106	FORTRAN	IBM 1800	LORAN FIX LRFIX
106	FORTRAN	IBM 1800	PLAN COURSE AND SCHEDULE CRUIS
106	FORTRAN	IBM 1800	EARTH SPHERICAL SUBROUTINES ESTCH ESTC2 ESTPL
105	FORTRAN	IBM 1800	PLOTS MERCATOR GRID CHART
105	FORTRAN	IBM 1800	NAVIGATIONAL SATELLITE PASSES ALRTX
145	FORTRAN	IBM 1800	JULIAN DAY SUBROUTINES CLEJL
145	FORTRAN	IBM 1800	JULIAN DAY SUBROUTINES CLJUL
145	FORTRAN	IBM 1800	TIME CONVERSION OTIME
145	FORTRAN IV	IBM 1800	CURRENT METER DATA REDUCTION
142	FORTRAN	IBM 1800	TRIGONOMETRY SUBROUTINES ASSUB SAS ASA

107	FORTRAN	IBM 1800	DEGREE CONVERSIONS DEGFR DEMI
107	FORTRAN	IBM 1800	MERCATOR DEGREES DMRCT
107	FORTRAN	IBM 1800	MAGNETIC FIELD COMPONENTS MAGFI
98	FORTRAN	IBM 7074	LIGHT AND SOUND INSTRUCTION B
112	FORTRAN	IBM 7074	SOUNDING PLOT
112	FORTRAN	IBM 7074	SINGLE INTEGRATION
137	FORTRAN	IBM 7074	SINGLE INTEGRATION
45	FORTRAN	IBM 7074	LIGHT AND SOUND INSTRUCTION D
46	FORTRAN	IBM 7074	SEAMOUNT MAGNETIZATION
46	FORTRAN	IBM 7074	OBSERVATION DRAPING GRAVITY
76	FORTRAN	IBM 7074	CURRENT METER TURBULENCE
139	FORTRAN	IBM 7074	LEAST SQUARES PLOT
89	FORTRAN	IBM 7074	SOLAR RADIATION CONVERSION
89	FORTRAN	IBM 7074	WIND STRESS
89	FORTRAN	IBM 7074	TWO-DIMENSIONAL POWER SPECTRUM FOR SWOP II
144	FORTRAN	IBM 7074	BATHYMETRIC DATA REDUCTION
14	FORTRAN	IBM 7074	MONTHLY SONIC LAYER DEPTH
14	FORTRAN	IBM 7074	VERTICAL TEMPERATURE GRADIENTS
40	FORTRAN IV	IBM 7074	COMPUTATION AND PLOTTING OF MAGNETIC ANOMALIES
100	FORTRAN	IBM 7074	CRITICAL ACOUSTIC RATIO
110	FORTRAN II	IB7 7074	INDIVIDUAL POINT GENERATOR FOR MAP PROJECTIONS
90	FORTRAN	IBM 7074	PREDICTION OF VERTICAL TEMPERATURE CHANGE
90	FORTRAN	IBM 7074	CLOUD COVER AND DAILY SEA TEMPERATURE
111	FORTRAN II	IB7 7074	INDIVIDUAL POINT GENERATOR FOR DISTANCE
111	FORTRAN	IB7 7074	GEODETIC DATUM REDUCTION
111	FORTRAN	IB7 7074	GEODETIC POSITION COMPUTATION AND PLOT
146	FORTRAN II	IBM 7094	STATION DATA REDUCTION SYNOP
52	FORTRAN IV	IBM 7094	CONCENTRATIONS PER SQUARE METER OF SURFACE
135	FORTRAN	IBM 7090	FOURIER ANALYSIS LA01
134	FORTRAN	IBM 7090	TWO-DIMENSIONAL AUTOCORRELATION
104	MAD	IBM 7090	GENERAL MAP PROJECTION
104	MAD	IBM 7090	FINITE MAP PROJECTION DISTORTIONS
80	MAD	IBM 7090	THEORETICAL RADIAL TIDAL FORCE
91	FORTRAN IV	IBM 7090-94	SEA ICE STUDIES YAKIT
91	FORTRAN IV	IBM 7090-94	SEA ICE STUDIES FLIP
91	FORTRAN IV	IBM 7090-94	SEA ICE STUDIES SALPR
91	FORTRAN IV	IBM 7090-94	SEA ICE STUDIES RITE
146	FORTRAN II	IBM 7094	STATION DATA REDUCTION SYNOP
53	FORTRAN IV	IBM 7094	PHYTOPLANKTON NUMBERS VOLUME SURFACE AREA
53	MAP	IBM 7094	PHYTOPLANKTON NUMBERS VOLUME SURFACE AREA
101	FORTRAN II	IBM 7090	ACOUSTIC RAY TRACING

UNIVAC

138	FORTRAN V	UNIVAC	FITTING A LEAST SQUARES DISTANCE HYPERPLANE
20	FORTRAN	UNIVAC 1106	APPENDS NEW DATA TO FILE DERIVE
20	FORTRAN	UNIVAC 1106	CONCATENATES SORTS SEGMENTS OUTPUTS DMSCRT
20	FORTRAN	UNIVAC 1106	INTERPOLATES TO UNIFORM GRID MATRIX OI
20	FORTRAN	UNIVAC 1106	TIME SERIES STD OR PCM PROFILES PLSAC
20	FORTRAN	UNIVAC 1106	INTERNAL WAVES IWEG
20	FORTRAN	UNIVAC 1106	DYNAMICAL FIELDS INTERNAL WAVE RAYS CHRSEC
20	FORTRAN	UNIVAC 1106	AUTO AND CROSS SPECTRA TUKEY METHOD
20	FORTRAN	UNIVAC 1106	AUTO AND CROSS SPECTRA POLARIZED FORM CPXSPC
20	FORTRAN	UNIVAC 1106	AMPLITUDES PHASES LEAST SQUARES TIDES4
20	FORTRAN	UNIVAC 1106	METEOROLOGICAL FLUXES METFLX
20	FORTRAN	UNIVAC 1106	CROSS COVARIANCE MATRIX EMPEIGI
101	FORTRAN IV	UNIVAC 1108	SONAR IN REFRACTIVE WATER
101	FORTRAN IV	UNIVAC 1108	SONAR IN REFRACTIVE WATER

101	FORTRAN IV	UNIVAC 1108	SORTS SOUND RAY DATA RAY SORT
141	FORTRAN IV	UNIVAC 1108	SMOOTHING DATA USING THE CUBIC SPLINE
121	FORTRAN	UNIVAC 1108	OVERLAY PLOTTING OVLPLT
121	FORTRAN V	UNIVAC 1108	REFORMATS DATA PLOTS TRACK CHART MASTRACK
110	FORTRAN	UNIVAC 1108	LORAN TO GEOGRAPHIC AND/GEOGRAPHIC TO LORAN
110	FORTRAN	UNIVAC 1108	LORAN COORDINATE COMPUTATION
110	FORTRAN	UNIVAC 1108	LORAN SKYWAVE CORRECTION
50	FORTRAN IV	UNIVAC 1108	INVERSE PROBLEM IN ECOSYSTEM ANALYSIS
44	FORTRAN IV	UNIVAC 1108	LISTS GEOPHYSICAL DATA LISTP
44	FORTRAN IV	UNIVAC 1108	COURSE, SPEED, EOTVOS CORRECTION LCXNAV
44	FORTRAN IV	UNIVAC 1108	CONVERTS GEOPHYSICAL DATA PHONEY
44	FORTRAN IV	UNIVAC 1108	SOUND VELOCITY VARIATION AND NAVIGATION FATHOM
99	FORTRAN V	UNIVAC 1108	CONTINUOUS GRADIENT RAY TRACING SYSTEM CONGRATS
99	FORTRAN	UNIVAC 1108	RAY PATH SC434B
139	FORTRAN	UNIVAC 1108	TEMPERATURE SALINITY CORRECTIONS CURVEFIT N1S512
109	FORTRAN	UNIVAC 1108	FAA PLOT
109	FORTRAN	UNIVAC 1108	DISTANCE AND AZIMUTH CIRAZD
109	FORTRAN	UNIVAC 1108	PARAMETRIC MAP
94	FORTRAN V	UNIVAC 1108	BEAM PATTERNS AND WIDTHS GBEAM
94	FORTRAN V	UNIVAC 1108	STATISTICS ACOUSTIC MEASUREMENTS AND PREDICTIONS
94	FORTRAN IV	UNIVAC 1108	PROPAGATION LOSS FAST FIELD PROGRAM
94	FORTRAN II	UNIVAC 1108	BOTTOM REFLECTIVITY
34	FORTRAN V	UNIVAC 1108	BOOMERANG CORER DESCENT/ASCENT TRAJECTORIES
34	FORTRAN V	UNIVAC 1108	BUOY-SHIP DYNAMICS
34	FORTRAN V	UNIVAC 1108	BUOY-SYSTEM DYNAMICS
34	FORTRAN V	UNIVAC 1108	FIXED THIN LINE ARRAY DYNAMICS
14	FORTRAN V	UNIVAC 1108	WATER CLARITY
24	FORTRAN IV	UNIVAC 1108	THREE DIMENSIONAL ESTUARINE CIRCULATION MODEL
134	FORTRAN IV	UNIVAC 1108	SPECTRAL ANALYSIS OF TIME SERIES
43	FORTRAN IV	UNIVAC 1108	LISTS EVERY HUNDREDTH VALUE SNOOP
43	FORTRAN IV	UNIVAC 1108	NAVIGATION COMPUTATIONS TPNAV
43	FORTRAN IV	UNIVAC 1108	EDITS GEOPHYSICAL DATA ZEDIT
43	FORTRAN IV	UNIVAC 1108	GEOPHYSICAL DATA CONVERSION HANDY
93	FORTRAN V	UNIVAC 1108	NORMAL MODE PROPAGATION MODEL
53	FORTRAN IV	UNIVAC 1108	GENERATES ZOOPLANKTON TAXONOMIC DIRECTORY
53	FORTRAN IV	UNIVAC 1108	DEEP OCEAN ZOOPLANKTON DISTRIBUTION
53	FORTRAN IV	UNIVAC 1108	DEEP OCEAN ZOOPLANKTON POPULATION STATISTICS
33	FORTRAN V	UNIVAC 1108	CABLE TOWED BUOY CONFIGURATIONS IN A TURN
33	FORTRAN V	UNIVAC 1108	FREE-FLOATING SPAR-ARRAY DYNAMICS
33	FORTRAN V	UNIVAC 1108	FREE-FLOATING SPAR-BUOY DYNAMICS
33	FORTRAN V	UNIVAC 1108	SHIP SUSPENDED ARRAY DYNAMICS
36	FORTRAN V	UNIVAC 1108	TOWED SYSTEM DYNAMICS
36	FORTRAN V	UNIVAC 1108	TRAPEZOIDAL ARRAY DEPLOYMENT DYNAMICS
16	FORTRAN V	UNIVAC 1108	STD-S/V DATA S2049
36	FORTRAN V	UNIVAC 1108	STEADY-STATE SUBSURFACE BUOY SYSTM CONFIGURATION
36	FORTRAN V	UNIVAC 1108	TOWED ARRAY DYNAMICS
76	FORTRAN V	UNIVAC 1108	IN-SITU CURRENT
76	FORTRAN	UNIVAC 1108	WATER DISPLACEMENT DISPLA
84	FORTRAN IV	UNIVAC 1108	STORM SURGE
84	FORTRAN IV	UNIVAC 1108	WAVE REFRACTION
46	FORTRAN IV	UNIVAC 1108	CONVERTS DIGITIZER DATA DYGYT
46	FORTRAN IV	UNIVAC 1108	EDITS REDUCED GEOPHYSICAL DATA EDIT
42	FORTRAN IV	UNIVAC 1108	LISTS RAW DATA 2LIST
42	FORTRAN IV	UNIVAC 1108	PLOTS TRACKLINE CCKDRAW
42	FORTRAN IV	UNIVAC 1108	PLOTS CONTOUR CROSSING INTERVALS COUBLX
42	FORTRAN IV	UNIVAC 1108	PLOTS GEOPHYSICAL DATA PLOT2
32	FORTRAN V	UNIVAC 1108	STEADY STATE TRAPEZOIDAL ARRAY CONFIGURATIONS
32	FORTRAN V	UNIVAC 1108	ANCHOR LAST-BUOY SYSTEM DEVELOPMENT DYNAMICS
45	FORTRAN IV	UNIVAC 1108	PATTERN FUNCTION CALCULATIONS

45	FORTRAN V	UNIVAC 1108	RAYLEIGH-MORSE BOTTOM REFLECTION COEFFICIENTS
45	FORTRAN V	UNIVAC 1108	PROPAGATION LOSS
45	FORTRAN V	UNIVAC 1108	AMOS PROPAGATION LOSS
125	FORTRAN	UNIVAC 1108	SPECTRAL ANALYSIS SUBROUTINES
35	FORTRAN V	UNIVAC 1108	FIXED THIN LINE ARRAY STEADY STATE CONFIGURATION
35	FORTRAN V	UNIVAC 1108	MARINE CORER DYNAMICS
35	FORTRAN V	UNIVAC 1108	STEADY-STATE BUOY SYSTEM CONFIGURATIONS
45	FORTRAN IV	UNIVAC 1108	REGIONAL FIELD RESIDUAL MAGNETIC ANOMALY GAMMA
45	FORTRAN IV	UNIVAC 1108	GRAVITY GAL
45	FORTRAN IV	UNIVAC 1108	PLOTS PROFILES OF GEOPHYSICAL DATA DISPLOT
37	FORTRAN V	UNIVAC 1108	STEADY STATE CABLE LAYING
37	FORTRAN V	UNIVAC 1108	TOWED ARRAY CONFIGURATIONS
37	FORTRAN V	UNIVAC 1108	TRAPEZOIDAL ARRAY DYNAMICS
47	FORTRAN	UNIVAC 1108	TRUE OCEAN DEPTH FATHOR
97	FORTRAN	UNIVAC 1108	SOUND VELOCITY FOR MARINE SEDIMENTS
77	FORTRAN V	UNIVAC 1108	CURRENT METER PRINT
77	FORTRAN V	UNIVAC 1108	CURRENT METER PLOT
77	FORTRAN V	UNIVAC 1108	CONVERT CURRENT METER TAPE
77	FORTRAN V	UNIVAC 1108	CURRENT METER DATA MPRINTO
138	FORTRAN V	UNIVAC 1108	CURVE FITTING VELOCITY PROFILE NEWFIT
48	FORTRAN	UNIVAC 1108	SEDIMENT SIZE
46	FORTRAN IV	UNIVAC 1108	BOTTOM SEDIMENT DISTRIBUTION PLOT

XEROX DATA SYSTEMS

41	FORTRAN IV	XDS SIGMA 7	GEOMAGNETIC FIELD MFIELD
10	FORTRAN IV	XDS SIGMA 7	READS STATION DATA
10	FORTRAN IV	XDS SIGMA 7	GEOSTROPHIC VELOCITY DIFFERENCE VEL
10	FORTRAN IV	XDS SIGMA 7	VOLUME TRANSPORT VTR
10	FORTRAN IV	XDS SIGMA 7	SIGMA-T SIGMAT AND CSIGMT
10	FORTRAN IV	XDS SIGMA 7	ADIABATIC TEMPERATURE GRADIENT ATG
10	FORTRAN IV	XDS SIGMA 7	POTENTIAL TEMPERATURE POTEMP
10	FORTRAN IV	XDS SIGMA 7	SPECIFIC VOLUME SPVOL
50	FORTRAN IV	XDS SIGMA 7	WHOI BIOLOGY SERIES FTAPE
50	FORTRAN IV	XDS SIGMA 7	WHOI BIOLOGY SERIES FLISHT
50	FORTRAN IV	XDS SIGMA 7	WHOI BIOLOGY SERIES CHKSPIT
50	FORTRAN IV	XDS SIGMA 7	WHOI BIOLOGY SERIES SELECT
50	FORTRAN IV	XDS SIGMA 7	WHOI BIOLOGY SERIES CHANAT
50	FORTRAN IV	XDS SIGMA 7	WHOI BIOLOGY SERIES PREPLOTG
50	FORTRAN IV	XDS SIGMA 7	WHOI BIOLOGY SERIES PLOTSPECG
50	FORTRAN IV	XDS SIGMA 7	WHOI BIOLOGY SERIES STATAB
119	FORTRAN IV	XDS SIGMA 7	PLOT OF FREQUENCY DISTRIBUTION THISTO
119	FORTRAN IV	XDS SIGMA 7	VELOCITY VECTOR AVERAGES VECTAV
119	FORTRAN IV	XDS SIGMA 7	PROGRESSIVE VECTORS PROVEC
119	FORTRAN IV	XDS SIGMA 7	PLOTS DATA ALONG TRACK
119	FORTRAN IV	XDS SIGMA 7	PROFILE VERSUS TIME OR DISTANCE
9	FORTRAN IV	XDS SIGMA 7	DYNAMIC HEIGHT DYNHT
9	FORTRAN IV	XDS SIGMA 7	POTENTIAL ENERGY ANOMALY PEN
9	FORTRAN IV	XDS SIGMA 7	VARIOUS PARAMETERS FROM STATION DATA OCCOMP
9	FORTRAN IV	XDS SIGMA 7	SPECIFIC VOLUME ANOMALY SVANOM
9	FORTRAN IV	XDS SIGMA 7	PRESSURE SUBROUTINE PRESS
38	FORTRAN IV	XDS SIGMA 7	X-RAY DIFFRACTION ANALYSIS
39	FORTRAN IV	XDS SIGMA 7	MAGNETIC ANOMALIES MAG2D
136	FORTRAN IV	XDS SIGMA 7	STATISTICS FROM WHOI FORMAT STATS
106	FORTRAN IV	XDS SIGMA 7	SUM OF FINITE ROTATIONS ON A SPHERE SUMROT
105	FORTRAN IV	XDS SIGMA 7	TRANSFORMATION OF SPHERICAL COORDINATES ROTOUT
143	FORTRAN IV	XDS SIGMA 7	THERMOMETER CORRECTION TCPLC
6	FORTRAN IV	XDS SIGMA 7	FLEXIBLE SYSTEM BIO PHYS CHEM DATA SEDHYP

6	FORTRAN IV	XDS SIGMA 7	SUBROUTINES PHYS CHEM BIO PARAMETERS
6	FORTRAN IV	XDS SIGMA 7	INTERPOLATION SUBROUTINES
97	FORTRAN IV	XDS SIGMA 7	SOUND VELOCITY SONVEL
97	FORTRAN IV	XDS SIGMA 7	DEPTH CORRECTION MICOR SOUND VELOCITY
77	FORTRAN IV	XDS SIGMA 7	CURRENT METER CLOCK SEQUENCE XTAL
118	FORTRAN IV	XDS SIGMA 7	HORIZONTAL HISTOGRAMS HISTO
118	FORTRAN IV	XDS SIGMA 7	PRINTER PLOTS LISPLO
148	FORTRAN IV	XDS SIGMA 7	EDITING FOR WHOI FORMAT SCRUB
8	FORTRAN IV	XDS SIGMA 7	BRUNT-VAISALA FREQUENCY OBVFRQ
78	FORTRAN IV	XDS SIGMA 7	CURRENT METER CALIBRATION CASDEC
78	FORTRAN IV	XDS SIGMA 7	CURRENT METER DATA REDUCTION AND EDITING CARP
147	FORTRAN IV	XDS SIGMA 7	CONVERTS ACCC FORMAT DATA TO BNDO FORMAT
147	FORTRAN IV	XDS SIGMA 7	CONVERTS DATA TO BNDO FORMAT TRANSCOD
147	FORTRAN IV	XDS SIGMA 7	READS BNDO FORMAT DATA LSTA 1142
7	FORTRAN IV	XDS SIGMA 7	PROCESSES STD AND CTD DATA SEDSTD
102	FORTRAN IV	XDS SIGMA 7	RAYTRACE

INSTITUTION INDEX

CENTRO ARGENTINO DE DATOS OCEANOGRAFICOS, ARGENTINA

4	COBOL		CALCULATION OF THERMOMETRIC VALUES
4	COBOL	IBM 360/50	CONSISTENCY OF PHYSICAL AND CHEMICAL DATA
4	FORTRAN	IBM 360/50	CONSISTENCY OF PHYSICAL AND CHEMICAL DATA
4	FORTRAN		CALCULATION OF THERMOMETRIC VALUES
4	COBOL		STATION DATA SYSTEM FINAL VALUES
4	FORTRAN		STATION DATA SYSTEM FINAL VALUES

COAST GUARD OCEANOGRAPHIC UNIT, WASHINGTON, DC

11	FORTRAN IV	CDC 3300	OXYGEN OPLOT
11	FORTRAN IV	CDC 3300	CHLOROPHYLL CHLC
11	FORTRAN IV	CDC 3300	SALINITY SALTY
11	FORTRAN IV	CDC 3300	TEMPERATURE SALINITY CLASS VOLUME TSVOL
12	FORTRAN IV	CDC 3300	THERMOMETER CORRECTION THERZ
12	FORTRAN IV	CDC 3300	TRANSPORT XPORT

COAST GUARD, ICE PATROL, NEW YORK, NY

91	FORTRAN IV	CDC 3300	ICEBERG DRIFT ICE-PLOT

COLUMBIA UNIVERSITY, HUDSON LABORATORIES, DOBBS FERRY, NY

102	FORTRAN		RAY TRACING KLERER-MAY USER LANGUAGE

COLUMBIA UNIVERSITY, LAMONT-DOHERTY GEOLOGICAL OBSERVATORY, PALISADES, NY

145	FORTRAN II	IBM 1130	REDUCTION AND DISPLAY OF DATA ACQUIRED AT SEA
135	FORTRAN	IBM 7090	FOURIER ANALYSIS L401

CORNELL UNIVERSITY, ITHACA, NY

143	FORTRAN IV	IBM 360	AREAL CONCENTRATION INTEGRATE
143	FORTRAN IV	IBM 360	UNWEIGHTED AVERAGES AVERAGE
22	FORTRAN	IBM 360	CO2 AND OC SAT
54	FORTRAN IV	IBM 360	PIGMENT RATIO
54	FORTRAN IV	IBM 360	SUCCESSION
54	FORTRAN IV	IBM 360	SPECIES ABUNDANCE

ENVIRONMENTAL DATA SERVICE, NATIONAL OCEANOGRAPHIC DATA CENTER, WASHINGTON, DC

136	FORTRAN IV	IBM 360/65	FITS A SMOOTH CURVE
141	PL/1	IBM 360/65	LINEAR INTERPOLATION LININT
141	PL/1	IBM 360/65	LAGRANGIAN THREE POINT INTERPOLATION LAG3PT
141	FORTRAN IV	IBM 360/65	CALCULATES SPLINE COEFFICIENT SPLCOF
141	FORTRAN IV	IBM 360/65	INTERPOLATING BY CUBIC SPLINE
97	FORTRAN	IBM 360/65	SOUND VELOCITY WILSONS FORMULA WLSND
97	FORTRAN	IBM 360/65	SOUND VELOCITY WILSONS FORMULA SVELFS
97	FORTRAN	IBM 360/65	SOUND VELOCITY WILSONS FORMULA VELPRS
150	FORTRAN IV	IBM 360/65	FILE INDEPENDENT GEN APP SYS GAS GASDIPBS
150	FORTRAN IV	IBM 360/65	FILE INDEPENDENT GEN APP SYS GAS GASSAMPC
150	FORTRAN IV	IBM 360/65	FILE INDEPENDENT GEN APP SYS GAS GASEINV
150	FORTRAN IV	IBM 360/65	FILE INDEPENDENT GEN APP SYS GAS GASCCI
150	FORTRAN IV	IBM 360/65	FILE INDEPENDENT GEN APP SYS GAS GASVPRT
150	FORTRAN IV	IBM 360/65	FILE INDEPENDENT GEN APP SYS GAS GVAREFRM

150	FORTRAN IV	IBM 360/65	FILE INDEPENDENT GEN APP SYS GAS CANADA
150	FORTRAN IV	IBM 360/65	FILE INDEPENDENT GEN APP SYS GAS GAS
150	FORTRAN IV	IBM 360/65	FILE INDEPENDENT GEN APP SYS GAS GASVASUM
151	FORTRAN IV	IBM 360/65	FILE INDEPENDENT GEN APP SYS GAS ALTERGAS
151	FORTRAN IV	IBM 360/65	FILE INDEPENDENT GEN APP SYS GAS GASB
151	FORTRAN IV	IBM 360/65	FILE INDEPENDENT GEN APP SYS GAS NODCSQ
151	FORTRAN IV	IBM 360/65	FILE INDEPENDENT GEN APP SYS GAS NAMES
151	FORTRAN IV	IBM 360/65	FILE INDEPENDENT GEN APP SYS GAS SD2 GAS
150	PL/1	IBM 360/65	FILE INDEPENDENT GEN APP SYS GAS GAS THERM
150	ASSEMBLER	IBM 360/65	FILE INDEPENDENT GEN APP SYS GAS GASTHERM
150	ASSEMBLER	IBM 360/65	FILE INDEPENDENT GEN APP SYS GAS INDATA
150	ASSEMBLER	IBM 360/65	FILE INDEPENDENT GEN APP SYS GAS CREATE
150	ASSEMBLER	IBM 360/65	FILE INDEPENDENT GEN APP SYS GAS MONTH8C
150	ASSEMBLER	IBM 360/65	FILE INDEPENDENT GEN APP SYS GAS CHEM80
150	ASSEMBLER	IBM 360/65	FILE INDEPENDENT GEN APP SYS GAS DEPTH8C
150	ASSEMBLER	IBM 360/65	FILE INDEPENDENT GEN APP SYS GAS LATLON80
150	ASSEMBLER	IBM 360/65	FILE INDEPENDENT GEN APP SYS GAS GASCRDER
151	ASSEMBLER	IBM 360/65	SDRETV
151	ASSEMBLER	IBM 360/65	SD2TCSD1
152	ASSEMBLER	IBM 360/65	SDPRT2
152	ASSEMBLER	IBM 360/65	SUPERSEL
152	ASSEMBLER	IBM 360/65	SDPASS
152	ASSEMBLER	IBM 360/65	XORDER
152	ASSEMBLER	IBM 360/65	XBTCCUNT
153	ASSEMBLER	IBM 360/65	RETXET
153	ASSEMBLER	IBM 360/65	XBTCCNV
153	ASSEMBLER	IBM 360/65	RETBT
153	ASSEMBLER	IBM 360/65	BTLISTC
152	FORTRAN	IBM 360/65	XBTQKCUT
153	FORTRAN IV	IBM 360/65	XBSELECT
153	FORTRAN IV	IBM 360/65	XBMSINV
153	FORTRAN IV	IBM 360/65	XBGECSUM
153	FORTRAN IV	IBM 360/65	CANWMC
151	PL/1	IBM 360/65	SD2CHAR
152	PL/1	IBM 360/65	SDGECIV
152	PL/1	IBM 360/65	XBEVALU
152	PL/1	IBM 360/65	XBCCNV
152	PL/1	IBM 360/65	XBFNWC
152	PL/1	IBM 360/65	XBTNWSUM
153	PL/1	IBM 360/65	BTGECIV
153	PL/1	IBM 360/65	SCHNINE
153	PL/1	IBM 360/65	SCMULTI
153	PL/1	IBM 360/65	DRYLAND
18	FORTRAN	IBM 360/65	ISENTROPIC INTERPOLATION
18	ASSEMBLER	IBM 360/65	POTENTIAL TEMP AND/OR DENSITY POTDEN
18	FORTRAN	IBM 360/65	SIGMAT
18	FORTRAN IV	IBM 360/65	DYNAMIC DEPTH ANOMALY DYANCM
18	FORTRAN	IBM 360/65	SALINITY FROM CONDUCTIVITY T P SALINE
19	FORTRAN	IBM 360/65	VOLUME TRANSPORT FUNCTION CFUN
19	FORTRAN IV	IBM 360/65	POTENTIAL TEMP AND DENSITY PODENS
19	FORTRAN IV	IBM 360/65	VOLUME TRANSPORT VOLTRN
19	FORTRAN IV	IBM 360/65	COMPUTES PRESSURE PRESSR
20	ASSEMBLER	IBM 360/65	TEMPERATURE DIFFERENCE CALCULATIONS
115	FORTRAN IV	IBM 360/65	COMPUTE GREAT CIRCLE PATH GCIRC
115	FORTRAN IV	IBM 360/40	MAP PROJECTIONS AND GRIDS MAP
78	ASSEMBLER	IBM 360/65	SURFACE CURRENT SUMMARY SUFCUR

ENVIRCNMENTAL CATA SERVICE, NATIONAL GECPHYSICAL AND SOLAR-TERRESTRIAL DATA CENTER, BOULDER, CO

41	FORTRAN IV	IBM 360/65	MARINE GECPHYSICAL CATA REDUCTION
41	FORTRAN IV	IBM 360/65	PLCTS PROFILES OF BATHYMETRY AND MAGNETIC

ENVIRONMENTAL CATA SERVICE, CENTER FOR EXPERIMENT CESIGN ANC CATA ANALYSIS, WASHINGTON, DC

139	FORTRAN IV	IBM 360/65	FITS POLYNCMIAL P3TERM
142	FORTRAN IV	IBM 360/65	CHECKS ANGLES TWOPI
142	FORTRAN IV	CDC 6600	CHECKS ANGLES TWOPI
122	FORTRAN IV	IBM 360/65	PLCTS SCATTERGRAM SCTGM4 SCTGMS
123	FORTRAN IV	CDC 6600	X-Y PLOTS EBTPLT
148	FORTRAN IV	CDC 6600	REPRCDUCE ANC SERIALIZE DECK DUPE
148	FORTRAN IV	IBM 360/65	FLAGS SUSPICICUS DATA VALUES EDITQ
144	FORTRAN IV	IBM 360/65	JULIAN CAY CCNVERSICN JDAYWK
144	FORTRAN IV	IBM 360/65	JULIAN CATE CCNVERSICN ROUTINES JULDAY
144	FORTRAN IV	IBM 360/65	JULIAN CATE CCNVERSICN ROUTINES JULIAN
144	FORTRAN IV	IBM 360/65	JULIAN CATE CCNVERSION ROUTINES JULYAN
144	FORTRAN IV	IBM 360/65	JULIAN DATE CCNVERSION ROUTINES JULSEC
144	FORTRAN IV	IBM 360/65	JULIAN CATE CCNVERSICN ROUTINES CESLUJ
144	FORTRAN IV	IBM 360/65	DAY CF THE WEEK NDAYWK
17	FORTRAN IV	CDC 6500	WET BULB TEMPERATURE WETBLA

ENVIRCNMENTAL PROTECTION AGENCY, GULF BREEZE, FL

51	FORTRAN IV	IBM 360	TOXICITY BICASSAY PRCBIT ANALYSIS

ENVIRONMENTAL RESEARCH LABORATCRIES, PACIFIC MARINE ENVIRCNMENTAL LABCRATORY, SEATTLE, WA

125	FORTRAN IV	CDC 6400	SCALAR TIME SERIES TEMPLT7
87	FORTRAN	CDC 6400	PYRANCMETER AND RADICMETER TIME SERIES RAD
78	FORTRAN IV	CDC 6400	VECTCR TIME SERIES CURPLT6

ENVIRONMENTAL RESEARCH LABCRATORIES, ATLANTIC CCEANCGRAPHIC AND METECROLOGICAL LABCRATCRIES, MIAMI, FL

17	FORTRAN	CDC 6600	INTERNAL WAVE CSCILLATICNS ZMODE
17	FORTRAN	CDC 7600	INTERNAL WAVE CSCILLATICNS ZMODE
42	FORTRAN IV	UNIVAC 1108	LISTS RAW DATA 2LIST
42	FORTRAN IV	UNIVAC 1108	PLCTS TRACKLINE GCKCRAW
42	FORTRAN IV	UNIVAC 1108	PLCTS CCNTOUR CROSSING INTERVALS COUBLX
42	FORTRAN IV	UNIVAC 1108	PLOTS GEOPHYSICAL DATA PLOT2
43	FORTRAN IV	UNIVAC 1108	LISTS EVERY HUNCRECTH VALUE SNOCP
43	FORTRAN IV	UNIVAC 1108	NAVIGATICN CCMPUTATICNS TPNAV
43	FORTRAN IV	UNIVAC 1108	EDITS GEOPHYSICAL DATA ZEDIT
43	FORTRAN IV	UNIVAC 1108	GECPHYSICAL CATA CCNVERSICN HANDY
44	FORTRAN IV	UNIVAC 1108	LISTS GEOPHYSICAL DATA LISTP
44	FORTRAN IV	UNIVAC 1108	COURSE, SPEEC, ECTVCS CCRRECTION LCXNAV
44	FORTRAN IV	UNIVAC 1108	CCNVERTS GECPHYSICAL DATA PHONEY
44	FORTRAN IV	UNIVAC 1108	SOUNC VELCCITY VARIATION AND NAVIGATION FATHOM
45	FORTRAN IV	UNIVAC 1108	REGICNAL FIELC RESICUAL MAGNETIC ANCMALY GAMMA
45	FORTRAN IV	UNIVAC 1108	GRAVITY GAL
45	FORTRAN IV	UNIVAC 1108	PLCTS PROFILES CF GEOPHYSICAL DATA DISPLOT
46	FORTRAN IV	UNIVAC 1108	CCNVERTS CIGITIZER CATA DYGYT
46	FORTRAN IV	UNIVAC 1108	EDITS REDUCEC GEOPHYSICAL DATA EDIT

FISHERIES RESEARCH BOARD OF CANADA, CANADA

117	FORTRAN IV	IBM 1130	PLCTS HYCRC CAST CATA PLOG
117	FORTRAN IV	IBM 1130	PLOTS STD DATA STPG1
118	FCRTRAN IV	IBM 1130	PLCTS TEMFERATURE-SALINITY PSAL 1
146	FORTRAN VI	IBM 1130	THERMCMETER CCRRECTICN TCHK2
1	FORTRAN I	IBM 1620	TRANSPCRT CCPPUTATIONS FRCM ATMOSPHERIC PRESSURE
1	FCRTRAN IV	IBM 1130	TRANSPCRT CCPPUTATICNS FRCM ATMOSPHERIC PRESSURE
1	FORTRAN IV	IBM 1130	STD CCMPUTATICNS STP02
1	FORTRAN IV	IBM 1130	HYCRO CAST CCPPUTATIONS
1	FORTRAN	HP 2115A	DIGITIZES STC CATA CEEP
2	FCRTRAN	HP 2115A	STD PROCESSING WET
135	FCRTRAN IV	IBM 1130	ANALYSIS CF NCN-LINEAR RESPONSE SURFACE
135	FCRTRAN IV	IBM 1130	MULTIPLE DISCRIMINANT ANALYSIS MULCA
103	FORTRAN IV	IBM 1130	SATELLITE RISE AND SET TIMES ALERT ASORT
54	FCRTRAN IV	IBM 1130	YIELD PER RECRUIT RYLC BIOM

GEOLOGICAL SURVEY, NATIONAL CENTER, RESTON, VA

103	FORTRAN IV	IBM 360/65	ASTRONOMIC FCSITION AZIMUTH METHOD
22	FORTRAN IV	IBM 360/65	PERCENTAGE SATURATICN OF OXYGEN IN ESTUARY
23	FORTRAN IV	IBM 360/65	WATER CHEMISTRY DIELECTRIC CONSTANT
38	FORTRAN IV	IBM 360/65	GRAVITATICNAL ATTRACTICN TWO-DIMENSIONAL BCCIES

GEOLOGICAL SURVEY, WOODS HOLE, MA

38	FCRTRAN IV	XDS SIGMA 7	X-RAY DIFFRACTION ANALYSIS
39	FORTRAN IV	XDS SIGMA 7	MAGNETIC ANCMALIES MAG2D

GEOLOGICAL SURVEY, MENLO PARK, CA

122	FORTRAN IV	IBM 360/61	PROFILE PLCTS TIME AXIS PROFL3
122	FORTRAN IV	IBM 360/61	PROFILE PLCTS DISTANCE AXIS PFLDST
122	FCRTRAN IV	IBM 360/61	MAP PLCTS MAPPLT

GECLCGICAL SURVEY, CCRPUS CHRISTI, TX

38	FORTRAN IV	IBM 1130	SEDIMENT GRAIN SIZE ANALYSIS

INSTITUTE OF CCEANCGRAPHIC SCIENCES, WALES

40	FCRTRAN IV	IBM 1130	RECUCTICN DISPLAY STORAGE GEOPHYSICAL DATA

INTER-AMERICAN TRCPICAL TUNA CCMMISSICN, LA JCLLA, CA

58	FCRTRAN	B 6700	NCRMAL CISTRIBUTICN SEPARATCR TCPA1
58	FCRTRAN	B 6700	SPAWNER-RECRUIT CURVE FITTING TCPA2
58	FORTRAN	B 6700	WEIGHT-LENGTH CURVE FITTING TCPA3
59	FORTRAN	B 6700	AGE CCMPOSITION ESTIMATION TCPB1
59	FCRTRAN	B 6700	ESTIMATE CATCH NUMBERS PERCENT WEIGHT
59	FORTRAN	B 67CC	LENGTH-FRECUENCY DISTRIBUTICN
60	FORTRAN	B 67CO	VON BERTALANFFY GROWTH CURVE FITTING TCPC1
60	FORTRAN	B 6700	VON BERTALANFFY GRCWTH UNEQUAL AGE INTERVAL
60	FCRTRAN	B 6700	VON BERTALANFFY GROWTH EQUAL AGE INTERVAL
61	FCRTRAN	B 6700	VON BERTALANFFY GRCWTH CURVE FITTING TCPC4
64	FORTRAN	B 67CC	ESTIMATION CF LINEAR GROWTH
61	FORTRAN	B 6700	FISHING PCWER ESTIMATICN TCPD1

62	FORTRAN	B 6700	SURVIVAL RATE ESTIMATION TCPE1
63	FORTRAN	B 6700	FISHING MORTALITIES ESTIMATION TCPE2
63	FORTRAN	B 6700	RELATIVE YIELD PER RECRUIT
63	FORTRAN	B 6700	YIELD CURVES WITH CONSTANT RATES TCPF2
63	FORTRAN	B 6700	EUMETRIC YIELD TCPF3
64	FORTRAN	B 6700	PIECEWISE INTEGRATION OF YIELD CURVES TCPF4
64	FORTRAN	B 6700	PIECEWISE INTEGRATION OF YIELD CURVES
65	FORTRAN	B 6700	CONSTANTS IN SCHAEFER'S MODEL TCPF6
65	FORTRAN	B 6700	SCHAEFER LOGISTICS MODEL OF FISH PRODUCTION
65	FORTRAN	B 6700	FITS GENERALIZED STOCK PRODUCTION MODEL TCPF8
65	FORTRAN	B 6700	BIOMETRY-LINEAR REGRESSION ANALYSIS TCSA1
66	FORTRAN	B 6700	GENERALIZED WEIGHTED LINEAR REGRESSION
66	FORTRAN	B 6700	LINEAR REGRESSION, BOTH VARIABLES
66	FORTRAN	B 6700	BIOMETRY-PRODUCT-MOMENT CORRELATION
67	FORTRAN	B 6700	COOLEY-LOHNES MULTIPLE-REGRESSION
67	FORTRAN	B 6700	BIOMETRY-GOODNESS OF FIT
67	FORTRAN	B 6700	BIOMETRY-BASIC STATISTIC FOR UNGROUPED DATA
68	FORTRAN	B 6700	BIOMETRY-BASIC STATISTIC FOR GROUPED DATA
68	FORTRAN	B 6700	BIOMETRY-SINGLE CLASSIFICATION ANOVA
68	FORTRAN	B 6700	BIOMETRY-FACTORIAL ANOVA TCSD2
69	FORTRAN	B 6700	BIOMETRY-SUM OF SQUARES STP TCSD3
69	FORTRAN	B 6700	BIOMETRY-STUDENT-NEWMAN-KEULS TEST TCSD4
69	FORTRAN	B 6700	BIOMETRY-TEST OF HOMOGENEITY
69	FORTRAN	B 6700	BIOMETRY-TEST OF EQUALITY
70	FORTRAN	B 6700	BIOMETRY-TUKEY'S TEST
70	FORTRAN	B 6700	BIOMETRY-KRUSKAL-WALLIS TEST TCSE4
70	FORTRAN	B 6700	BIOMETRY-FISHER'S EXACT TEST TCSE5
71	FORTRAN	B 6700	BIOMETRY-R X C TEST OF INDEPENDENCE MAP

JOHNS HOPKINS UNIVERSITY, BALITMORE, MD

29	FORTRAN		NUMERICAL MDL ESTUARY DYNAMICS & KINEMATICS
28	FORTRAN		SALINITY DISTRIBUTION IN ONE-DIMENSIONAL ESTUARY

LOS ANGELES CITY SANITATION DEPARTMENT, LOS ANGELES, CA

73	ANS FORTRAN	IBM 360	ECOLOGICAL STATISTICAL PROGRAMS ECOSTAT
73	ANS FORTRAN	IBM 370	ECOLOGICAL STATISTICAL PROGRAMS ECOSTAT

MARINE ENVIRONMENTAL DATA SERVICE, CANADA

117	FORTRAN	CDC CYBER	X-Y PLOTS IN A FLEXIBLE FORMAT MEDSPLOT
4	FORTRAN IV	CDC CYBER 74	DAILY SEAWATER OBSERVATIONS
4	FORTRAN	CDC 6400	DATA MGT SYS FOR PHYS CHEM DATA OCEANSV
4	COBOL	IBM 360/65	DATA MGT SYS FOR PHYS CHEM DATA OCEANSV
4	PL/1	IBM 360/85	DATA MGT SYS FOR PHYS CHEM DATA OCEANSV

MASSACHUSETTS INSTITUTE OF TECHNOLOGY, CAMBRIDGE, MA

72	PL/1	IBM 370/168	MONTE CARLO SPILL TRACKER
135	FORTRAN IV	IBM 360/40	SPECTRA PROGRAMS DETRND AUTCOV CRSCOV FOURTR
85	FORTRAN	IBM 360/40	WATER WAVE TEACHING AIDS PROF1
85	FORTRAN	IBM 360/40	WATER WAVE TEACHING AIDS UMAX1
85	FORTRAN	IBM 360/40	WATER WAVE TEACHING AIDS UTMAX1
85	FORTRAN	IBM 360/40	WATER WAVE TEACHING AIDS WMAX1
85	FORTRAN	IBM 360/40	WATER WAVE TEACHING AIDS LENG1
85	FORTRAN	IBM 360/40	WATER WAVE TEACHING AIDS DETRND
85	FORTRAN	IBM 360/40	WATER WAVE TEACHING AIDS WTMAX2

85	FORTRAN	IBM 360/40	WATER WAVE TEACHING AIDS UOFT1
85	FORTRAN	IBM 360/40	WATER WAVE TEACHING AIDS WOFT1
85	FORTRAN	IBM 360/40	WATER WAVE TEACHING AIDS UTOFT1
85	FORTRAN	IBM 360/40	WATER WAVE TEACHING AIDS WTOFT1
85	FORTRAN	IBM 360/40	WATER WAVE TEACHING AIDS AUTCOV
85	FORTRAN	IBM 360/40	WATER WAVE TEACHING AIDS CRSCOV
85	FORTRAN	IBM 360/40	WATER WAVE TEACHING AIDS FOURTR
86	FORTRAN	IBM 360/40	WATER WAVE TEACHING AIDS PROFILE
86	FORTRAN	IBM 360/40	WATER WAVE TEACHING AIDS REFL1
86	FORTRAN	IBM 360/40	WATER WAVE TEACHING AIDS FORCE AND MOVEMENT
85	FORTRAN	IBM 360/40	WATER WAVE TEACHING AIDS EDSIT
25	FORTRAN IV	IBM 360/65	MIT SALINITY INTRUSION PROGRAM
87	PL/1	IBM 370/180	MARKOVIAN ANALYSIS OF TDF-14 WIND DATA
40	FORTRAN IV	IBM 7074	COMPUTATION AND PLOTTING OF MAGNETIC ANOMALIES
74	PL/1	IBM 360/168	DRIFT BOTTLE/STATISTICS
74	PL/1	IBM 360/168	DRIFT BOTTLE PLOTS
74	PL/1	IBM 360/168	REFORMAT AND SORT DRIFT BOTTLE DATA

NATIONAL ENVIRONMENTAL SATELLITE SERVICE, ROCKVILLE, MD

123	FORTRAN	CDC 6600	DISPLAYS VHRR SATELLITE DATA V5DMD
123	FORTRAN	IBM 360/195	MICROFILM PLOTS OF VHRR SATELLITE DATA

NATIONAL INSTITUTE OF OCEANOGRAPHY, ENGLAND

135	FORTRAN	IBM 1800	BARTLETT'S CURVE FITTING
145	FORTRAN IV	IBM 1800	CURRENT METER DATA REDUCTION
37	FORTRAN IV	IBM 1800	CABLE CONFIGURATION
134	FORTRAN IV	IBM 1800	GENERATES ARBITRARY FILTER HILOW
136	FORTRAN	IBM 1800	CLUSTER ANALYSIS
84	FORTRAN IV	IBM 1800	SHIPBORNE WAVE RECORDER ANALYSIS SBWRG
103	FORTRAN	IBM 1800	SATELLITE NAVIGATION
104	FORTRAN IV	IBM 1800	LORAN/DECCA COORDINATES CALCULATION HNAV
104	FORTRAN IV	IBM 1800	LORAN/DECCA FILE INITIALIZATION HNV1
104	FORTRAN IV	IBM 1800	GEODETIC DISTANCE AND AZIMUTH SDANO

NATIONAL MARINE FISHERIES SERVICE, SOUTHWEST FISHERIES CENTER, LA JOLLA, CA

123	FORTRAN 63	CDC 3600	VERTICALLY ANALYZED CONTOURS VACCTS
12	FORTRAN IV	B 6700	PLOT TEMP LIST MIXED LAYER DEPTH WEEKPLOT
12	ALGOL	B 6700	CONSTANTS FOR HARMONIC SYNTHESIS MEAN SEA TEMP
12	FORTRAN 63	CDC 3600	VERTICAL SECTION PLOTS ESTPAC
13	FORTRAN	CDC 3600	CONVERTS STD DATA NOECTP
13	FORTRAN	CDC 3600	CORRECTS STD DATA TPHCD
56	FORTRAN	B 6700	LENGTH FREQUENCY ANALYSIS LENFRE
56	FORTRAN	B 6700	YIELD PER RECRUIT FOR MULTI-GEAR FISHERIES
57	FORTRAN	B 6700	A GENERALIZED EXPLOITED POPULATION SIMULATOR
57	FORTRAN	CDC 6600	A GENERALIZED EXPLOITED POPULATION SIMULATOR
57	FORTRAN	CDC 6600	GENERALIZED STOCK PRODUCTION MODEL PRODFIT
57	FORTRAN	B 6700	GENERALIZED STOCK PRODUCTION MODEL PRODFIT
87	FORTRAN	B 6700	SUMMARIZES WEATHER REPORTS

NATIONAL MARINE FISHERIES SERVICE, SOUTHWEST FISHERIES CENTER, HONOLULU, HI

136	FORTRAN IV	IBM 360/65	EXTENDED NORMAL SEPARATOR PROGRAM ENORMSEP

NATIONAL MARINE FISHERIES SERVICE, SOUTHEAST FISHERIES CENTER, MIAMI, FL

124	FORTRAN IV	IBM 360/65	OXYGEN PHOSPHATE DENSITY PLOTS
124	FORTRAN IV	IBM 360/65	GENERAL MERCATOR PLOT

NATIONAL OCEAN SURVEY, ROCKVILLE, MD

112	FORTRAN IV	IBM 360/30	ADJUSTS A STATE PLANE COORDINATE TRAVERSE
113	FORTRAN IV	IBM 360/65	NOS SCIENTIFIC SUBROUTINE SYSTEM ANGLE
113	FORTRAN IV	IBM 360/65	NOS SCIENTIFIC SUBROUTINE SYSTEM ANLIS
113	FORTRAN IV	IBM 360/65	NOS SCIENTIFIC SUBROUTINE SYSTEM APCTN
113	FORTRAN IV	IBM 360/65	NOS SCIENTIFIC SUBROUTINE SYSTEM APCWN
113	FORTRAN IV	IBM 360/65	NOS SCIENTIFIC SUBROUTINE SYSTEM APOLY
113	FORTRAN IV	IBM 360/65	NOS SCIENTIFIC SUBROUTINE SYSTEM CGSPC
113	FORTRAN IV	IBM 360/65	NOS SCIENTIFIC SUBROUTINE SYSTEM CUBIC
113	FORTRAN IV	IBM 360/65	NOS SCIENTIFIC SUBROUTINE SYSTEM EXCEB
113	FORTRAN IV	IBM 360/65	NOS SCIENTIFIC SUBROUTINE SYSTEM GMLIC
113	FORTRAN IV	IBM 360/65	NOS SCIENTIFIC SUBROUTINE SYSTEM HIFIX
114	FORTRAN IV	IBM 360/65	NOS SCIENTIFIC SUBROUTINE SYSTEM LORAN
114	FORTRAN IV	IBM 360/65	NOS SCIENTIFIC SUBROUTINE SYSTEM OMEGA
114	FORTRAN IV	IBM 360/65	NOS SCIENTIFIC SUBROUTINE SYSTEM SCDIN
114	FORTRAN IV	IBM 360/65	NOS SCIENTIFIC SUBROUTINE SYSTEM SCDPN
114	FORTRAN IV	IBM 360/65	NOS SCIENTIFIC SUBROUTINE SYSTEM TPFIX
114	FORTRAN IV	IBM 360/65	NOS SCIENTIFIC SUBROUTINE SYSTEM UTMCO
114	SPS	IBM 1620	COMPUTES GEOGRAPHIC POSITIONS
114	SPS	IBM 1620	LORAN C VERSION2
80	FORTRAN IV	CDC 6600	HARMONIC ANALYSIS OF DATA AT TIDAL FREQUENCIES

NATIONAL WEATHER SERVICE, TECHNIQUES DEVELOPMENT LABORATORY, SILVER SPRING, MD

82	FORTRAN IV	CDC 6600	HURRICANE STORM SURGE FORECASTS SPLASH I
82	FORTRAN IV	CDC 6600	HURRICANE STORM SURGE FORECASTS SPLASH II
82	FORTRAN IV	IBM 360/195	EAST COAST STORM SURGE
82	FORTRAN IV	IBM 360/195	WAVE FORECASTS
80	FORTRAN IV	IBM 360/195	ASTRONOMICAL TIDE PREDICTION

NAVY, CIVIL ENGINEERING LABORATORY, PORT HUENEME, CA

30	FORTRAN IV	CDC 6600	DEEP OCEAN LOAD HANDLING SYSTEMS CELLS
30	FORTRAN IV	CDC 6600	LOAD MOTION AND CABLE STRESSES CABL
30	FORTRAN IV	CDC 6600	SOIL TEST DATA TRIAX
30	FORTRAN IV	CDC 6600	DYNAMIC STRESS RESPONSE OF LIFTING LINES CABANA
31	FORTRAN IV	CDC 6600	DYNAMIC RESPONSE OF CABLE SYSTEM SNAPLG
31	FORTRAN IV	CDC 6600	CHANGES IN ELECTROMECHANICAL CABLE RAMSC
31	FORTRAN IV	CDC 6600	END RESPONSES IN ELECTROMECHANICAL CABLE RADAC
48	FORTRAN II	IBM 1620	SOIL AND SEDIMENT ENGINEERING TEST DATA

NAVY, NAVAL POSTGRADUATE SCHOOL, MONTEREY, CA

17	FORTRAN IV	IBM 360	OBJECTIVE THERMOCLINE ANALYSIS
17	FORTRAN IV	CDC 6500	OBJECTIVE THERMOCLINE ANALYSIS
91	FORTRAN 60	IBM 1604	WIND DRIFT AND CONCENTRATION OF SEA ICE ICEGRID
97	FORTRAN	CDC 3100	SOUND SPEED COMPUTATION MODEL SOVEL
97	FORTRAN	CDC 3200	SOUND SPEED COMPUTATION MODEL SOVEL
97	FORTRAN	CDC 1604	SOUND SPEED COMPUTATION MODEL SOVEL
93	FORTRAN IV	CDC 1604	SOUND SCATTERING BY ORGANISMS SKAT
72	FORTRAN IV	CDC 6500	THERMAL POLLUTION MODEL
72	FORTRAN IV	CDC 1604	THERMAL POLLUTION MODEL

72	FORTRAN	CDC 3100	DANISH ADVECTION PROGRAM
134	FORTRAN IV	IBM 360	TIME SERIES ANALYSIS BLACKY
83	FORTRAN IV	CDC 6500	FRENCH SPECTRO-ANGULAR WAVE MODEL
83	FORTRAN IV	CDC 7600	FRENCH SPECTRO-ANGULAR WAVE MODEL
83	FORTRAN IV	CDC 3100	SURF PREDICTION MODEL
83	FORTRAN	CDC 3100	SINGULAR WAVE PREDICTION MODEL
83	FORTRAN	CDC 3200	SINGULAR WAVE PREDICTION MODEL
22	FORTRAN	IBM 360	SPECIFIC CONDUCTIVITY WITH PRESSURE EFFECT
24	FORTRAN IV	CDC 6500	MULTI-LAYER HYDRODYNAMIC-NUMBERICAL MODEL
24	FORTRAN IV	CDC 7600	MULTI-LAYER HYDRODYNAMICAL-NUMERICAL MODEL
24	FORTRAN IV	CDC 6500	SINGLE LARGE HYDRODYNAMICAL-NUMERICAL MODEL
24	FORTRAN IV	IBM 360	SINGLE LARGE HYDRODYNAMICAL-NUMERICAL MODEL
87	FORTRAN	CDC 1604	OCEAN CLIMATOLOGY ANALYSIS MODEL ANALYS
88	FORTRAN IV	CDC 6500	HURRICANE HEAT POTENTIAL MODEL
88	FORTRAN	CDC 3100	MIXED LAYER DEPTH ANALYSIS MODEL MEDMLD
88	FORTRAN	CDC 3100	ATMOSPHERIC WATER CONTENT MODEL
88	FORTRAN IV	CDC 6500	OCEAN-ATMOSPHERE FEEDBACK MODEL
89	FORTRAN	CDC 1604	WIND COMPUTATION FROM SHIP OBSERVATIONS TRUWIND
75	FORTRAN	CDC 7600	OPTIMIZED MULTI-LAYER HN MODEL
75	FORTRAN	CDC 3100	OPTIMIZED MULTI-LAYER HN MODEL
75	FORTRAN	CDC 6500	MEAN DRIFT ROUTINE
75	FORTRAN	CDC 1604	MEAN DRIFT ROUTINE
80	FORTRAN 60	IBM 360/195	TIDES IN THE OPEN SEA

NAVY, FLEET NUMERICAL WEATHER CENTRAL, MONTEREY, CA

148	FORTRAN II	CDC 1604	FORTRAN ACCESS TO SCIENTIFIC DATA FASD
76	FORTRAN	CDC 6500	SEARCH AND RESCUE PLANNING NSAR

NAVY, NAVAL UNDERSEA RESEARCH AND DEVELOPMENT CENTER, SAN DIEGO, CA

121	FORTRAN 63	CDC 1604	MACHINE PLOTTING ON MERCATOR PROJECTION
14	FORTRAN EXT	CDC 6500	OCEANOGRAPHIC DATA COMPUTATION TPCCNV
15	FORTRAN EXT	CDC 6500	VARIANCE AND STANDARD DEVIATION SUMMARY

NAVY, NAVAL ELECTRONICS LABORATORY, SAN DIEGO, CA

120	FORTRAN	IBM 360/65	SEQUENTIAL PLOTTING

NAVY, NAVAL UNDERSEA CENTER, PASADENA, CA

138	FORTRAN V	UNIVAC 1108	CURVE FITTING VELOCITY PROFILE NEWFIT
101	FORTRAN IV	UNIVAC 1108	SONAR IN REFRACTIVE WATER
101	FORTRAN IV	UNIVAC 1108	SONAR IN REFRACTIVE WATER
101	FORTRAN IV	UNIVAC 1108	SORTS SOUND RAY DATA RAY SORT
45	FORTRAN IV	UNIVAC 1108	PATTERN FUNCTION CALCULATIONS
45	FORTRAN V	UNIVAC 1108	RAYLEIGH-MORSE BOTTOM REFLECTION COEFFICIENTS

NAVY, NAVAL UNDERWATER SYSTEMS CENTER, NEW LONDON, CT

138	FORTRAN V	UNIVAC	FITTING A LEAST SQUARES DISTANCE HYPERPLANE
141	FORTRAN IV	UNIVAC 1108	SMOOTHING DATA USING THE CUBIC SPLINE
121	FORTRAN	UNIVAC 1108	OVERLAY PLOTTING OVLPLT
99	FORTRAN V	UNIVAC 1108	CONTINUOUS GRADIENT RAY TRACING SYSTEM CONGRATS
95	FORTRAN	UNIVAC 1108	RAY PATH SC434E
93	FORTRAN V	UNIVAC 1108	NORMAL MODE PROPAGATION MODEL
94	FORTRAN V	UNIVAC 1108	BEAM PATTERNS AND WIDTHS GBEAM
94	FORTRAN V	UNIVAC 1108	STATISTICS ACOUSTIC MEASUREMENTS AND PREDICTIONS

94	FORTRAN IV	UNIVAC 1108	PROPAGATION LOSS FAST FIELD PROGRAM
94	FORTRAN II	UNIVAC 1108	BOTTOM REFLECTIVITY
45	FORTRAN V	UNIVAC 1108	PROPAGATION LOSS
45	FORTRAN V	UNIVAC 1108	AMOS PROPAGATION LOSS
36	FORTRAN V	UNIVAC 1108	TOWED SYSTEM DYNAMICS
36	FORTRAN V	UNIVAC 1108	TRAPEZOIDAL ARRAY DEPLOYMENT DYNAMICS
37	FORTRAN V	UNIVAC 1108	STEADY STATE CABLE LAYING
37	FORTRAN V	UNIVAC 1108	TOWED ARRAY CONFIGURATIONS
37	FORTRAN V	UNIVAC 1108	TRAPEZOIDAL ARRAY DYNAMICS
125	FORTRAN	UNIVAC 1108	SPECTRAL ANALYSIS SUBROUTINES
47	FORTRAN	UNIVAC 1108	TRUE OCEAN DEPTH FATHOR
53	FORTRAN IV	UNIVAC 1108	GENERATES ZOOPLANKTON TAXONOMIC DIRECTORY
53	FORTRAN IV	UNIVAC 1108	DEEP OCEAN ZOOPLANKTON DISTRIBUTION
53	FORTRAN IV	UNIVAC 1108	DEEP OCEAN ZOOPLANKTON POPULATION STATISTICS
74			CURRENT PROFILES FROM TILT DATA
16	FORTRAN V	UNIVAC 1108	STD-S/V DATA S2049
32	FORTRAN V	UNIVAC 1108	STEADY STATE TRAPEZOIDAL ARRAY CONFIGURATIONS
32	FORTRAN V	UNIVAC 1108	ANCHOR LAST-BUOY SYSTEM DEVELOPMENT DYNAMICS
33	FORTRAN V	UNIVAC 1108	CABLE TOWED BUOY CONFIGURATIONS IN A TURN
33	FORTRAN V	UNIVAC 1108	FREE-FLOATING SPAR-ARRAY DYNAMICS
33	FORTRAN V	UNIVAC 1108	FREE-FLOATING SPAR-BUOY DYNAMICS
33	FORTRAN V	UNIVAC 1108	SHIP SUSPENDED ARRAY DYNAMICS
34	FORTRAN V	UNIVAC 1108	BOOMERANG CORER DESCENT/ASCENT TRAJECTORIES
34	FORTRAN V	UNIVAC 1108	BUOY-SHIP DYNAMICS
34	FORTRAN V	UNIVAC 1108	BUOY-SYSTEM DYNAMICS
34	FORTRAN V	UNIVAC 1108	FIXED THIN LINE ARRAY DYNAMICS
35	FORTRAN V	UNIVAC 1108	FIXED THIN LINE ARRAY STEADY STATE CONFIGURATION
35	FORTRAN V	UNIVAC 1108	MARINE CORER DYNAMICS
35	FORTRAN V	UNIVAC 1108	STEADY-STATE BUOY SYSTEM CONFIGURATIONS
36	FORTRAN V	UNIVAC 1108	STEADY-STATE SUBSURFACE BUOY SYSTM CONFIGURATION
36	FORTRAN V	UNIVAC 1108	TOWED ARRAY DYNAMICS

NAVY, NAVAL UNDERWATER SYSTEMS CENTER, NEWPORT, RI

142	FORTRAN	CDC 3300	SOLVE ALGEBRAIC EQUATIONS MATRIX
121	FORTRAN	CDC 3300	PHYSICAL DATA PLOT FRAME
99	FORTRAN	CDC 3300	ACOUSTIC PERFORMANCE AND EVALUATION
94	FORTRAN	CDC 3300	SOUND REFRACTION CORRECTIONS FITIT
15	FORTRAN		SIGMA-T INVREJ
15	FORTRAN		STD PROCESSING OCEANDATA
15	FORTRAN		INTERNAL WAVES WITCOMB
15	FORTRAN	CDC 3200	INTERPOLATION FOR OCEANOGRAPHIC DATA
15	FORTRAN	IBM 1620	INTERPOLATION FOR OCEANOGRAPHIC DATA
75	FORTRAN	CDC 3300	CURRENT METER DATA CREATE-C
75	FORTRAN	CDC 3300	CURRENT METER DATA CURRENT
75	FORTRAN	CDC 3300	CURRENT METER DATA CURRPLOT
75	FORTRAN	CDC 3300	CURRENT METER DATA SPECTRUM

NAVY, NAVAL SURFACE WEAPONS CENTER, SILVER SPRING, MD

93	FORTRAN IV	CDC 6500	NORMAL MODE CALCULATIONS NORMOD 3
93	FORTRAN	CDC 6400	HORIZONTAL RANGE

NAVY, NAVAL RESEARCH LABORATORY, WASHINGTON, DC

120	FORTRAN	CDC 3800	LINE PRINTER PLOTS

124	ASSEMBLY	HP 2100S	PLOTTER COMMANDS PLOT DVRIC
100	FORTRAN 63	CDC 3800	GRASS UNDERWATER ACOUSTICS PREDICTION DTSTOV
100	FORTRAN 63	CDC 3800	GRASS UNDERWATER ACOUSTICS PREDICTION VFC
100	FORTRAN 63	CDC 3800	GRASS UNDERWATER ACOUSTICS PREDICTION CTCUR
100	FORTRAN 63	CDC 3800	GRASS UNDERWATER ACOUSTICS PREDICTION PFFPLT
100	FORTRAN 63	CDC 3800	GRASS UNDERWATER ACOUSTICS PREDICTION SERPENT
101	FORTRAN 63	CDC 3800	GRASS UNDERWATER ACOUSTICS PREDICTION RAFLCT
101	FORTRAN 63	CDC 3800	GRASS UNDERWATER ACOUSTICS PREDICTION LOSSPLOT
16	FORTRAN IV	HP 2100S	THERMOMETRIC DEPTH CALCULATION CAST
16	FORTRAN IV	HP 2100S	THERMOMETER DATA FILE HANDLER THERMO
16	FORTRAN	CDC 3300	INTERNAL GRAVITY WAVES DISPER
16	FORTRAN IV	CDC 3200	SEA SURFACE TEMPERATURES ANALYSIS
31	BASIC	HP 9830A	UNMANNED FREE-SWIMMING SUBMERSIBLE PLOT
32	BASIC	HP 9830A	UNMANNED FREE-SWIMMING SUBMERSIBLE HOTEL LOAD
32	BASIC	HP 9830A	UNMANNED FREE-SWIMMING SUBMERSIBLE
107	FORTRAN	CDC 3800	ANNOTATED TRACK ON STEREOGRAPHIC PROJECTION
107	FORTRAN IV	HP 2100S	ANNOTES CHART
108	FORTRAN IV	HP 2100S	BATHYMETRIC OR MAGNETICS CHART PROFL
108	FORTRAN IV	HP 2100S	MERCATOR CHART DIGITIZATION ANTRK
108	FORTRAN IV	HP 2100S	BATHYMETRIC CHART DIGITIZATION DGBTH
108	FORTRAN IV	HP 2100S	PLOTS ON STEREOGRAPHIC CHART ANNOT
108	FORTRAN IV	HP 2100S	PLOTS NAVIGATION DATA OCEAN
109	FORTRAN IV	HP 2100S	LONG BASE LINE ACOUSTIC TRACKING
89	FORTRAN	CDC 3800	MIE SCATTERING COMPUTATIONS
47	FORTRAN	CDC 3600	PLOTS TRACK AND DATA PROFILE TRACK
47	FORTRAN	CDC 3800	PLOTS TRACK AND DATA PROFILE TRACK
47	FORTRAN	CDC 3800	GEODATA
47	FORTRAN	CDC 3600	GEODATA
47	FORTRAN	CDC 3600	MAGNETIC SIGNATURES MAGPLOT
47	FORTRAN	CDC 3800	MAGNETIC SIGNATURES MAGPLOT
107	FORTRAN	CDC 3600	ANNOTATED TRACK ON STEREOGRAPHIC PROJECTION

NAVY, FLEET WEATHER FACILITY, SUITLAND, MD

91	FORTRAN II	CDC 160A	ICE DRIFT ANALYSIS/FORECAST

NAVY, NAVAL OCEANOGRAPHIC OFFICE, WASHINGTON, DC

139	FORTRAN	IBM 7074	LEAST SQUARES PLOT
139	FORTRAN	UNIVAC 1108	TEMPERATURE SALINITY CORRECTIONS CURVEFIT N1S512
139	FORTRAN	PDP-9	BARTLETT'S CURVE FITTING
121	FORTRAN V	UNIVAC 1108	REFORMATS DATA PLOTS TRACK CHART MASTRACK
121	FORTRAN		PRODUCES CONTOUR CHARTS GRIDIT
121	FORTRAN		PRODUCES CONTOUR CHARTS AUTOMATED CONTOUR
100	FORTRAN	IBM 7074	CRITICAL ACOUSTIC RATIO
97	FORTRAN	UNIVAC 1108	SOUND VELOCITY FOR MARINE SEDIMENTS
58	FORTRAN	IBM 7074	LIGHT AND SOUND INSTRUCTION 8
45	FORTRAN	IBM 7074	LIGHT AND SOUND INSTRUCTION 0
144	FORTRAN	IBM 7074	BATHYMETRIC DATA REDUCTION
14	FORTRAN	IBM 7074	MONTHLY SONIC LAYER DEPTH
14	FORTRAN	IBM 7074	VERTICAL TEMPERATURE GRADIENTS
14	FORTRAN V	UNIVAC 1108	WATER CLARITY
137	FORTRAN	IBM 7074	SINGLE INTEGRATION
110	FORTRAN II	IBM 7074	INDIVIDUAL POINT GENERATOR FOR MAP PROJECTIONS
111	FORTRAN II	IBM 7074	INDIVIDUAL POINT GENERATOR FOR DISTANCE
111	FORTRAN	IBM 7074	GEODETIC DATUM REDUCTION
111	FORTRAN	IBM 7074	GEODETIC POSITION COMPUTATION AND PLOT

111	FORTRAN		ASTRONOMIC LATITUDE
112	FORTRAN	CDC 3100	SOUNDING PLOT
112	FORTRAN	IBM 7074	SOUNDING PLOT
112	FORTRAN	IBM 7074	SINGLE INTEGRATION
112	FORTRAN	CDC 3100	SODANC INVERSE
89	FORTRAN	IBM 7074	SOLAR RADIATION CONVERSION
89	FORTRAN	IBM 7074	WIND STRESS
89	FORTRAN	IBM 7074	TWO-DIMENSIONAL POWER SPECTRUM FOR SWOP II
90	FORTRAN	IBM 7074	PREDICTION OF VERTICAL TEMPERATURE CHANGE
90	FORTRAN	IBM 7074	CLOUD COVER AND DAILY SEA TEMPERATURE
46	FORTRAN	IBM 7074	SEAMOUNT MAGNETIZATION
46	FORTRAN	IBM 7074	OBSERVATION GRAPING GRAVITY
48	FORTRAN	UNIVAC 1108	SEDIMENT SIZE
48	FORTRAN IV	UNIVAC 1108	BOTTOM SEDIMENT DISTRIBUTION PLOT
76	FORTRAN	IBM 7074	CURRENT METER TURBULENCE
76	FORTRAN V	UNIVAC 1108	IN-SITU CURRENT
76	FORTRAN	UNIVAC 1108	WATER DISPLACEMENT DISPLA
77	FORTRAN V	UNIVAC 1108	CURRENT METER PRINT
77	FORTRAN V	UNIVAC 1108	CURRENT METER PLOT
77	FORTRAN V	UNIVAC 1108	CONVERT CURRENT METER TAPE
77	FORTRAN V	UNIVAC 1108	CURRENT METER DATA MPRINTO

NAVY, DEFENSE MAPPING AGENCY HYDROGRAPHIC CENTER, WASHINGTON, DC

109	FORTRAN	UNIVAC 1108	FAA PLOT
109	FORTRAN	UNIVAC 1108	DISTANCE AND AZIMUTH CIRAZD
109	FORTRAN	UNIVAC 1108	PARAMETRIC MAP
110	FORTRAN	UNIVAC 1108	LORAN TO GEOGRAPHIC AND/GEOGRAPHIC TO LORAN
110	FORTRAN	UNIVAC 1108	LORAN COORDINATE COMPUTATION
110	FORTRAN	UNIVAC 1108	LORAN SKYWAVE CORRECTION

NAVY, NAVAL ACADEMY, ANNAPOLIS, MD

13	BASIC	IBM 360	ENVIRONMENTAL DYNAMICS SUBROUTINES OCEANLIB
13	BASIC	IBM 360	GEOSTROPHIC CURRENT

NORTH CAROLINA STATE UNIVERSITY, RALEIGH, NC

84	FORTRAN	IBM 360/165	WAVE INTERACTION WITH CURRENT CAPGRAY
24	FORTRAN	IBM 370/165	ESTUARINE MODEL NONLNRA
26	FORTRAN	CDC 6400	UPWELLING CSTLUPWL
26	FORTRAN IV	IBM 360	MATHEMATICAL WATER QUALITY MODEL FOR ESTUARIES
26	FORTRAN IV	IBM 360	COMPUTATION OF FLOW THROUGH MASONBORO INLET NC
26	FORTRAN IV	IBM 360	CIRCULATION IN PAMLICO SOUND

OREGON STATE UNIVERSITY, CORVALLIS, OR

126	FORTRAN	CDC 3300/OS3	TIME SERIES ARAND ACFFT
126	FORTRAN	CDC 3300/OS3	TIME SERIES ARAND ACORR
126	FORTRAN	CDC 3300/OS3	TIME SERIES ARAND ACRPLT
126	FORTRAN	CDC 3300/OS3	TIME SERIES ARAND ALIGN
126	FORTRAN	CDC 3300/OS3	TIME SERIES ARAND AMPACO
126	FORTRAN	CDC 3300/OS3	TIME SERIES ARAND ARMAP
126	FORTRAN	CDC 3300/OS3	TIME SERIES ARAND AUTO
126	FORTRAN	CDC 3300/OS3	TIME SERIES ARAND AUTOPLT

126	FORTRAN	CDC 3300/OS3	TIME SERIES	ARAND	AXISL
126	FORTRAN	CDC 3300/OS3	TIME SERIES	ARAND	CCFFT
127	FORTRAN	CDC 3300/OS3	TIME SERIES	ARAND	CCORR
127	FORTRAN	CDC 3300/OS3	TIME SERIES	ARAND	CCNPLT
127	FORTRAN	CDC 3300/OS3	TIME SERIES	ARAND	CCMPLOT
127	FORTRAN	CDC 3300/OS3	TIME SERIES	ARAND	CCNFID
127	FORTRAN	CDC 3300/OS3	TIME SERIES	ARAND	CCNFID 1
127	FORTRAN	CDC 3300/OS3	TIME SERIES	ARAND	CCNMODE
127	FORTRAN	CDC 3300/OS3	TIME SERIES	ARAND	CCPH
127	FORTRAN	CDC 3300/OS3	TIME SERIES	ARAND	CCSTR
127	FORTRAN	CDC 3300/OS3	TIME SERIES	ARAND	CPEES
127	FORTRAN	CDC 3300/OS3	TIME SERIES	ARAND	CPLT1
127	FORTRAN	CDC 3300/OS3	TIME SERIES	ARAND	CPLT2
127	FORTRAN	CDC 3300/OS3	TIME SERIES	ARAND	CROPLT
127	FORTRAN	CDC 3300/OS3	TIME SERIES	ARAND	CROSS
127	FORTRAN	CDC 3300/OS3	TIME SERIES	ARAND	CUSID
127	FORTRAN	CDC 3300/OS3	TIME SERIES	ARAND	CUSFC
128	FORTRAN	CDC 3300/OS3	TIME SERIES	ARAND	C2T
128	FORTRAN	CDC 3300/OS3	TIME SERIES	ARAND	DATPLT
128	FORTRAN	CDC 3300/OS3	TIME SERIES	ARAND	DEMOD1
128	FORTRAN	CDC 3300/OS3	TIME SERIES	ARAND	DEMOD2
128	FORTRAN	CDC 3300/OS3	TIME SERIES	ARAND	DEMOD3
128	FORTRAN	CDC 3300/OS3	TIME SERIES	ARAND	DETRND
128	FORTRAN	CDC 3300/OS3	TIME SERIES	ARAND	DIFF12
128	FORTRAN	CDC 3300/OS3	TIME SERIES	ARAND	EUREKA
128	FORTRAN	CDC 3300/OS3	TIME SERIES	ARAND	EXSMO
129	FORTRAN	CDC 3300/OS3	TIME SERIES	ARAND	FFIN
126	FORTRAN	CDC 3300/OS3	TIME SERIES	ARAND	FFINI
128	FORTRAN	CDC 3300/OS3	TIME SERIES	ARAND	FFTCNV
128	FORTRAN	CDC 3300/OS3	TIME SERIES	ARAND	FFTPS
128	FORTRAN	CDC 3300/OS3	TIME SERIES	ARAND	FFTS
128	FORTRAN	CDC 3300/OS3	TIME SERIES	ARAND	FFTSPC
128	FORTRAN	CDC 3300/OS3	TIME SERIES	ARAND	FILTER1
128	FORTRAN	CDC 3300/OS3	TIME SERIES	ARAND	FIVET
129	FORTRAN	CDC 3300/OS3	TIME SERIES	ARAND	FOLD
129	FORTRAN	CDC 3300/OS3	TIME SERIES	ARAND	FOURTR
129	FORTRAN	CDC 3300/OS3	TIME SERIES	ARAND	FOUSPC
129	FORTRAN	CDC 3300/OS3	TIME SERIES	ARAND	FOUSPC1
129	FORTRAN	CDC 3300/OS3	TIME SERIES	ARAND	FOUSPC2
129	FORTRAN	CDC 3300/OS3	TIME SERIES	ARAND	FRESPON
129	FORTRAN	CDC 3300/OS3	TIME SERIES	ARAND	GAPH
129	FORTRAN	CDC 3300/OS3	TIME SERIES	ARAND	GENER1
129	FORTRAN	CDC 3300/OS3	TIME SERIES	ARAND	GENER2
129	FORTRAN	CDC 3300/OS3	TIME SERIES	ARAND	GENER3
129	FORTRAN	CDC 3300/OS3	TIME SERIES	ARAND	LOGPLOT
129	FORTRAN	CDC 3300/OS3	TIME SERIES	ARAND	MC12T
129	FORTRAN	CDC 3300/OS3	TIME SERIES	ARAND	PHAPLT
129	FORTRAN	CDC 3300/OS3	TIME SERIES	ARAND	PLTFOR
129	FORTRAN	CDC 3300/OS3	TIME SERIES	ARAND	PLTFRQ
129	FORTRAN	CDC 3300/OS3	TIME SERIES	ARAND	PLTSPC
130	FORTRAN	CDC 3300/OS3	TIME SERIES	ARAND	POLRT
130	FORTRAN	CDC 3300/OS3	TIME SERIES	ARAND	POLYDV
130	FORTRAN	CDC 3300/OS3	TIME SERIES	ARAND	PROPLT
130	FORTRAN	CDC 3300/OS3	TIME SERIES	ARAND	PSQRT
130	FORTRAN	CDC 3300/OS3	TIME SERIES	ARAND	RANCM
130	FORTRAN	CDC 3300/OS3	TIME SERIES	ARAND	RCTFFT
130	FORTRAN	CDC 3300/OS3	TIME SERIES	ARAND	RESPON
130	FORTRAN	CDC 3300/OS3	TIME SERIES	ARAND	REVERS
130	FORTRAN	CDC 3300/OS3	TIME SERIES	ARAND	RPLACE

130	FORTRAN	CDC 3300/OS3	TIME SERIES ARAND HRVERS
130	FORTRAN	CDC 3300/OS3	TIME SERIES ARAND SARIT
130	FORTRAN	CDC 3300/OS3	TIME SERIES ARAND SERGEN
130	FORTRAN	CDC 3300/OS3	TIME SERIES ARAND SHAPE
130	FORTRAN	CDC 3300/OS3	TIME SERIES ARAND SINTR
130	FORTRAN	CDC 3300/OS3	TIME SERIES ARAND SMO
130	FORTRAN	CDC 3300/OS3	TIME SERIES ARAND SPEC
130	FORTRAN	CDC 3300/OS3	TIME SERIES ARAND SPECT1
130	FORTRAN	CDC 3300/OS3	TIME SERIES ARAND SPECT2
131	FORTRAN	CDC 3300/OS3	TIME SERIES ARAND TAUTOPLT
131	FORTRAN	CDC 3300/OS3	TIME SERIES ARAND TCOHPLT
131	FORTRAN	CDC 3300/OS3	TIME SERIES ARAND TCROPLT
131	FORTRAN	CDC 3300/OS3	TIME SERIES ARAND TFORM1
131	FORTRAN	CDC 3300/OS3	TIME SERIES ARAND TFORM2
131	FORTRAN	CDC 3300/OS3	TIME SERIES ARAND TIMSPC
131	FORTRAN	CDC 3300/OS3	TIME SERIES ARAND TLOGPLT
131	FORTRAN	CDC 3300/OS3	TIME SERIES ARAND TNCIZT
131	FORTRAN	CDC 3300/OS3	TIME SERIES ARAND TPHAPLT
131	FORTRAN	CDC 3300/OS3	TIME SERIES ARAND TPLTFRQ
131	FORTRAN	CDC 3300/OS3	TIME SERIES ARAND TPLTSPC
131	FORTRAN	CDC 3300/OS3	TIME SERIES ARAND TRISMO
132	FORTRAN	CDC 3300/OS3	TIME SERIES ARAND TSGEN
132	FORTRAN	CDC 3300/OS3	TIME SERIES ARAND TSPECT1
132	FORTRAN	CDC 3300/OS3	TIME SERIES ARAND TSPECT2
132	FORTRAN	CDC 3300/OS3	TIME SERIES ARAND TRANFR
132	FORTRAN	CDC 3300/OS3	TIME SERIES ARAND TRANFRM
132	FORTRAN	CDC 3300/OS3	TIME SERIES ARAND TTYCON
132	FORTRAN	CDC 3300/OS3	TIME SERIES ARAND TTYNUM
132	FORTRAN	CDC 3300/OS3	TIME SERIES ARAND UNLEAV
132	FORTRAN	CDC 3300/OS3	TIME SERIES ARAND USES
132	FORTRAN	CDC 3300/OS3	TIME SERIES ARAND USFC
132	FORTRAN	CDC 3300/OS3	TIME SERIES ARAND USIC
132	FORTRAN	CDC 3300/OS3	TIME SERIES ARAND USPE
132	FORTRAN	CDC 3300/OS3	TIME SERIES ARAND WINDOW
133	FORTRAN	CDC 3300/OS3	TIME SERIES ARAND WINDOW1
25	FORTRAN	IBM 370/155	ESTUARINE DENSITY CURRENTS AND SALINITY
39	FORTRAN IV	CDC 3300	GEOPHYSICAL DATA REDUCTION AND PLOTTING
39	FORTRAN IV	CDC 3300	PROCESSING/DISPLAY MARINE GEOPHYSICAL DATA
39	FORTRAN IV	CDC 3300	MARINE SEISMIC DATA REDUCTION AND ANALYSIS
39	FORTRAN IV	CDC 3300	A LIBRARY OF GEOPHYSICAL SUBROUTINES GLIB

RAND CORPORATION, SANTA MONICA, CA

91	FORTRAN IV	IBM 7090-94	SEA ICE STUDIES YARIT
91	FORTRAN IV	IBM 7090-94	SEA ICE STUDIES FLAP
91	FORTRAN IV	IBM 7090-94	SEA ICE STUDIES SALPR
91	FORTRAN IV	IBM 7090-94	SEA ICE STUDIES RITE

RICE UNIVERSITY, HOUSTON, TX

38	FORTRAN IV	CDC 6600	CONVECTION INVARIABLE VISCOSITY FLUID CONVEC

SCRIPPS INSTITUTION OF OCEANOGRAPHY, LA JOLLA, CA

142	FORTRAN	IBM 1800	TRIGONOMETRY SUBROUTINES ASSUB SAS ASA
116	FORTRAN IV	CDC 3600	PLOTTING PROGRAM FACFL

149	FORTRAN	IBM 1800	FORMAT FREE INPUT SUBROUTINE GREAD
149	FORTRAN	IBM 1800	METERS VS FATHOMS MATBL
144	FORTRAN	IBM 1800	DATE CALCULATIONS DAYWK
144	FORTRAN	IBM 1800	DATE CALCULATIONS NWDAT
144	FORTRAN	IBM 1800	DATE CALCULATIONS NXTDY
144	FORTRAN	IBM 1800	DATE CALCULATIONS YSTDY
145	FORTRAN	IBM 1800	JULIAN DAY SUBROUTINES CLEJL
145	FORTRAN	IBM 1800	JULIAN DAY SUBROUTINES CLJUL
145	FORTRAN	IBM 1800	TIME CONVERSION DTIME
146	FORTRAN 63	CDC 6600	HYDROGRAPHIC DATA REDUCTION TWO FIVE
2	FORTRAN IV	CDC 6600	STD DATA PROCESSING
105	FORTRAN	IBM 1800	PLOTS MERCATOR GRID CHART
105	FORTRAN	IBM 1800	NAVIGATIONAL SATELLITE PASSES ALRTX
106	FORTRAN	IBM 1800	LORAN FIX LRFIX
106	FORTRAN	IBM 1800	PLAN COURSE AND SCHEDULE CRUIS
106	FORTRAN	IBM 1800	EARTH SPHERICAL SUBROUTINES ESTCH ESTC2 ESTPL
107	FORTRAN	IBM 1800	DEGREE CONVERSIONS DEGFR DEMI
107	FORTRAN	IBM 1800	MERCATOR DEGREES DMRCT
107	FORTRAN	IBM 1800	MAGNETIC FIELD COMPONENTS MAGFI
51	FORTRAN	CDC 3600	SPECIES AFFINITIES REGROUP
116	FORTRAN	CDC 3600	X-Y PLOTS PLOPAK
2	ALGOL	B 6700	STATION DATA RETRIEVAL HYDROSEARCH
142	ALGOL	B 6700	INTERACTIVE CALCULATIONS DSDP/CALC
58	ALGOL	B 6700	SOUND VELOCITY THRU SOLID SAMPLES DSDP/SON
148	ALGOL	B 6700	MAILING LABELS
48	ALGOL	B 6700	SAND SILT AND CLAY FRACTIONS DSDP/GRAIN

SOUTHAMPTON COLLEGE, SOUTHAMPTON, NY

25	FORTRAN IV	IBM 360/65	MIT SALINITY INTRUSION PROGRAM

TEXAS AGM UNIVERSITY, COLLEGE STATION, TX

7	FORTRAN IV	IBM 360/65	READ CALC INTERP STATION DATA CAPRICORN
7	FORTRAN IV	IBM 360/65	STATION DATA CALCULATIONS F3
8	FORTRAN IV	IBM 360/65	PLOTS STATION DATA PLTECT
8	FORTRAN IV	IBM 360/65	CALCULATES STATION DATA SECPG
103	FORTRAN IV	IBM 360/65	PLOTS MAPS GRIDS TRACKS MAP

UNIVERSIDAD N A DE MEXICO, MEXICO, DF

5	FORTRAN IV	B 6700	OCEANOGRAPHY STATION COMPUTER PROGRAM

UNIVERSITY OF BERGEN, NORWAY

79	FORTRAN II	IBM 1620	PROCESSES CURRENT INSTRUMENT OBSERVATIONS

UNIVERSITY OF DELAWARE, LEWES, DE

25	FORTRAN IV	IBM 360	DYNAMIC DETERMINISTIC SIMULATION SIMLDELT

UNIVERSITY OF HAWAII, HONOLULU, HI

116	FORTRAN	IBM 360	DENDROGRAPH
116	FORTRAN	IBM 370	DENDROGRAPH

UNIVERSITY OF ILLINOIS, URBANA, IL

83	FORTRAN IV	IBM 360/75	WAVE BOTTOM VELOCITY

UNIVERSITY OF MAINE, WALPOLE, ME

153	FORTRAN	IBM 370	REFORMATTED STATION OUTPUT IBM 1
28	FORTRAN IV	IBM 370	ESTUARINE CHEMISTRY MYACHEM
28	FORTRAN IV	IBM 370	ESTUARINE TIDES
55	FORTRAN	IBM 370	CHLOROPHYLL CHLOR
55	FORTRAN	IBM 370	PHYTOPLANKTON POPULATION DENSITY
55	FORTRAN	IBM 370	SPECIES DIVERSITY

UNIVERSITY OF MARYLAND, COLLEGE PARK, MD

24	FORTRAN IV	UNIVAC 1108	THREE DIMENSIONAL ESTUARINE CIRCULATION MODEL
50	FORTRAN IV	UNIVAC 1108	INVERSE PROBLEM IN ECOSYSTEM ANALYSIS

UNIVERSITY OF MIAMI, MIAMI, FL

20	FORTRAN	PDP-11	GENERAL PURPOSE EDITOR DMSEC
20	FORTRAN	PDP-11	TIME SERIES INTO PROFILES CMSCHP
20	FORTRAN	PDP-11	AANDERAA CURRENT METER DATA AACAL
20	FORTRAN	PDP-11	CURRENT PROFILER DATA MK2CAL
20	FORTRAN	PDP-11	APPENDS NEW DATA TO FILE DERIVE
20	FORTRAN	UNIVAC 1106	APPENDS NEW DATA TO FILE DERIVE
20	FORTRAN	UNIVAC 1106	CONCATENATES SORTS SEGMENTS OUTPUTS DMSCRT
20	FORTRAN	UNIVAC 1106	INTERPOLATES TO UNIFORM GRID MATRIX 01
20	FORTRAN	UNIVAC 1106	TIME SERIES STD OR PCM PROFILES PLSAC
20	FORTRAN	UNIVAC 1106	INTERNAL WAVES IWEG
20	FORTRAN	UNIVAC 1106	DYNAMICAL FIELDS INTERNAL WAVE RAYS CHRSEC
20	FORTRAN	UNIVAC 1106	AUTO AND CROSS SPECTRA TUKEY METHOD
20	FORTRAN	UNIVAC 1106	AUTO AND CROSS SPECTRA POLARIZED FORM CMXSPC
20	FORTRAN	UNIVAC 1106	AMPLITUDES PHASES LEAST SQUARES TIDES4
20	FORTRAN	UNIVAC 1106	METEOROLOGICAL FLUXES METFLX
20	FORTRAN	UNIVAC 1106	CROSS COVARIANCE MATRIX EMPEIGI

UNIVERSITY OF MICHIGAN, ANN ARBOR, MI

104	MAD	IBM 7090	GENERAL MAP PROJECTION
104	MAD	IBM 7090	FINITE MAP PROJECTION DISTORTIONS

UNIVERSITY OF PITTSBURGH, PITTSBURGH, PA

[illegible]	MAD	IBM 7090	THEORETICAL RADIAL TIDAL FORCE

UNIVERSITY OF RHODE ISLAND, KINGSTON, RI

28	FORTRAN	IBM 370/155	MODELING AN OCEAN POND

UNIVERSITY OF PUERTO RICO, MAYAGUEZ, PR

5	FORTRAN II	PDP 8E	MASS TRANSPORT AND VELOCITIES GEOMASS
5	FORTRAN IV	PDP 10	STATION DATA THIRP
5	FORTRAN IV	PDP 10	THERMOMETER CORRECTION THERMOMETRIC DEPTH

UNIVERSITY OF TEXAS, PORT ARANSAS, TX

147	FORTRAN IV	IBM 360/65	READS NCDC STATION DATA TAPE
51	FORTRAN IV	CDC 6600	PRODUCTIVITY OXYGEN
52	FORTRAN IV	CDC 6600	SPECIES DIVERSITY JOB
52	FORTRAN IV	CDC 6600	PRODUCTIVITY ECOPROD

UNIVERSITY OF WASHINGTON, SEATTLE, WA

146	FORTRAN II	IBM 7094	STATION DATA REDUCTION SYNOP
27	FORTRAN IV	CDC 6400	THREE-DIMENSIONAL SIMULATION PACKAGE AUGUR
52	FORTRAN IV	IBM 7094	CONCENTRATIONS PER SQUARE METER OF SURFACE
52	FORTRAN IV	CDC 6400	COMBINED CHLOROPHYLL AND PRODUCTIVITY
53	FORTRAN IV	IBM 7094	PHYTOPLANKTON NUMBERS VOLUME SURFACE AREA
53	MAP	IBM 7094	PHYTOPLANKTON NUMBERS VOLUME SURFACE AREA

UNIVERSITY OF WISCONSIN, MILWAUKEE, WI

134	FORTRAN IV	UNIVAC 1108	SPECTRAL ANALYSIS OF TIME SERIES
134	ALGOL	B 6700	SPECTRAL ANALYSIS OF TIME SERIES

VIRGINIA POLYTECHNIC INSTITUTE AND STATE UNIVERSITY, BLACKSBURG, VA

136	FORTRAN IV	IBM 370	PROBABILITY DISTRIBUTION WEIBUL
56	FORTRAN IV	IBM 370	RESOURCES ALLOCATION IN FISHERIES MGT PISCES
56	FORTRAN IV	IBM 370	WATER RESOURCES TEACHING GAME DAM
50	FORTRAN	IBM 370	OPTIMAL ECOSYSTEM POLICIES OEP

WILLIAMS COLLEGE, WILLIAMSTOWN, MA

25	FORTRAN IV	IBM 1130	BEACH SIMULATION MODEL
29	FORTRAN IV	IBM 1130	BEACH AND NEARSHORE MAPS A-S

WOODS HOLE OCEANOGRAPHIC INSTITUTION, WOODS HOLE, MA

118	FORTRAN IV	XDS SIGMA 7	HORIZONTAL HISTOGRAMS HISTO
118	FORTRAN IV	XDS SIGMA 7	PRINTER PLOTS LISPLO
119	FORTRAN IV	XDS SIGMA 7	PLOT OF FREQUENCY DISTRIBUTION THISTO
119	FORTRAN IV	XDS SIGMA 7	VELOCITY VECTOR AVERAGES VECTAV
119	FORTRAN IV	XDS SIGMA 7	PROGRESSIVE VECTORS PRCVEC
119	FORTRAN IV	XDS SIGMA 7	PLOTS DATA ALONG TRACK
119	FORTRAN IV	XDS SIGMA 7	PROFILE VERSUS TIME OR DISTANCE
120	FORTRAN IV	HP MINI	PLOTS NAVIGATION WITH ANY OTHER DATA TYPE DEEP6
102	FORTRAN IV	XDS SIGMA 7	RAYTRACE
97	FORTRAN IV	XDS SIGMA 7	SOUND VELOCITY SONVEL

97	FORTRAN IV	XDS SIGMA 7	DEPTH CORRECTICN MICOR SOUND VELCCITY
148	FORTRAN IV	XDS SIGMA 7	EDITING FCR WHCI FCRMAT SCRUB
143	FORTRAN IV	XDS SIGMA 7	THERMCMETER CCRRECIICN TCPLC
143	FORTRAN	HP 2100	THERMCMETER CCRRECIION DEPTH COMP HYD1
8	FCRTRAN IV	HP 2100	STATICN DATA HYC2
8	FORTRAN IV	XDS SIGMA 7	BRUNT-VAISALA FREQUENCY OBVFRQ
9	FORTRAN IV	XDS SIGMA 7	DYNAMIC HEIGHT DYNHT
9	FORTRAN IV	XDS SIGMA 7	POTENTIAL ENERGY ANCMALY PEN
9	FCRTRAN IV	XDS SIGMA 7	VARIOUS PARAMETERS FRCM STATION DATA OCCCMP
9	FCRTRAN IV	XDS SIGMA 7	SPECIFIC VCLUME ANCMALY SVANOM
9	FCRTRAN IV	XDS SIGMA 7	PRESSURE SUBRCUTINE PRESS
10	FORTRAN IV	XDS SIGMA 7	READS STATICN DATA
10	FCRTRAN IV	XDS SIGMA 7	GECSTROPHIC VELOCITY DIFFERENCE VEL
10	FORTRAN IV	XDS SIGMA 7	VOLUME TRANSPCRT VTR
10	FCRTRAN IV	XDS SIGMA 7	SIGMA-T SIGMAT AND DSIGMT
10	FORTRAN IV	XDS SIGMA 7	ADIABATIC TEMPERATURE GRADIENT ATG
10	FORTRAN IV	XDS SIGMA 7	POTENTIAL TEMPERATURE PCTEMP
10	FCRTRAN IV	XDS SIGMA 7	SPECIFIC VCLUME SPVCL
136	FORTRAN IV	XDS SIGMA 7	STATISTICS FRCM WHCI FCRMAT STATS
105	FCRTRAN IV	HP 2100S	LORAN CR CMEGA CONVERSICN GEPCS
105	FCRTRAN IV	HP 3100A	CRUISE TRACK TMERC
105	FORTRAN IV	XDS SIGMA 7	TRANSFORMATICN CF SPHERICAL CCORDINATES ROTGUT
106	FCRTRAN IV	XDS SIGMA 7	SUM CF FINITE RCTATICNS CN A SPHERE SUMRCT
41	FCRTRAN IV	XDS SIGMA 7	GECMAGNETIC FIELD MFIELD
50	FORTRAN IV	XDS SIGMA 7	WHCI BICLCGY SERIES FTAPE
50	FORTRAN IV	XDS SIGMA 7	WHCI BICLCGY SERIES FLISHT
50	FORTRAN IV	XDS SIGMA 7	WHCI BICLCGY SERIES CHKSPIT
50	FORTRAN IV	XDS SIGMA 7	WHCI BICLCGY SERIES SELECT
50	FORTRAN IV	XDS SIGMA 7	WHCI BICLCGY SERIES CHANAT
50	FORTRAN IV	XDS SIGMA 7	WHOI BICLCGY SERIES PREPLOTG
50	FORTRAN IV	XDS SIGMA 7	WHCI BICLCGY SERIES PLOTSPECG
50	FCRTRAN IV	XDS SIGMA 7	WHOI BICLCGY SERIES STATAB
77	FCRTRAN IV	XDS SIGMA 7	CURRENT METER CLOCK SEQUENCE XTAL
78	FCRTRAN IV	XDS SIGMA 7	CURRENT METER CALIBRATICN CASDEC
78	FCRTRAN IV	XDS SIGMA 7	CURRENT METER DATA REDUCTICN AND EDITING CARP

FEDERAL INFORMATION PROCESSING STANDARD SOFTWARE SUMMARY

01. Summary date (Yr. | Mo. | Day)

02. Summary prepared by (Name and Phone)

03. Summary action: New ☐ Replacement ☐ Deletion ☐

Previous Internal Software ID

04. Software date (Yr. | Mo. | Day)

05. Software title

06. Short title

07. Internal Software ID

08. Software type
☐ Automated Data System
☐ Computer Program
☐ Subroutine/Module

09. Processing mode
☐ Interactive
☐ Batch
☐ Combination

10. Application area

General:
☐ Computer Systems Support/Utility
☐ Scientific/Engineering
☐ Bibliographic/Textual
☐ Management/Business
☐ Process Control
☐ Other

Specific

11. Subm'tting organization and address

12. Technical contact(s) and phone

13. Narrative

14. Keywords

15. Computer manuf'r and model

16. Computer operating syst...

17. Programing language(s)

18. Number of source program statements

19. Computer memory requirements

20. Tape drives

21. Disk/Drum units

22. Terminals

23. Other operational requirements

24. Software availability: Available ☐ Limited ☐ In-house only ☐

25. Documentation availability: Available ☐ Inadequate ☐ In-house only ☐

26. FOR SUBMITTING ORGANIZATION USE

185-101

Standard Form 185
1974 July
U.S. Dept. of Commerce—NBS
(FIPS. Pub. 30)

INSTRUCTIONS

01. Summary Date. Enter date summary prepared. Use Year, Month, Day format: YYMMDD.

02. Summary Prepared By. Enter name and phone number (including area code) of individual who prepared this summary.

03. Summary Action. Mark the appropriate box for new summary, replacement summary or deletion of summary. If this software summary is a replacement, enter under "Previous Internal Software ID" the internal software identification as reported in item 07 of the original summary, and enter the new internal software identification in item 07 of this form; complete all other items as for a new summary. If a software summary is to be deleted, enter under "Previous Internal Software ID" the internal software identification as reported in item 07 of the original summary; complete only items 01, 02, 03 and 11 on this form.

04. Software Date. Enter date software was completed or last updated. Use Year, Month, Day format: YYMMDD.

05. Software Title. Make title as descriptive as possible.

06. Short Title. (Optional) Enter commonly used abbreviation or acronym which identifies the software.

07. Internal Software ID. Enter a unique identification number or code.

08. Software Type. Mark the appropriate box for an Automated Data System (set of computer programs), Computer Program, or Subroutine/Module, whichever best describes the software.

09. Processing Mode. Mark the appropriate box for an Interactive, Batch, or Combination mode, whichever best describes the software.

10. Application Area.
General: Mark the appropriate box which best describes the general area of application from among:

Computer Systems Support/Utility	Process Control
Management/Business	Bibliographic/Textual
Scientific/Engineering	Other

Specific: Specify the sub-area of application; e.g.: "COBOL optimizer" if the general area is "Computer Systems Support/Utility"; "Payroll" if the general area is "Management/Business"; etc. Elaborate here if the general area is "Other."

11. Submitting Organization and Address. Identify the organization responsible for the software as completely as possible, to the Branch or Division level, but including Agency, Department (Bureau/Administration), Service, Corporation, Commission, or Council. Fill in complete mailing address, including mail code, street address, city, state, and ZIP code.

12. Technical Contact(s) and Phone: Enter person(s) or office(s) to be contacted for technical information on subject matter and/or operational aspects of software. Include telephone area code. Provide organization name and mailing address, if different from that in item 11.

13. Narrative. Describe concisely the problem addressed and methods of solution. Include significant factors such as special operating system modifications, security concerns, relationships to other software, input and output media, virtual memory requirements, and unique hardware features. Cite references, if appropriate.

14. Keywords. List significant words or phrases which reflect the functions, applications and features of the software. Separate entries with semicolons.

15. Computer Manufacturer and Model. Identify mainframe computer(s) on which software is operational.

16. Computer Operating System. Enter name, number, and release under which software is operating. Identify enhancements in the Narrative (item 13).

17. Programing Language(s). Identify the language(s) in which the software is written, including version; e.g., ANSI COBOL, FORTRAN V, SIMSCRIPT II.5, SLEUTH II.

18. Number of Source Program Statements. Include statements in this software, separate macros, called subroutines, etc.

19. Computer Memory Requirements. Enter minimum internal memory necessary to execute software, exclusive of memory required for the operating system. Specify words, bytes, characters, etc., and number of bits per unit. Identify virtual memory requirements in the Narrative (item 13).

20. Tape Drives. Identify number needed to operate software. Specify, if critical, manufacturer, model, tracks, recording density, etc.

21. Disk/Drum Units. Identify number and size (in same units as "Memory"—item 19) needed to operate software. Specify, if critical, manufacturer, model, etc.

22. Terminals. Identify number of terminals required. Specify, if critical, type, speed, character set, screen/line size, etc.

23. Other Operational Requirements. Identify peripheral devices, support software, or related equipment not indicated above, e.g., optical character devices, facsimile, computer-output microfilm, graphic plotters.

24. Software Availability. Mark the appropriate box which best describes the software availability from among: Available to the Public, Limited Availability (e.g.: for government use only), and For-In-house Use Only. If the software is "Available", include a mail or phone contact point, as well as the price and form in which the software is available, if possible.

25. Documentation Availability. Mark the appropriate box which best describes the documentation availability from among: Available to the Public, Inadequate for Distribution, and For In-house Use Only. If documentation is "Available", include a mail or phone contact point, as well as the price and form in which the documentation is available, if possible. If documentation is presently "Inadequate", show the expected availability date.

26. For Submitting Organization Use. This area is provided for the use of the organization submitting this summary. It may contain any information deemed useful for internal operation.

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